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The Corporate Governance of Profit Shifting

Abstract

Tax-motivated profit shifting is an increasingly important element in the agenda of academics and policy-makers in the effort to understand tax-planning behavior and to promote tax fairness. In this research, we view profit shifting as the outcome of corporate governance characteristics of multinational enterprises (MNEs), *ceteris paribus*. Using a sample of 860 parent firms from 24 countries, 6,698 subsidiaries in 49 countries, we first measure profit shifting from the responses of subsidiary profits to parent earnings shocks. We draw on several agency theories of the firm and we show that elements of board structure, directors' experience and networks, and CEO duality have an economically important influence on the aggressiveness of profit shifting. Using our baseline specification, a one-standard deviation change in these board characteristics implies an 11.06% total response in our measure of profit shifting.

Keywords: Profit shifting; Corporate governance; Board structure; Directors' experience; CEO duality
JEL classification: F23, H25, H26; H32, M41

1. Introduction

Profit shifting refers to the tax planning strategies of multinational enterprises (MNEs) to move profits to low-tax jurisdictions and increase their after-tax income. Economic globalization intensified this practice and triggered increased efforts and policies by local governments and international organizations to contain it. Despite these efforts and policies, we know little about the intra-firm processes that lead to more aggressive profit shifting. In this study, we aim to partially fill this gap by looking into the effects of specific board characteristics on the aggressiveness of profit shifting. Guided by agency theory, we show that board structure, and directors' experience and network are key driving factors of profit shifting.

Profit shifting and corporate governance of MNEs have independently been the focus of researchers for more than two decades. We mainly draw our theoretical arguments for a nexus between corporate governance and profit shifting from the agency theory of the firm and the relevant problems that arise due to intra-firm conflicts of interest. Profit shifting bears both benefits and costs to MNEs. The benefits mainly reflect the profits from exploiting taxation differences between the parent and subsidiary countries. The costs reflect the administration, opportunity, and reputation costs related to the profit-shifting activities. Differences in corporate governance can effectively result in differences in the aggressiveness of profit shifting because of potential differences in the way management approaches the relative benefits and costs.

We focus on governance mechanisms that we believe are more closely related to profit-shifting decisions. First, elements of board structure, such as greater board independence and separation of the roles of CEO and board's chairman (CEO duality) can lead to less profit shifting because independent directors, especially those with audit expertise, promote transparent accounting practices and improved monitoring, as they care about their own reputation (Li, Maydew, Willis and Xu, 2017). In turn, these might lead to less profit shifting (Dyreng, Hoopes

and Wilde, 2016). Similarly, MNEs with larger boards can less effectively communicate the complex and sometimes controversial profit-shifting procedures, implying less profit shifting for these MNEs.

Second, experienced directors with larger networks can view profit shifting more favorably. Expertise reduces profit-shifting uncertainty and the associated costs and thus increases the perceived net benefits of the process. Further, larger directors' networks enhance knowledge of internal processes (e.g., knowledge of intra-firm profit-shifting processes) and external practices (e.g., country-specific institutional environments) as well as ways to mitigate the costs of profit shifting if these arise (e.g., reduction of penalties and reputational costs). Brown (2011) and Brown and Drake (2014) demonstrate that board members help to promulgate aggressive tax shelter transactions and tax aggressive behavior more broadly through their network ties.

We test these hypotheses using data from Orbis and BoardEx. Orbis provides accounting data for firms worldwide, as well as detailed information on their ownership structure and links between parent companies and subsidiaries. BoardEx collects biographical information on executives and board members of public companies. Our sample includes approximately 18,000 observations from 6,698 subsidiaries and 860 parent firms for the period 2009-2013. This sample includes subsidiaries from 49 countries and parent firms from 24 countries.

We conduct our empirical analysis in two stages. We first estimate the level of profit shifting at the subsidiary-year level, using the differences-in-differences (DID) model of Dharmapala and Riedel (2013). This model makes the measurement of profit shifting exogenous by exploiting earnings shocks to firms that are "comparable" to the parent firm[1] and examining the propagation of these shocks toward the parent's subsidiaries. The premise is that an exogenous

[1] Comparable firms are those in the same industry and country with the parent firm (Bertrand et al., 2002).

increase in the profits of the parent implies partial profit shifting to subsidiaries in low-tax countries. To improve confidence in the shocks' exogeneity, we restrict the empirical analysis to subsidiaries in different industries (and of course countries) than their parent companies. Then, we use the partial fitted values from the DID model as our estimates of what we refer to as "profit-shifting response" to the exogenous shocks. These responses are our firm-year measure for aggressiveness of profit-shifting behavior of parent firms.

In the second stage, we examine the effect of the parents' corporate governance characteristics, mainly boards' structure, directors' experience, and CEO's presence in the board, on the firm-year profit-shifting responses. We use a number of different specifications and estimation methods and all yield similar results. Our main model predicts that a one standard deviation increase in independent non-executive directors (NEDs; also termed externals or outsiders) with audit experience and board size additively reduce profit-shifting behavior by around 6%. Further, a one standard deviation decrease in directors' tenure, number of directorships, and network size collectively reduce profit-shifting response by approximately 4.7%. Moreover, we find that CEO duality implies higher profit-shifting response by approximately 0.37%, which is economically a less notable effect compared to board structure and directors' experience and network.

In terms of economic significance, our results suggest a one standard deviation change in all the corporate governance variables of interest (those reflecting board size and independence, directors' experience and CEO duality) yields an approximately 11% change in profit-sifting response. This implies an approximately 140,000 USD annual change for the mean parent, 640,000 USD for the parent in the top 10% in network size, and 1,780,000 USD for the parent in the top 1% in network size.

Our study contributes to the profit-shifting literature by looking, for the first time, into the role of corporate governance. In many respects, we draw on the research of Dharmapala and Riedel (2013), especially in the way we estimate profit shifting. Our research also relates to a small but rapidly evolving literature on the determinants of profit shifting. From these studies, the more closely related to our research are the following. Markle (2016) shows that multinationals subject to territorial tax regimes shift more income than those subject to worldwide tax regimes, but the change is not statistically different when the worldwide firms can defer repatriation of the shifted income. Klassen and Laplante (2012) show that U.S. MNEs become more active at shifting income as the regulatory costs of shifting decrease.

Our research also contributes a specific example to a broader literature that explores governance mechanisms and their effect on tax planning. Brown (2011) and Brown and Drake (2014) show how boards can influence the adoption of more aggressive tax plans by tracing board interlocks and the aggressive tax planning of network corporations. Armstrong, Blouin, Jagolinzer and Larcker (2015) focus on "knowledgeable" boards (in terms of financial expertise and independence) and their role in encouraging neither inadequate nor excessive tax planning aggressiveness. Li et al. (2017) show that country board reforms, particularly related to increasing member independence and eliminating CEO duality, increase cash ETR, on average. Bird and Karolyi (2017) focus primarily on institutional investors as a means of providing oversight to management with regard to tax planning. However, they show that a positive shock to institutional ownership, in conjunction with board turnover, magnifies the decrease in reported effective tax rate (ETR). Our study differs from these studies because we focus on a particular tax planning strategy, income shifting, rather than broad measures of tax avoidance, ETR or cash ETR. Further, our research design permits us to make stronger causal inferences. By focusing on a particular, but

widely used, tax plan, with a stronger research design, we are able to strengthen the inferences about the role of various parent board features on the risky tax planning activities of the firm.

Finally, our findings may benefit policy-makers as they attempt to (i) identify potential firms more likely to engage in profit shifting by looking, *inter alia*, at the corporate governance characteristics of MNEs and (ii) potentially containing excessive profit shifting by proposing changes in these characteristics. For example, Deloitte places corporate governance in the core of its analysis of corporate taxation (Deloitte, 2015). In turn, the OECD, within its base erosion and profit shifting (BEPS) initiative, directly links corporate governance with tax management (e.g., Centre for tax policy and Administration, 2009; Lambe, 2015). Governments have already begun related processes. For example, U.K. and Canada tax authorities undertake governance reviews in conjunction with their tax audits,[2] and Australia has an extensive guide to the corporations' responsibilities for tax oversight, including at the board of directors' level.[3]

The rest of the paper proceeds as follows. Section 2 provides a theoretical discussion and testable hypotheses for the effect of corporate governance characteristics on profit shifting. Section 3 discusses the empirical analysis on the identification of profit shifting. Section 4 discusses the empirical findings on the effect of corporate governance characteristics on profit shifting. Section 5 summarizes the main findings and offers policy implications.

2. Theoretical considerations

Profit shifting is part of the tax planning strategies of firms. In their review, Wilde and Wilson (2017) argue that tax planning encompasses deliberate efforts to reduce the corporate tax burden.

[2] http://www.ey.com/Publication/vwLUAssets/EY_-_HMRCs_approach_to_assessing_tax_governance_and_Senior_Accounting_Officer_certification/$FILE/EY-tax-governance.pdf, and Misutka and MacEachern (2013).

[3] https://www.ato.gov.au/business/large-business/in-detail/key-products-and-resources/tax-risk-management-and-governance-review-guide/

Thus, we consider profit shifting as a specific but complicated method of tax planning. The word "complicated" is used because (i) profit shifting requires an international network of affiliates to be implemented; and (ii) profit shifting navigates a complex set of laws and regulations to permit firms to reduce their domestic tax base and allowing these earnings to be taxed in a foreign country.

Both the profit-shifting activities of MNEs and their corporate governance have been of interest to researchers, as described more fully below. To the best of our knowledge, this study is the first that links these two areas of academic research. Profit shifting is typically a value-enhancing activity for an MNE; however, like other forms of tax planning, it is not costless because it involves tax administration costs, opportunity and transaction costs, potential court penalties, and reputation costs (e.g., Dyreng, Hoopes and Wilde, 2016). These benefits and costs for the MNE imply that agency problems and certain corporate governance characteristics can lead managers to choose a level of profit shifting that differs from what shareholders would prefer (Armstrong et al., 2015; Slemrod, 2004).

In the following, we examine the implications of existing literature on elements potentially linking corporate governance to profit shifting. We mainly draw these implications from the effects of corporate governance characteristics on firms' performance and accounting transparency. The corporate governance characteristics that have been shown to play such a role are the board's structure and directors' experience and network.

2.1. Board structure

Where there is an agency conflict between shareholders and managers, greater board independence leads to better monitoring of managers (Jensen and Meckling, 1976; Fama, 1980; Fama and Jensen, 1983). The motivation of NEDs to monitor managers results from their need to maintain their own reputation in the external directors' labor market (Fama and Jensen, 1983; Weisbach,

1988; Beasley, 1996; Dechow et al., 1996). Desai and Dharmapala (2006), Desai, Dyck and Zingales (2007); and Desai and Dharmapala (2009) collectively develop a theory that relations between insiders, outsiders and the government have spill-over effects on the others. In particular, stronger governance will improve the compliance between insiders and the government through less aggressive tax reporting. While some subsequent empirical evidence contravenes this theory (Seidman and Stomberg, 2017; Blaylock, 2016; and Rego and Wilson, 2012), other papers provide evidence consistent with the theory (Li et al., 2017; Lennox, Lisowsky, and Pittman, 2013; Hasan, Hoi, Wu and Zhang, 2014; and Kim, Li, and Zhang, 2011).

Empirical evidence finds that a higher number of NEDs is linked with (i) less financial fraud (Beasley, 1996; Uzun et al., 2004; Chen et al., 2006), (ii) fewer transfer-pricing manipulations (Lo et al., 2010), and (iii) lower propensity for opportunistic earnings management (Peasnell et al., 2005). Moreover, Dechow et al. (1996), McMullen (1996), and Beasley et al. (2000) find that expertise of outside directors in accounting or finance reduces fraud behavior and earnings management. On the same line, Agrawal and Chadha (2005) add that the absence of accounting or financial expertise renders the outside directors ineffective in curbing accounting errors and fraud.

Profit shifting can result from reasonable, but opportunistic, application of the judgment necessary to determine intra-firm pricing or capital structuring. However, very aggressive use of this ambiguity can lead to costly, public and protracted challenges by tax authorities and other organizations (see, for example, Dyreng, Hoopes and Wilde, 2016). Thus, consistent with the arguments linking NEDs, especially those with audit experience, with lower levels of financial fraud, we expect that a larger number of board members with audit experience should reduce profit shifting. Enhanced board independence and audit expertise by board members promotes effective monitoring of the MNE's tax planning activities (including the associated risks) and constrain

profit shifting within "reasonable" limits. By constraining management, NEDs maintain their own reputation and reduce conflict of interest between management and shareholders.

Within the same theoretical context, CEO duality (the CEO also chairs the board) may also affect profit shifting aggressiveness. From an agency-theory perspective, the two roles should be separated because management and CEO monitoring lowers conflicts of interest (e.g., Jensen, 1993). For example, CEO duality has been offered as an important reason for the failure of corporations like Enron and WorldCom. Adams et al. (2005) find that duality negatively affects firm's performance by increasing the volatility of stock returns. Deli and Gillan (2000) and Klein (2002) find that duality has a small but negative effect on performance. Chen et al. (2006) find that duality increases the likelihood of fraud in firm operations. More closely related to our study, Lo et al. (2010) examine the role of duality in transfer pricing and find that transfer-pricing manipulations are more likely with duality in China. We thus expect that more intense conflicts of interest and loose monitoring due to duality might lead to higher levels of profit shifting.

Similar to board independence, a number of studies find that communication and decision-making of larger boards are less effective in representing shareholders' interests compared to small boards (Jensen, 1993; Yermack, 1996; Van den Berghe and Levrau, 2004). Phrased differently, the coordination problems in a larger board overwhelm the advantages gained from having more people to draw on. Beasley (1996) finds that as the board size decreases, the likelihood of financial statement fraud decreases.

In contrast, Bhagat and Black (1999) suggest that smaller boards with a large number of independent directors are not necessarily better in terms of shareholders' interests. This board profile might lead to significant loss of firm-specific knowledge. Coles et al. (2008) find that there is no unique optimal board structure and suggest that complex firms (such as large firms, diversified firms, and high-debt firms) have larger boards because of the greater advising needs.

They also find weak evidence that insiders' representation is positively correlated with R&D intensive firms, where the firm-specific knowledge is highly valued.

Based on these theoretical considerations, we assert that firms with smaller boards and boards with fewer NEDs will engage in more profit shifting. Complex and risky profit shifting will be easier to communicate and justify to a smaller number of board members, and where fewer board members are independently knowledgeable.

Based on the above theoretical considerations, we formulate our first hypothesis as follows:

Hypothesis 1. More independent and larger boards engage in less tax-motivated profit shifting.

2.2. Directors' experience

Directors' experience has also been a focal point of academic research. The main branches of this research consider the role of tenure and network as determinants of firms' decision-making processes and performance. Concerning the first branch, the main argument is that it takes a lengthy period for directors to gain adequate understanding of a firm and the way it operates (Bacon and Brown, 1973; Huang, 2013). Celikyurt et al. (2014) add that firm-specific knowledge is accumulated as tenure increases over time and this knowledge leads to higher firm value. Burt (1992), Coleman (1988), and Nahapiet and Ghoshal (1998) argue that a longer tenure relates to learning-by-doing processes and increased human capital (the know-how) and social capital (the acquaintances and networks). On the same line, Oh et al. (2006) and Pennings et al. (1998) examine the human and social capital, respectively, that members bring to their groups and how these positively affect their actions and effectiveness.

Given that tax-motivated profit shifting is risky, complex, and potentially costly, long-tenured directors with deeper firm-specific knowledge might be better acquainted with the MNEs operations in both the parent and the subsidiaries. They might even be assigned to direct and

monitor one or more affiliate companies and gain expertise in their internal operations as well as the business and legal environments within which these firms operate. This expertise reduces profit-shifting uncertainty, allows handling more complicated types of profit shifting, and generates important relevant networks and social capital. Thus, we hypothesize that long-tenured directors are more skilled in handling profit shifting.

In turn, directors with a high number of directorships (multiple appointments) can generate benefits and increase firm value because of their large network and better access to resources, suppliers, and customers (e.g., Booth and Deli, 1995). A greater number of directorships for each board member also expands the network reach of the board. Brown and Drake (2014) show evidence consistent with the role of directors' networks in reducing the firm's effective tax rate when other firms in the network also have low ETRs.

We formulate our second hypothesis as follows:

Hypothesis 2. MNEs that have directors with longer tenure, more directorships, and larger network size engage in more tax-motivated profit shifting.

We also note that a threshold potentially exists, above which directors are overcommitted (very busy) and thus potentially ineffective in monitoring managers (e.g., Fich and Shivdasani, 2006). This "busyness" can reduce the monitoring of management, allowing the diversion of shareholders' and managers' preferences concerning profit shifting. This could lead to a decline in the disciplining role of the board when it comes to aggressive income shifting.

3. First stage: Estimation of profit shifting

3.1. Empirical model

The ultimate goal of our research (and the second stage of our analysis) is to examine the effect of

MNEs' corporate governance characteristics on profit shifting. To do this, we must first identify profit-shifting flows from each parent to each subsidiary. Broadly speaking, multinational firms might shift income to their affiliates for reasons unrelated to tax purposes (e.g., tunneling, risk-sharing or internal capital operations). However, such profit shifting would apply to both low-tax and high-tax subsidiaries.

We estimate tax-motivated profit shifting using the differences-in-differences (DID) model of Dharmapala and Riedel (2013). The basic idea of this model is to observe the effect of an exogenous shock to the parent's pretax and pre-shifting profit, $\tilde{\pi}_{pt}$ on the subsidiaries in the low-tax countries. These subsidiaries form a treatment group and subsidiaries in high-tax countries are a control group. In the presence of tax-motivated income shifting, we expect that an exogenous increase in the parent pretax and pre-shifting profits (i.e., a positive earnings shock) would exert a positive impact on the pretax profits of a low-tax subsidiary relative to a high-tax subsidiary.

The empirical model takes the form:

$$log\pi_{it} = \varphi_i + \beta_1 log a_{it} + \beta_2 log\tilde{\pi}_{pt} + \beta_3\left(d_{it} \cdot log\tilde{\pi}_{pt}\right) + \beta_4 d_{it} + \beta_5 lever_{it} + \rho_t + e_{it}. \quad (1)$$

The dummy variable d_{it} in the above equation is the DID identifier: it equals one if the subsidiary faces a lower corporate tax rate than the parent firm; it equals zero otherwise.[4] In line with Dharmapala and Riedel (2013), we also control for the subsidiary i's size, a_{it}, and its exposure to debt, $lever_{it}$. Further, ρ_t is a set of fixed effects of different dimensions (i.e., subsidiary fixed effects, year fixed effects, industry-year fixed effects, and country-year fixed effects)[5] and *e* is the remainder disturbance.

[4] This dummy is not eliminated by the inclusion of country fixed effects because it depends not only on the corporate tax rates of the subsidiary country but also on the tax rate of the parent country.

[5] Regressions with multiple fixed effects often entail singleton groups, i.e., groups with only one observation. According to Correia (2015), "Keeping singleton groups in such regressions is not only computationally inefficient,

To construct $\tilde{\pi}_{pt}$, we follow Bertrand et al. (2002) and use the system of equations:

$$\tilde{\pi}_{pt} = \tilde{p}_{pt} * \alpha_{pt}, \quad (2)$$

$$\tilde{p}_{pt} = \sum_j \frac{\alpha_{jt}}{\sum_j \alpha_{jt}} \cdot p_{jt}, p \neq j, \ \forall\, t \in \{1, \dots, T\}. \quad (3)$$

In equations (2) and (3), α_{pt} denotes the total assets of the subsidiary $i's$ parent firm p, α_{jt} the total assets of comparable parent firms j in year t, and $p_{jt} = \pi_{jt}/\alpha_{jt}$ the comparable parents' pretax profit over total assets. The product of the average industry profitability ratio, $\tilde{p}_{pt}$, with the parent total assets, α_{pt}, in eq. (2) scales this instrument of parent earnings at the firm-year level. Therefore, the estimation of equation (1) yields a firm-year estimates of profit shifting. Even though we have information on the variable for the actual parent earnings, using $\tilde{\pi}_{pt}$ is necessary to ensure the shocks are exogenous.[6] Importantly, using shocks from comparable firms (and not from the parent) improves inference in the second stage of our analysis by mitigating potential reverse-causality issues between the profit-shifting shocks and corporate governance characteristics of parent firms. We discuss this further below.

We define a firm as comparable if it belongs in the same industry (4 digit NACE) and country each year with the specific parent firm p. To construct the set of comparable firms, we use all the national and multinational firms included in Orbis for which information on profits and total assets is available (this amounts to more than a million observations).[7] We keep only the subsidiary-year combinations in our sample if (i) each set of comparable firms includes at least 10 firms and (ii) the subsidiaries operate in different four-digit NACE industries than their parent

but overstates the statistical significance of the regression coefficients and might lead to incorrect inference." Thus, we drop all singleton groups from our regressions.

[6] The correlation between the true parent earnings and $\tilde{\pi}_{pt}$ is 0.85. The descriptive statistics of the two variables are also similar, with $\tilde{\pi}_{pt}$ exhibiting (as expected) somewhat larger variation.

[7] To avoid the correlation (and the endogeneity) that arises if we include a firm itself in the calculation of its industry profitability and then use that industry's profitability to predict the firm's own profit, we exclude the firm itself from the set of comparable firms.

companies. The first requirement increases the accuracy of our measure by providing a sufficient level of information for each industry. The second requirement prevents industry shocks from driving the reported pretax profits of each subsidiary.

If tax-motivated profit shifting occurs, then we expect $\hat{\beta}_3$ to be positive.[8] This implies that for each given level of corporate-tax difference between the parent and the subsidiary firms, a parent-firm earnings shock, $\tilde{\pi}_{pt}$, will propagate asymmetrically toward low-tax subsidiaries compared to high-tax subsidiaries.

3.2. Data and variables

For the first stage of our empirical analysis we mainly obtain data from Orbis, which provides accounting data for national and multinational firms worldwide.[9] After dropping missing observations for our main variables, we have a sample of around 18,000 observations from 6,698 subsidiaries and 860 parent firms for the period 2009-2013. This sample includes subsidiaries from 49 countries and parent firms from 24 countries. In Table A1 we provide summary statistics for the parent firms and their subsidiaries by country and in Table A2 a correlations matrix for the main variables of our study.

For subsidiaries, we use unconsolidated statements; for parents, we rely on consolidated statements. Consolidated parent profits can shift to low-tax subsidiaries and should be included in the analysis (as opposed to only including unconsolidated profits) given that we examine profits shifted only from parents to subsidiaries and not among subsidiaries. If we do not include the

[8] Under an extreme scenario, β_3 could be negative. If for a certain period a large number of low-tax subsidiaries are systematically located in high tax uncertainty countries (i.e., in countries with frequent changes in their corporate tax rates) and the corporate tax rate changes upwards, then the MNE will see an increase in the "cost" of profit-shifting.
[9] Information from Orbis has the drawback that the ownership structure is only available for the last reported year (2013 in our sample). In line with previous studies, this is not a key concern because the potential misclassification of parent-subsidiary connections would, if anything, bias our results toward zero (e.g., Budd et al., 2005).

profits of the consolidated parent firms, we might lose an important part of profit shifting. The only part of these profits to exclude are those of subsidiary *i*. However, as discussed, for the construction of the average industry profitability index ($\tilde{p}_{pt}$) we use data for comparable firms, implying that the profits of subsidiary *i* are not included. Thus, it might even be preferable to use consolidated data, which nets out potential profit shifting (as the considered firm is a multinational), when determining the earnings shock variable. In turn, for α_{pt} in equation (2), we avoid double counting the assets of subsidiary *i* in the parent's consolidated statement by subtracting the subsidiary's total assets from the parent's total assets.

Table 1 formally defines all variables of the empirical analysis and provide the data sources. We measure subsidiary *i*'s profits using the log of pretax earnings (EBT), subsidiary's size using the log of subsidiary's total assets,[10] and financial leverage using the ratio of total debt to total assets. We use the variables in logs due to their high skewness and this limits our sample to subsidiaries with positive earnings before interest and taxes (e.g., Hines and Rice, 1994).

[Insert Table 1 about here]

Table 2 reports summary statistics for the variables used in our empirical analysis. The number of observations in Table 2 differs slightly from the one reported in the regression tables because we drop singleton-group observations. Our sample includes relatively large parent firms that operate a number of foreign subsidiaries worldwide. This allows exploiting differences even among subsidiaries of the same parent firm that reside in different countries. The average parent firm in our sample has pretax profits of $2.78 billion USD; the average subsidiary has pretax profits of $31.5 million USD and total assets of $312.8 million USD. Further, 55% of the subsidiaries in our sample face lower corporate tax rates than their parents do.

[10] Alternatively, we could use other control variables for firm size, such as the log of fixed assets or the number of employees. The results are quantitatively and qualitatively very similar.

[Insert Table 2 about here]

We use statutory tax rates to define whether a subsidiary is low tax. Our choice is theoretically justified because multinationals shift profits among subsidiaries already abroad and thus take advantage of tax allowances in countries in which they already operate. Having done so, the advantage of transferring a dollar of profit from a high-tax country to a low-tax country depends on differences in statutory rates (See the appendix and Deveraux and Mafini, 2007, for further discussion).

3.3. Estimates of profit-shifting response

Table 3 reports the results from estimating equation (1). In columns 1 to 3, we employ different sets of fixed effects. In all specifications, the coefficient on *Low-tax subsidiary * Parent profit* is positive and statistically significant. According to the most restrictive specification in column 3, a 10% increase in the parent's earnings implies that low-tax subsidiaries receive 0.59% more profit than the high-tax subsidiaries. Given our sample's mean value of *EBT*, the coefficient on *Low-tax subsidiary * Parent profit* in column 3 implies that a 10% increase in parent earnings leads to an increase in profit shifting by $0.19 million US (i.e., 0.59*$31.5 million US) per subsidiary. In our sample (after dropping singleton groups) the mean parent firm owns 12.2 subsidiaries and 55% of them are low-tax subsidiaries. These statistics imply that approximately $1.25 million US of profit per parent firm is shifted toward low-tax jurisdictions (see calculations in Table A3 of the appendix).

[Insert Table 3 about here]

Finally, we use $\hat{\beta}_3$ to calculate the partial fitted values $\hat{Y}_{partial} = \hat{\beta}_3\left(d_{it} \cdot log\tilde{\pi}_{pt}\right)$, which represent the response of subsidiary's earnings to a 1% increase in parent profits. This is our estimate of *Profit-shifting response* (psr_{it}) by subsidiary-year, which is the dependent variable in

the second stage of our analysis. Notably, as in Dharmapala and Riedel (2013), profit shifting is only derived from $\hat{\beta}_3$ and not from the total effect of $\tilde{\pi}_{pt}$. In other words, the coefficient $\hat{\beta}_2$ does not reflect shifted income to a subsidiary; it reflects a co-movement between parent shocks and subsidiary profits. This co-movement can be due to, for example, productivity linkages between parent and subsidiary profits.

4. Second stage: The effect of corporate governance on profit shifting

4.1. Empirical model, data, and variables

To examine whether corporate governance characteristics affect the firm-year *Profit-shifting response*, psr_{it}, we estimate the model:

$$psr_{it} = c_0 + c_1 g_{it} + c_2 f_{it} + \rho' + u_{it}, \quad (4)$$

where *g* is the vector of governance characteristics, *f* is the vector of subsidiary-year and/or parent-year control variables, and *u* is the stochastic disturbance.[11] As in equation (1), we also include several types of fixed effects ρ'.

Information for the corporate governance variables is from BoardEx. These variables are for each director level and, thus, we calculate averages by parent and year. We group the corporate governance variables into two categories, namely board structure and directors' experience. These groups reflect our hypotheses in section 2. Concerning board structure, we use the number of independent NEDs with functional experience in audit committees (*NEDs audit experts*), the total number of directors (*Board size*), and a dummy variable (*Duality*) that takes the value 1 if the CEO

[11] An alternative empirical approach would be to conduct the analysis in a single stage, where we introduce triple interactions between governance characteristics and the DID identifier in equation (1). These interaction terms would show the differential level of profit shifting due to the governance characteristics. However, this approach would imply introducing several triple interaction terms (because of the use of several corporate governance variables), implying a statistical stretch of our data with possible multicollinearities. We do, however, conduct a robustness test on our baseline findings using the model with triple interactions and find results consistent with our main tests.

is also the chairman of the board and zero otherwise. Concerning directors' experience, we use the mean directors' tenure in the board (*Tenure*), the number of multiple directorships held by the directors (*Number of directorships*), and the directors' network size (*Network size*).

We report summary statistics in Table 2. The mean *NEDs audit experts* is 0.57 and the mean *Board size* is approximately 13 directors. Also, 50.5% of the parent firms in our sample have CEO/Chairman duality. Each director serves on average for 7.1 years in the same board and the mean board has almost 28 directorships. The mean *Network size* approximately equals 9,000 firms.

We control for a number of additional factors in equation (4), also defined in Table 1. There are additional board characteristics that are potentially important, but the current agency theory does not strongly suggest hypotheses in this context. First, we control for the share of female directors in the board. Females are believed to hold stricter attitudes towards law compliance and more conservative financial reporting (Francis et al., 2015), and might exert higher audit effort (Gul et al., 2008). Next, we control for the directors' mean age because several studies suggesting that conservatism increases with an executive's age (e.g., MacGrimmon and Wehrung, 1990; Hambrick and Fukutomi, 1991; Wu et al., 2005). Further, we control for the audit committee's size. A larger audit committee might reduce profit shifting because it will be more effective in fulfilling its monitoring role. Last, the presence of directors from the subsidiary's country might increase MNEs' profit shifting to that subsidiary due to their experience with the fiscal and accounting environment where the subsidiary resides (e.g., Masulis et al., 2012).

At the subsidiary-year and parent-year levels, we control for firm size, leverage, and firm growth rates. As in the first stage of our analysis, we also use subsidiary, parent, year, industry-year, and country-year fixed effects. The parent and subsidiary fixed effects are particularly important because they imply identification from within-firm changes in corporate governance

characteristics and not from the full cross-section. Overall, the fixed effects make equation (4) immune from relevant alternative explanations of the findings.

A potentially important endogeneity problem is reverse causality between *psr* and *g*: parent firms strategically choose their future corporate governance characteristics because of the current level of profit shifting to their subsidiaries. Similar arguments can be found in most recent studies examining the effect of corporate governance on firm performance. However, as briefly discussed in section 3.1, we do not expect reverse causality to be important in the estimating equation (4) because we estimate profit-shifting shocks (and not the level of profit shifting) and these shocks are derived from profits of comparable firms (and not the profits of the own parent firms). To the extent that there is no causal effect running from the board characteristics of comparable firms to the profit-shifting activity of the parent firms, there should be no reverse causality.

4.2. Main empirical results

Table 4 reports our baseline results from the estimation of equation (4). Besides the usual coefficient estimates and t-statistics, we standardize our results across the different governance variables by reporting the change in *Profit-shifting response* from a one standard deviation increase in each corporate governance variable.[12] This allows the direct comparison of the effects of the corporate governance characteristics of main interest. Specifications (2) to (4) sequentially add more control variables

We include subsidiary fixed effects, parent fixed effects, year fixed effects, industry-year fixed effects, and country-year fixed effects. Using these fixed effects increases the adjusted R-squared to about 95%, implying that the omitted-variable bias, if present, is small.

[12] We standardize coefficients using the product $(\widehat{c_1} * sd)$, where c_1 is obtained from the estimation of equation (4) and *sd* is the standard deviation of each relevant variable in Table 2.

Our model shows that firms with more *NEDs audit experts*, larger *Board size*, and without *Duality* exhibit lower profit shifting. These coefficients on the first two variables are significant at the 1% level, are in line with hypotheses 1, and highlight the importance of the board structure for profit shifting. The coefficient estimates on *Duality* are less statistically significant (at the 5% or 10% level). In turn, in line with hypothesis 2, our model predicts that increases in *Tenure*, *Number of directorships*, and *Network size*, significantly increase MNEs' profit shifting.

[Insert Table 4 about here]

The results are also economically significant. According to the specification with all the controls (column 4), decrease in *Profit-shifting response*, which is the largest effect among our six main corporate governance variables. The second and third largest effects come from *Network size* (approximately 2.5%) and *Number of directorships* (approximately 1.25%), respectively. The smallest effect economically is that of *Duality*.

Perhaps more importantly, the lower part of Table 4 shows the total effect on *Profit-shifting response* of corporate governance characteristics related to board structure is around 6.4% and the equivalent of directors' experience is around 4.7%. To provide an even more integrated picture of our results, we highlight that a one standard deviation increase in *NEDs audit experts* and *Board size*, along with an equivalent decrease in the rest of the corporate governance characteristics of main interest, implies approximately an 11.06% reduction in *Profit-shifting response*. Applying this response magnitude to the sample firms yields an annual USD reduction in profit shifting that ranges from \$140 thousand for the parent in our sample with 12.2 subsidiaries (mean of our sample), to \$0.64 million for a parent with 56.2 subsidiaries (90^{th} centile), and to around \$1.78 million for a parent with 157.5 subsidiaries (99^{th} centile). We provide the analytical calculations for these values in Table A3.

4.3. Robustness

We conduct several sensitivity tests on the baseline results.[13] Following Armstrong et al. (2015), we show in Table A4 that our data exhibit a low within variation for the corporate governance variables, whereas the within variation of *Profit-shifting response* is comparatively larger (more than 100 times larger than the relative variation of the corporate governance variables). As a consequence profit shifting should only be one of the many targets (and perhaps one of lesser importance) that are considered when a firm decides on its board's characteristics.

We conduct two more tests to show that there is indeed very limited (if not statistically negligible) probability of the effect running from *psr* to *g*. First, we use the approach of Fich and Shivdashani (2006) and estimate models with the board characteristics as dependent variables and *Profit-shifting response* as the main explanatory variable (among the rest of the controls). We estimate the models with Poisson maximum likelihood (PML) for all the corporate governance variables that are count variables, with the logistic regression for the *Duality* dummy and with OLS for *Tenure*, as the latter is a continuous variable. If we find that the effect of *Profit-shifting response* in these regressions is statistically insignificant, then we limit the possibility of reverse causality.

Table 5 reports the results. All models include at least the usual control variables of previous specifications. However, we use additional industry and country controls because we cannot use the full array of fixed effects (maximum likelihood models do not converge). We define these variables in Table 1. Clearly, the results suggest that the effect of *Profit-shifting response* on the key corporate governance variables is statistically insignificant for all the corporate governance characteristics. This shows no evidence for a causal effect running from our measure of profit

[13] For expositional brevity, from this point onward we do not include the effect of all of the control variables in the tables. These results are available on request.

shifting to boardroom characteristics.[14]

[Insert Table 5 about here]

Second, following the previous corporate governance literature (e.g., Wintoki et al., 2012; Minnick and Noga, 2010), we experiment with a GMM model that is also suitable to account for the potential dynamics (persistence) in *Profit-shifting response*. Specifically, we use the Blundell and Bond (1998) two-step GMM to control for simultaneity and dynamic endogeneity (e.g., Wintoki et al., 2012; Minnick and Noga, 2010). GMM for dynamic panels, albeit sensitive to the instruments used, provide a series of specification tests to verify the strength of the instruments (e.g., Hansen and Sargan tests) and exclude serial correlation (AR test). Formally, the estimated equation is:

$$psr_{it} = c_0 + psr_{it-1} + c_1 g_{it} + c_2 f_{it} + u_{it}, \quad (5)$$

where for the lagged psr_{it-1}, we utilize as instruments the $(t-2)$ and $(t-3)$ values of psr_{it}. We prefer the two-step GMM, whose standard covariance matrix is robust to panel-specific autocorrelation and heteroscedasticity and performs somewhat better in terms of lower bias (Windmeijer, 2005). We use robust standard errors (Windmeijer's correction).

Table 6 reports the results in a manner like Table 4. The AR(2) and Hansen tests confirm that our model does not suffer from autocorrelated errors and overidentifying restrictions. Concerning the effect of board structure, both *NEDs audit experts* and *Board size* continue to exert a negative impact on *Profit-shifting response* at a 1% level of statistical significance. The difference is that the effect of *Board size* is economically smaller. Moreover, the positive coefficient on *Duality* is considerably higher than the equivalent in Table 4 and significant at 1%.

[14] Table A5 provides further sensitivity tests by controlling for the average industry corporate governance characteristics instead of the own parent governance characteristics. The results are very similar with those in Table 4.

Similarly, the variables reflecting directors' experience (*Tenure*, *Number of directorships*, and *Network size*) have a positive and statistically significant effect on *Profit-shifting response*. Overall, the total economic significance of the corporate governance variables is a bit smaller compared to our baseline results, albeit the statistical significance is even stronger.

[Insert Table 6 about here]

Further, in the first two columns of Table 7, we use *Profit-shifting response* estimates obtained from specifications (1) and (2) of Table 3. In column 3, we cluster the standard errors at the country-year level instead of the subsidiary level to avoid relevant heteroscedasticity driving our inference. Last, in column 4, we aim to mitigate the potential bias arising from carrying the error in *Profit-shifting response* from the first stage, and we use bootstrapping with 200 replications (see e.g., Efron and Tibshirani, 1993, Chapter 10). The results from these specifications are very similar to the ones of Table 4.

[Insert Table 7 about here]

Table 8 provides further sensitivity tests using alternative variables to define board independence. We replace *NEDs audit experts* with *NEDs with CFO experience* (column 1), *Ind. NEDs on audit comm.* (column 2), and *NED with audit experience* (column 3). The results from these regressions are similar to the baseline, both in terms of statistical and economic significance.

[Insert Table 8 about here]

As suggested in footnote 11, an alternative modelling framework would be to use triple interaction terms between the variables capturing profit shifting ($d_{it} \times log\tilde{\pi}_{it}$) and each corporate governance variable. The advantage of this all-in-one single-stage approach is that we do not have to "carry" an error term in the second stage.[15] However, we favor the two-stage approach used in

[15] Of course, the results from the bootstrapping approach are not overly sensitive to this issue.

the bulk of our analysis for two reasons. First, numerous triple interactions might cloud inference because of the considerable non-linearity introduced in the model (it might even require non-parametric econometrics) and associated multicollinearity. Second, triple interactions imply different slopes only for the variables included in the interactions and not for the rest of the control variables. Thus, all other slopes (on the rest of the governance variables, other control variables, and fixed effects) and the intercept will be assumed to have no direct impact on the level of profit shifting. To avoid this we would need interaction terms between the DID term and all controls and fixed effects, further complicating the model.

In spite of these issues, we do check the sensitivity of our findings when using triple interaction terms. We use two indicators for board characteristics. The first, termed *Good structure*, is a binary variable equal 1 when there is a large enough number of *NEDs audit experts* and *Board size* (values are above the 1st quartile), and when *Duality* equals 0. The second, termed *Experienced directors*, equals 1 if *Tenure*, *Number of directorships*, and *Network size* take values above the 1st quartile. For full definitions, please see Table 1.

We report the estimates in Table A6. In line with our baseline results, the estimates on the triple interaction ($d_{it} \times log\tilde{\pi}_{it} \times Good\ structure$) in columns 1 and 2 show that *Good structure* has a negative effect on profit shifting. Similarly, the triple interaction ($d_{it} \times log\tilde{\pi}_{it} \times Experienced\ director$) in columns 3 and 4 is positive and significant at the 5% level. These estimates suggest once again that "more" connected and experienced directors are associated with higher levels of profit shifting.

Finally, in Table 9 we examine the effect of corporate governance on profit shifting only for the U.S. parent firms. The results are qualitatively similar to those of Table 4, albeit with two interesting differences. First, the results are a bit smaller in terms of economic significance. This

finding is in line with Markle (2016), who notes that MNEs subject to worldwide tax regimes (such as the U.S.) shift less income. Perhaps more interestingly for our study, the effect of *Duality* turns negative, albeit with a small economic significance. This result can be explained by the increasing pressure (mostly by shareholders but also governance experts) to separate the roles of the CEO and the board's chairman, which in turn leads to stricter monitoring by those CEOs with dual roles in an effort to avoid the change. This argument is in line with Larcker and Tayan (2016), who document these pressures and several cases in which firms decided in favor of duality.

[Insert Table 9 about here]

6. Conclusions and policy implications

Profit shifting is currently viewed as the single most important practice of MNEs and concern has been growing that aggressive profit shifting undermines the fairness and integrity of tax systems worldwide. This is mainly because MNEs can use profit shifting to exploit competitive advantages and the untaxed income bears an opportunity cost for the public sector. OECD's inclusive framework on BEPS brings together over 100 countries and jurisdictions to collaborate on the implementation of the OECD/ G20 BEPS Package. This pushes forward ongoing efforts to update international tax rules for the 21st century and limit profit-shifting activities.

In this study, we consider for the first time the role of corporate governance of MNEs as a set of practices affecting profit shifting. We use data for MNE subsidiaries in 49 countries, parent firms in 24 countries, and approximately 18,000 subsidiary-year observations for 2009-2013. Our empirical strategy aims to first identify exogenous profit-shifting responses due to earnings shocks to parent firms. Subsequently, we examine the role of corporate governance characteristics as explanatory variables of the estimated profit-shifting responses.

Our baseline model finds that an increase of one standard deviation in independent NEDs with audit experience and board size additively reduces profit shifting by around 6%. Furthermore, a one standard deviation decrease in tenure, number of directorships, and network size reduces the MNEs' profit-shifting response by approximately 4.7%. Finally, we find that duality implies higher profit-shifting response by approximately 0.37%, even though this result is almost the opposite when we use a U.S. sample. Collectively, these changes yield an approximately 11% reduction in profit shifting by parent firm-year. This estimation is robust to an extensive series of sensitivity tests, including tests to mitigate endogeneity concerns.

These results are important from a policy perspective; they imply that tax authorities would benefit from taking a closer look at MNEs' corporate governance. Encouraging stronger corporate governance would help to prevent profit shifting. Further, MNEs with a low number of NEDs and board members, and extensive directors' tenure, network size and number of directorships are more likely to engage in aggressive profit shifting.

On the prevention front, our findings point to the need for policy initiatives ranging from guidelines to regulation. As the Base Erosion and Profit Shifting (BEPS) project moves forward to fulfill its objectives for increased transparency and tax fairness, we provide evidence that corporate governance practices could hold a role in the design and implementation of this initiative. However, there seems to be consensus that more NEDs and a smaller board size positively contribute to firm performance; thus, the direction of the effects we identify are the same as the board structure–firm performance nexus. In the case of the directors' experience, however, which is hard to encourage or regulate, there is a tradeoff between profit shifting and firm performance.

Our research opens new pathways for academic research. The potential interplay between profit shifting and (i) gender diversity in the boardroom, (ii) the strategic use of directors from subsidiary countries, and (iii) executive compensation has either briefly been analyzed in this

paper, but more can be accomplished in future research. Further research could address the challenges of identifying the relation between these potential mechanisms and profit shifting, an effort that may require resorting to natural experiments. Another avenue for future research is identifying the precise profit-shifting mechanisms, such as transfer pricing and intra-group financial transactions, through which corporate governance affects profit shifting. Finally, future research could examine the effectiveness of corporate governance regulations in specific industries for reasons unrelated to profit shifting (e.g., banking) as a means through which profit shifting might be reduced. We leave these ideas for future research.

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Table 1: Variable definitions and sources

Name	Description	Data source
EBT	Subsidiary's pre-tax profits (in logs).	Orbis
Low-tax subsidiary	Dummy variable equal to one if the corporate tax rate in the subsidiary's country is lower than the one in the parent's country and zero otherwise.	OECD, KPMG
Parent profit	$\tilde{\pi}_{it} = \tilde{p}_{jt}\alpha_{it}$, where $\tilde{\pi}_{it}$ denotes the parent's pre-tax & pre-shifting profit. It is constructed as the product of the asset weighted average profitability of all firms in the same 4-digit NACE industry in the same country and the parent's total asset stock (i.e., $\tilde{p}_j = \sum_j \frac{\alpha_j}{\sum_j \alpha_j} p_j, i \neq j$ and $p_j = \frac{\pi_j}{\alpha_j}$).	Orbis, OECD, KPMG
Subsidiary total assets	Subsidiary's total assets (in logs).	Orbis
Subsidiary leverage	Subsidiary's leverage, defined as total debt/ total assets.	Orbis
Sub. country GDP per capita	Subsidiary country's GDP per capita (in logs).	World Bank
Sub. country population	Subsidiary country's permanent residents (in logs).	World Bank
Profit-shifting	The estimated value of profit-shifting response calculated running the DID approach of Dharmapala and Riedel (2013).	Orbis
Profit-shifting 2	The estimated value of profit-shifting response calculated running the DID approach of Dharmapala and Riedel (2013), while controlling only for subsidiary and time fixed effects.	Orbis
Profit-shifting 3	The estimated value of profit-shifting response calculated running the DID approach of Dharmapala and Riedel (2013), while controlling only for subsidiary fixed effects, time fixed effects, and industry-year fixed effects.	Orbis
NEDs audit experts	The number of independent non-executive directors with functional experience in audit committees.	BoardEx
Board size	The number of total directors in the board.	BoardEx
Duality	Dummy variable equal to one if the CEO is also the chairman of the board.	BoardEx
Tenure	The average tenure for directors in the board.	BoardEx
Number of directorships	The total number of directorships per board (private boards).	BoardEx
Network size	The summation of the network size of all directors in the board.	BoardEx
Female directors	The number of female directors in the board.	BoardEx
Audit committee size	The number of directors in the audit committee.	BoardEx
Mean age of the board	The average age of directors in the board.	BoardEx
Directors from subsidiary country	The number of directors in the board that come from a country where the group owns at least one subsidiary.	BoardEx
Parent total assets	Parent's total assets (in logs).	Orbis
Parent leverage	Parent's leverage defined as total debt/ total assets.	Orbis
Growth of parent total assets	Annual growth rate of parent's total assets.	Orbis
NEDs with CFO experience	The number of independent NEDs with experience as CFO.	BoardEx
NED with audit experience	Dummy variable equal to one if the board has independent NEDs with experience in audit committees.	BoardEx
Subsidiaries' industry ROA	The average industry ROA for each subsidiary.	Orbis
Parents' industry ROA	The average industry ROA for each parent.	Orbis

Parent country GDP per capita	Parent country's gross domestic product per capita (in logs).	World Bank
Parent country population	Parent country's permanent residents (in logs).	World Bank
Sub. country government debt	Subsidiary's country total government debt as a % of GDP.	World Bank
Ind. NEDs on audit committee	The total number of independent NEDs in the audit committee.	BoardEx
Ind. NEDs audit experts	The average *NEDs audit experts* by parent country, year, and industry.	BoardEx
Ind. board size	The average *Board size* by parent country, year, and industry.	BoardEx
Ind. duality	The average *Duality* by parent country, year, and industry.	BoardEx
Ind. tenure	The average *Tenure* by parent country, year, and industry.	BoardEx
Ind. number of directorships	The average *Number of directorships* by parent country, year, and industry.	BoardEx
Ind. network size	The average *Network size* by parent country, year, and industry.	BoardEx
Ind. female directors	The average *Female directors* by parent country, year, and industry.	BoardEx
Ind. audit committee size	The average *Audit committee size* by parent country, year, and industry.	BoardEx
Ind. mean age of the board	The average *Mean age of the board* by parent country, year, and industry.	BoardEx
Ind. directors from subsidiary country	The average *Number of directors* from the subsidiary's country by parent country, year, and industry.	BoardEx
Good structure	Dummy variable equal to one if *NEDs audit experts*, and *Board size* take values above the 1st quartile, and *Duality* equals zero (and zero otherwise).	BoardEx
Experienced directors	Dummy variable equal to one if *Tenure*, *Number of directorships*, and *Network size* take values above the 1st quartile (and zero otherwise).	BoardEx

Table 2: Summary statistics

The table reports the number of observations as well as the mean, median, standard deviation, minimum, and maximum of the main variables used in the empirical analysis. The variables are defined in Table 1. The monetary units are in thousand USD (current prices of 2005), while population is in thousand individuals.

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
EBT	17,873	31,512	4,022	236,260	0.583	17,000,000
Low-tax subsidiary	17,873	0.550	1.000	0.498	0.000	1.000
Parent profit	17,873	2,776,984	971,259	4,974,853	284.1	51,100,000
Subsidiary total assets	17,873	312,811	38,021	1,873,277	10.27	73,600,000
Subsidiary leverage	17,873	0.597	0.613	0.384	-0.011	33.93
Subsidiary GDP per capita	17,873	33.03	37.15	12.90	0.948	81.85
Subsidiary population	17,873	78,244	62,276	191,149	414.5	1,357,380
Profit-shifting	17,873	0.358	0.692	0.329	0.000	0.829
Profit-shifting 2	17,873	0.379	0.721	0.348	0.000	0.877
Profit-shifting 3	17,873	0.359	0.691	0.329	0.000	0.830
NEDs audit experts	17,873	0.570	0.000	0.727	0.000	4.000
Board size	17,873	13.24	11.00	5.837	4.000	30.00
Duality	17,873	0.505	1.000	0.500	0.000	1.000
Tenure	17,873	7.064	6.400	3.080	0.800	25.70
Number of directorships	17,873	27.97	16.00	27.27	0.000	159.0
Network size	17,873	9.062	7.216	7.493	0.063	38.68
Female directors	17,873	1.924	2.000	1.441	0.000	9.000
Audit committee size	17,873	4.009	4.000	1.498	0.000	8.000
Mean age of the board	17,873	59.05	58.71	3.893	39.80	68.67
Directors from subsidiary country	17,873	2.259	2.000	1.517	0.000	8.000
Parent total assets	17,873	32,900,000	12,700,000	48,500,000	3,628	350,000,000
Parent leverage	17,873	0.622	0.636	0.168	0.035	1.661
Growth of parent total assets	17,873	0.063	0.045	0.128	-0.986	0.993
NED with CFO experience	17,873	0.855	1.000	0.957	0.000	5.000
NED with audit experience	17,873	0.442	0.000	0.497	0.000	1.000
Subsidiaries' industry ROA	17,873	13.34	13.35	2.229	0.315	38.38
Parents' industry ROA	17,873	8.030	8.550	2.646	0.460	22.57
Parent country GDP per capita	17,868	39.60	39.47	6.280	3.122	65.62
Parent country population	17,868	133,132	66,028	117,877	4,560	1,350,695
Government debt	13,948	73.10	68.99	32.28	6.564	196.0
Ind. NEDs on audit comm.	17,873	2.666	3.000	1.769	0.000	8.000
Ind. NEDs audit experts	17,873	0.562	0.530	0.536	0.000	2.853
Ind. board size	17,873	13.01	11.00	5.263	4.000	27.22
Ind. duality	17,873	0.504	0.607	0.418	0.000	1.000
Ind. tenure	17,873	7.074	6.678	2.263	1.400	25.70
Ind. number of directorships	17,873	27.34	15.54	24.32	0.000	120.0
Ind. network size	17,873	8.662	8.182	5.792	0.111	34.17
Ind. female directors	17,873	1.858	1.583	1.167	0.000	6.729
Ind. audit committee size	17,873	3.979	3.908	1.248	0.000	8.000
Ind. mean age of the board	17,873	59.03	58.77	3.287	39.80	68.86
Ind. directors from subsidiary country	17,873	2.194	1.887	1.203	0.000	6.379
Good structure	17,873	0.191	0.000	0.393	0.000	1.000
Experienced directors	17,873	0.481	0.000	0.500	0.000	1.000

Table 3: Identification of profit-shifting response

The Table reports coefficient estimates and *t*-statistics (in brackets) from the DID model of equation (1), with robust standard errors clustered by subsidiary. The observational units are MNE subsidiaries with a foreign parent firm. The dependent variable is EBT and all variables are defined in Table 1. The lower part of the Table indicates the type of fixed effects used in each regression. Year effects (industry-year effects) indicate a full set of year fixed effects (industry-year fixed effects at the 2-digit NACE level). Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	**(2)**	**(3)**
Low-tax subsidiary * Parent profits	0.062***	0.059***	0.059***
	[2.927]	[2.740]	[2.685]
Low-tax subsidiary	-0.848***	-0.801***	-0.822***
	[-2.995]	[-2.776]	[-2.784]
Parent profits	0.034	0.014	0.014
	[1.406]	[0.532]	[0.486]
Subsidiary total assets	0.689***	0.698***	0.699***
	[16.279]	[15.566]	[15.565]
Subsidiary leverage	-0.574***	-0.777***	-0.774***
	[-4.963]	[-8.390]	[-8.079]
Population	2.088**	1.750**	
	[2.519]	[1.994]	
GDP per capita	1.338***	1.292***	
	[5.288]	[4.976]	
Observations	16,139	15,925	15,903
Number of subsidiaries	4,864	4,790	4,790
Adjusted R-squared	0.885	0.887	0.887
S.E. Clustering by	Subsidiary	Subsidiary	Subsidiary
Subsidiary effects	√	√	√
Parent effects	√	√	√
Year effects	√	-	-
Industry-year effects	-	√	√
Country-year effects	-	-	√

Table 4: The effect of corporate governance on profit-shifting

The Table reports coefficient estimates and t-statistics (in brackets) for all explanatory variables, as well as the percentage effect on profit-shifting responses by parent firm from a one standard deviation change for the main corporate governance variables. To obtain this percentage effect for each variable, we calculate the product ($\hat{c} * standard\_deviation$). The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line. For expositional brevity, the corporate governance variables are divided by 100. The lower part of the Table indicates the type of fixed effects used in each regression. Year effects (industry-year effects) indicate a full set of year fixed effects (industry-year fixed effects at the 2-digit NACE level). Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. We also report the total percentage profit-shifting reduction from a one standard deviation change in board characteristics. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Dependent: Profit-shifting	**(1)**	**(2)**	**(3)**	**(4)**
Board Structure	NEDs audit experts	-1.504***	-1.596***	-1.601***	-1.593***
		[-3.662]	[-3.789]	[-3.770]	[-3.746]
		1.09%	1.16%	1.16%	1.16%
	Board size	-0.715***	-0.712***	-0.823***	-0.830***
		[-3.873]	[-3.638]	[-4.141]	[-4.184]
		4.17%	4.16%	4.80%	4.84%
	Duality	0.483*	0.521*	0.726**	0.728**
		[1.668]	[1.726]	[2.401]	[2.409]
		0.24%	0.26%	0.37%	0.37%
Directors' Experience	Tenure	0.144	0.331**	0.305**	0.309**
		[1.426]	[2.240]	[2.068]	[2.093]
		0.44%	1.02%	0.94%	0.95%
	Number of directorships	0.066**	0.064**	0.046*	0.046*
		[2.515]	[2.439]	[1.801]	[1.792]
		1.80%	1.75%	1.25%	1.25%
	Network size	0.294***	0.324***	0.326***	0.331***
		[2.928]	[3.202]	[3.235]	[3.288]
		2.20%	2.43%	2.44%	2.48%
Corporate governance control variables	Female directors		-0.176	0.009	0.028
			[-0.782]	[0.042]	[0.123]
	Audit committee size		0.094	0.013	0.001
			[0.453]	[0.064]	[0.007]
	Mean age of the board		-0.262***	-0.280**	-0.273***
			[-2.115]	[-2.277]	[-2.27]
	Directors from subsidiary country		-0.007	0.043	0.041
			[-0.019]	[0.116]	[0.110]
Subsidiary and parent firms' control variables	Parent total assets			0.058***	0.055***
				[6.539]	[5.797]
	Parent leverage			0.053**	0.048*
				[2.102]	[1.888]
	Growth of parent total assets				0.011***
					[1.447]
	Subsidiary total assets				0.003
					[0.990]
	Subsidiary leverage				-0.027***
					[-2.669]

	Dependent: Profit-shifting	(1)	(2)	(3)	(4)
	Observations	15,903	15,903	15,903	15,903
	Number of subsidiaries	4,790	4,790	4,790	4,790
	Adjusted R-squared	0.945	0.945	0.945	0.945
	S.E. Clustering by	Subsidiary	Subsidiary	Subsidiary	Subsidiary
	Subsidiary effects	√	√	√	√
	Parent effects	√	√	√	√
	Year effects	-	-	-	-
	Industry-year effects	√	√	√	√
	Country-year effects	√	√	√	√
% effect of an 1 s.d. change in board structure		5.51%	5.58%	6.34%	6.37%
% effect of an 1 s.d. change in directors' experience		4.45%	5.19%	4.64%	4.69%
% effect of an 1 s.d. change in board's characteristics		**9.96%**	**10.77%**	**10.98%**	**11.06%**

Table 5: Robustness for reverse causality

The table reports coefficient estimates and *t*-statistics (in brackets) of regressions based on Poisson Maximum likelihood (columns 1-4), logistic estimation (column 5), and OLS estimation (column 6) with robust standard errors. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variables are shown at the 2nd line of the table. The lower part of the table indicates the type of fixed effects used in each regression. Year indicates a full set of year fixed effects. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

Estimation:	**Poison Maximum Likelihood**				**Logit**	**OLS**
Dependent variable:	**NEDs audit experts**	**Board size**	**Number of directorships**	**Network size**	**Duality**	**Tenure**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Profit-shifting	-0.021	0.001	-0.036	0.001	24.325	0.001
	[-0.446]	[0.189]	[-1.269]	[0.096]	[1.585]	[1.252]
NEDs audit experts		-0.888***	-9.232***	3.963***	-382.758***	0.186***
		[-4.061]	[-6.624]	[7.960]	[-7.012]	[5.320]
Board size	-2.345***		6.379***	7.384***	60.968***	-0.101***
	[-2.764]		[25.801]	[36.827]	[3.326]	[-5.315]
Duality	-26.345***	-2.645***	-14.247***	14.975***		-0.129***
	[-3.929]	[-6.730]	[-18.794]	[19.990]		[-2.983]
Tenure	6.524***	-0.871***	0.561*	-2.726***	68.155***	
	[4.860]	[-6.197]	[1.696]	[-12.691]	[3.201]	
Number of directorships	-1.414***	0.295***		-0.112***	-22.993***	0.001
	[-6.816]	[19.040]		[-4.113]	[-6.223]	[0.625]
Network size	2.727***	2.025***	0.963***		-26.745**	-0.059***
	[4.629]	[34.341]	[3.069]		[-2.355]	[-7.324]
Total number of females	-11.314***	2.611***	-3.955***	-0.395	85.282***	-0.017
	[-6.540]	[26.193]	[-14.775]	[-1.533]	[2.770]	[-0.954]
Audit committee size	32.792***	3.403***	2.725***	0.031	316.098***	0.069***
	[22.716]	[20.755]	[4.964]	[0.104]	[6.257]	[3.298]
Mean age of the board	-6.324***	-0.240**	-0.422	2.569***	-59.713***	0.519***
	[-5.774]	[-2.016]	[-1.475]	[12.606]	[-3.879]	[31.976]
Directors from subsidiary country	-10.007***	0.803***	-4.665***	2.235***	-184.939***	-0.035*
	[-5.505]	[6.226]	[-13.076]	[9.424]	[-3.471]	[-1.659]
Parent total assets	0.219***	0.061***	-0.035	0.063***	-11.012***	-0.002**
	[3.600]	[8.180]	[-1.336]	[3.970]	[-5.709]	[-2.064]
Parent leverage	0.621***	-0.062***	0.456***	-0.015	2.979	0.014***
	[4.839]	[-3.047]	[6.964]	[-0.399]	[0.824]	[5.864]
Growth of parent total assets	-0.182***	-0.009	0.042***	-0.074***	6.917***	0.003***
	[-3.855]	[-1.337]	[2.658]	[-8.588]	[6.397]	[3.307]
Subsidiary total assets	-0.016	0.002	0.013*	-0.009**	0.283	0.000
	[-0.772]	[0.936]	[1.929]	[-2.058]	[0.800]	[0.055]
Subsidiary leverage	0.042	0.002	-0.002	-0.003	0.400	0.002
	[0.565]	[0.303]	[-0.101]	[-0.290]	[0.315]	[1.348]
Subsidiaries' industry ROA	0.013***	-0.001*	-0.002	-0.000	0.078	0.000**
	[2.602]	[-1.804]	[-1.031]	[-0.128]	[0.799]	[2.453]
Parents' industry ROA	0.005	0.003***	-0.014***	0.007***	-0.780***	0.000**

	[1.139]	[4.200]	[-7.005]	[5.872]	[-4.615]	[2.481]
Estimation:	**Poison Maximum Likelihood**				**Logit**	**OLS**
Dependent variable:	**NEDs audit experts**	**Board size**	**Number of directorships**	**Network size**	**Duality**	**Tenure**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Sub. country GDP per capita	0.024	-0.006	-0.068	0.079	-7.407	-0.009
	[0.065]	[-0.186]	[-0.602]	[0.932]	[-1.308]	[-1.519]
Sub. country population	-1.494	-0.145	-0.772**	-0.062	-2.311	0.023
	[-1.475]	[-1.552]	[-2.535]	[-0.303]	[-0.129]	[1.599]
Parent country GDP per capita	-3.159***	-0.067	0.132	-0.739***	264.701***	-0.006
	[-4.159]	[-1.229]	[1.040]	[-6.426]	[8.600]	[-0.802]
Parent country population	-9.862***	-1.094***	2.657***	0.961***	487.609***	-0.130***
	[-3.696]	[-9.301]	[8.586]	[4.023]	[5.586]	[-7.671]
Sub. country government debt	-0.001	0.000	-0.000	0.001***	0.026	-0.000***
	[-0.790]	[1.257]	[-0.497]	[3.073]	[1.450]	[-2.635]
Observations	5,956	12,410	12,404	12,410	1,877	12,410
Number of subsidiaries	1,961	4,094	4,091	4,094	534	
Subsidiary effects	√	√	√	√	√	√
Year effects	√	√	√	√	√	√

Table 6: GMM estimates

The Table reports coefficient estimates and *t*-statistics (in brackets) from the estimation of equation (5) using the Blundell and Bond (1998) system GMM. The dependent variable is *Profit-shifting*. We use robust standard errors, corrected with Windmeijer's (2005) procedure. We use the t−2 and t−3 lags of *Profit-shifting* as our external instruments. AR(1) and AR(2) are tests for first and second order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen is the p-value of the Hansen test of overidentifying restrictions, which requires a value higher than 0.05 to accept the null (valid instruments) at the 5% level. The regressions include the controls of column (5) of Table 5. For expositional brevity, the corporate governance covariates are divided by 100. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
NEDs audit experts	-1.195***	-1.063***	-1.132***	-1.148***
	[-3.793]	[-3.189]	[-3.273]	[-3.320]
Board size	-0.240***	-0.182***	-0.171***	-0.159***
	[-6.420]	[-3.668]	[-3.107]	[-2.854]
Duality	1.781***	1.526***	1.525***	1.522***
	[8.897]	[8.250]	[8.259]	[8.258]
Tenure in the same Board	0.192***	0.159***	0.132***	0.124***
	[5.230]	[3.528]	[2.938]	[2.712]
Number of directorships	0.014*	0.019**	0.018**	0.020***
	[1.909]	[2.456]	[2.418]	[2.587]
Company network size	0.228***	0.242***	0.214***	0.219***
	[8.840]	[8.863]	[6.945]	[7.073]
Female directors		-0.343***	-0.322***	-0.305***
		[-3.382]	[-3.153]	[-2.983]
Audit committee size		-0.148	-0.117	-0.133
		[-1.466]	[-1.123]	[-1.273]
Mean age of the board		0.101***	0.105***	0.110***
		[2.954]	[2.999]	[3.134]
Directors from subsidiary country		-0.069	-0.101	-0.099
		[-0.617]	[-0.905]	[-0.885]
Parent total assets			0.001	0.001
			[1.412]	[1.325]
Parent leverage			-0.024***	-0.023***
			[-3.714]	[-3.394]
Growth of parent total assets				0.014***
				[2.838]
Subsidiary total assets				-0.001
				[-1.136]
Subsidiary leverage				-0.012***
				[-2.854]
Profit-shifting (1 lag)	0.948***	0.947***	0.945***	0.943***
	[181.512]	[180.914]	[177.653]	[173.921]
Constant	0.006	-0.047**	-0.054***	-0.044**
	[1.077]	[-2.537]	[-2.685]	[-2.100]
Observations	13,782	13,782	13,782	13,771
Number of no	5,028	5,028	5,028	5,025
AR1 test p-value	0.000	0.000	0.000	0.000
AR2 test p-value	0.463	0.468	0.476	0.469
Hansen test of over-identification p-value	0.117	0.123	0.130	0.120

Table 7: Sensitivity for alternative profit-shifting estimates and standard error correction

The Table reports coefficient estimates and *t*-statistics (in brackets) of regressions based on equation (4) with robust standard errors. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable in each specification is denoted in the second line of the Table. For expositional brevity, the corporate governance variables are divided by 100. Year effects (industry-year effects) indicate a full set of year fixed effects (industry-year fixed effects at the 2-digit NACE level). Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. The regressions include the controls of column (4) of Table 5. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

Estimation method:	**OLS**			**Bootstrap (200 rep.)**
Dependent variable:	**Profit-shifting response 2**	**Profit-shifting response 3**	**Profit-shifting response**	**Profit-shifting response**
	(1)	**(2)**	**(3)**	**(4)**
Number of Independent NED	-1.660***	-1.590***	-1.593***	-1.531***
	[-3.746]	[-3.746]	[-2.846]	[-3.198]
Board size	-0.865***	-0.828***	-0.830**	-0.820***
	[-4.184]	[-4.184]	[-2.296]	[-4.048]
Duality	0.759**	0.727**	0.728*	0.655*
	[2.409]	[2.409]	[1.885]	[1.881]
Tenure in the same Board	0.322**	0.308**	0.309	0.282
	[2.093]	[2.093]	[1.514]	[1.572]
Number of directorships	0.048*	0.046*	0.046	0.050*
	[1.792]	[1.792]	[0.920]	[1.749]
Company network size	0.345***	0.330***	0.331**	0.357***
	[3.288]	[3.288]	[2.125]	[3.551]
Observations	15,903	15,903	15,903	15,904
Number of subsidiaries	4,790	4,790	4,790	4,790
Adjusted R-squared	0.945	0.945	0.945	0.946
S.E. Clustering by	Subsidiary	Subsidiary	Country	Subsidiary
Corporate governance controls	√	√	√	√
Firms' controls	√	√	√	√
Subsidiary effects	√	√	√	√
Parent effects	√	√	√	√
Year effects	-	-	-	-
Industry-year effects	√	√	√	√
Country-year effects	√	√	√	√

Table 8: Sensitivity to alternative definitions of board independence

The Table reports coefficient estimates and *t*-statistics (in brackets) of regressions based on equation (4) with robust standard errors. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is *Profit-shifting response*. To obtain this percentage effect for each variable, we calculate the product ($\hat{c} * standard\_deviation$). For expositional brevity, the corporate governance variables are divided by 100. Year effects (industry-year effects) indicate a full set of year fixed effects (industry-year fixed effects at the 2-digit NACE level). Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. The regressions include the controls of column (4) of Table 5. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Dep.: Profit shifting	**(1)**	**(2)**	**(3)**
Board Structure	NEDs with CFO experience	-1.495***		
		[-4.023]		
		1.09%		
	Ind. NEDs on audit comm.		-0.906***	
			[-2.456]	
			1.60%	
	NED with audit experience			-1.463***
				[-2.889]
				0.78%
	Board size	-0.756***	-0.825***	-0.805***
		[-3.775]	[-4.166]	[-4.066]
		4.41%	4,82%	4.70%
	Duality	0.646**	0.984***	0.983***
		[2.129]	[3.286]	[3.252]
		0.32%	0.49%	0.49%
Directors' Experience	Tenure	0.283**	0.260*	0.286**
		[1.933]	[1.761]	[1,920]
		0.87%	0.80%	0.88%
	Number of directorships	0.043	0.053*	0.049*
		[1.660]	[2.070]	[1.935]
		1.17%	1.45%	1.34%
	Network size	0.309***	0.330***	0.301***
		[3.041]	[3.249]	[2.968]
		2.32%	2.47%	2.26%
	Observations	16,175	16,175	16,175
	Number of subsidiaries	4,835	4,835	4,835
	Adjusted R-squared	0.946	0.946	0.946
	Subsidiary effects	√	√	√
	Parent effects	√	√	√
	Industry-year effects	√	√	√
	Country-year effects	√	√	√
% effect of an 1 s.d. change in board synthesis		5.82%	6.91%	5.97%
% effect of an 1 s.d. change in directors' experience		4.36%	4.72%	4.48%
% effect of an 1 s.d. change in board's characteristics		**10.18%**	**11.63%**	**10.45%**

Table 9: Only U.S. parent firms

The Table reports coefficient estimates and t-statistics (in brackets) for all explanatory variables, as well as the percentage effect on profit-shifting responses by parent firm from a one standard deviation change for the main corporate governance variables. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is shown in the first line. For expositional brevity, the corporate governance variables are divided by 100. The lower part of the Table indicates the type of fixed effects used in each regression. Year effects (industry-year effects) indicate a full set of year fixed effects (industry-year fixed effects at the 2-digit NACE level). Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. We also report the total percentage profit-shifting reduction from a one standard deviation change in board characteristics. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent:	**Profit shifting**	**Profit shifting 2**	**Profit shifting 3**
VARIABLES	**(1)**	**(2)**	**(3)**
NEDs audit experts	-0.221***	-0.230***	-0.220***
	[-3.044]	[-3.044]	[-3.044]
Board size	-0.210***	-0.219***	-0.210***
	[-5.208]	[-5.208]	[-5.208]
Duality	-0.466***	-0.486***	-0.465***
	[-4.963]	[-4.963]	[-4.963]
Tenure in the same Board	0.049**	0.051**	0.049**
	[1.995]	[1.995]	[1.995]
Number of directorships	0.012**	0.012**	0.012**
	[1.962]	[1.962]	[1.962]
Company network size	0.138***	0.144***	0.138***
	[9.061]	[9.061]	[9.061]
Total number of females	0.081*	0.085*	0.081*
	[1.767]	[1.767]	[1.767]
Audit committee size	0.078**	0.081**	0.078**
	[2.025]	[2.025]	[2.025]
Mean age of the board	-0.099***	-0.103***	-0.099***
	[-3.584]	[-3.584]	[-3.584]
Directors from subsidiary country	0.311***	0.324***	0.310***
	[5.320]	[5.320]	[5.320]
Parent total assets	0.064***	0.066***	0.064***
	[28.366]	[28.366]	[28.366]
Parent leverage	-0.020***	-0.020***	-0.020***
	[-5.051]	[-5.051]	[-5.051]
Growth rate of parent total assets	0.004**	0.004**	0.004**
	[2.217]	[2.217]	[2.217]
Subsidiary total assets	0.000	0.000	0.000
	[0.692]	[0.692]	[0.692]
Subsidiary leverage	-0.000	-0.000	-0.000
	[-0.273]	[-0.273]	[-0.273]
Observations	4,492	4,492	4,492
Adjusted R-squared	0.993	0.993	0.993
Number of subsidiaries	1,318	1,318	1,318
S.E. Clustering by	Subsidiary	Subsidiary	Subsidiary
Subsidiary effects	√	√	√
Parent effects	√	√	√
Industry-year effects	√	√	√
Country-year effects	√	√	√

Appendix

This Appendix, intended for online use only, includes four sections. The first section discusses our choice to use the statutory tax rates. The second section includes Tables A1 and A2, which provide more information on our sample and the correlations between the main variables of our analysis. The third section includes Table A3, which provides an explicit example on the calculation of the dollar value of profit shifting from *Profit-shifting response*. The fourth section includes Tables A4 and A5, which provide further evidence on why reverse causality is not a significant problem in the second stage of our empirical analysis. Finally, Table A6 reports results from the estimation of a single-stage model with triple interaction terms.

On the use of statutory tax rates

To justify the use of the statutory tax rate in the identification of profit shifting, we follow Deveraux and Mafini (2007). Firms take relevant decisions in four stages. First, they decide whether to produce domestically and export goods abroad or to produce abroad. To make this choice, the company must assess the net post-tax income of each strategy, taking into account the different forms of taxation (i.e., local government tax, repatriation tax, tariffs). Thus, taxation in this case is better captured by the effective average tax rate. Conditional on choosing to produce abroad or not, the second decision concerns the location of production abroad, the criteria being similar to the ones in the first stage. Thus, the effective average tax rate is once again the most appropriate tax measure for this decision. In turn, conditional on a particular location, the firm must choose the investment's value. In this regard, the firm has to make a marginal decision, i.e., to equate the marginal benefit to the marginal cost of the investment. To reach a decision the firm should measure the impact of taxation using the effect of the tax on the cost of capital. This is determined by an effective marginal tax rate. In the final stage, the multinational firm chooses the location of its profits. We can assume quite realistically that firms take advantage of any tax allowances in any country in which they operate. Having done so, the advantage of transferring a dollar of profit from a high-tax country to a low-tax country must depend on differences in the statutory (and not the effective) tax rate.

Table A1: Information on firms in our sample by parent firms' countries

The Table reports the number of parent firms by country, the number of subsidiaries these parent firms own, the number of parent firms in each country as a share of the total parent firms in our sample (e.g., Australia has 5/860=0.58% of our sample), the equivalent share for subsidiaries (e.g., Australia has 13/6,698 subsidiaries or the 0.19% of our sample), and how many subsidiaries each parent firm owns by country.

Country	Parents	Parents %	Subsidiaries	Subsidiaries %	Subsidiaries/ parent	Low-tax subsidiaries
Australia	5	0.58%	13	0.19%	2.60	50.00%
Austria	3	0.35%	22	0.33%	7.33	29.03%
Belgium	6	0.70%	82	1.22%	13.67	89.36%
China	1	0.12%	4	0.06%	4.00	0.00%
Denmark	5	0.58%	27	0.40%	5.40	34.48%
Finland	9	1.05%	65	0.97%	7.22	48.76%
France	52	6.05%	763	11.39%	14.67	56.81%
Germany	49	5.70%	1001	14.94%	20.43	50.11%
Greece	3	0.35%	10	0.15%	3.33	0.00%
Ireland	1	0.12%	14	0.21%	14.00	10.00%
Israel	2	0.23%	4	0.06%	2.00	0.00%
Italy	13	1.51%	121	1.81%	9.31	18.97%
Japan	6	0.70%	361	5.39%	60.17	44.49%
Netherlands	10	1.16%	77	1.15%	7.70	31.84%
Norway	9	1.05%	43	0.64%	4.78	20.31%
Poland	4	0.47%	20	0.30%	5.00	0.00%
Portugal	2	0.23%	8	0.12%	4.00	0.00%
Russian Federation	6	0.70%	59	0.88%	9.83	0.73%
Spain	30	3.49%	300	4.48%	10.00	30.63%
Sweden	31	3.60%	420	6.27%	13.55	27.51%
Switzerland	1	0.12%	5	0.07%	5.00	0.00%
Turkey	2	0.23%	3	0.04%	1.50	0.00%
United Kingdom	258	30.00%	1332	19.89%	5.16	17.07%
United States of America	352	40.93%	1944	29.02%	5.52	99.63%
Total	**860**	**100.00%**	**6,698**	**100.00%**	**7.79**	**27.49%**

Table A2: Correlations matrix

Panel A: Firm characteristics (Sample size N=18,134)

	EBT	Parent profit	Profit-shifting response	Low-tax subsidiary	Subsidiary total assets	Parent total assets	Subsidiary leverage	Parent leverage	Growth of parent tota assets
EBT	1.000								
Parent profit	0.158*	1.000							
Profit-shifting response	-0.001	0.317*	1.000						
Low-tax subsidiary	-0.030*	0.203*	0.985*	1.000					
Subsidiary total assets	0.807*	0.174*	0.006	-0.023*	1.000				
Parent total assets	0.142*	0.961*	0.260*	0.153*	0.175*	1.000			
Subsidiary leverage	-0.092*	0.027*	-0.115*	-0.126*	-0.069*	0.052*	1.000		
Parent leverage	-0.024*	0.157*	-0.253*	-0.272*	-0.004	0.263*	0.163*	1.000	
Growth of parent total assets	-0.008	0.002	0.017	0.019	-0.010	-0.007	-0.014	-0.049	1.000

Panel B: Corporate governance characteristics (Sample size N=18,134)

	NEDs audit experts	Board size	Tenure	No. of di-rectorships	Network size	Duality	Mean age of the board	Directors from subs. country	Female directors	Audit com-mittee size
NEDs audit experts	1.000									
Board size	-0.274*	1.000								
Tenure	0.036*	-0.182*	1.000							
Number of directorships	-0.284*	0.701*	-0.147*	1.000						
Network size	0.112*	0.425*	0.067*	0.193*	1.000					
Duality	-0.248*	0.259*	0.318*	0.148*	0.214*	1.000				
Mean age of the board	-0.083*	-0.039*	0.392*	-0.141*	0.242*	0.298*	1.000			
Directors from subsidiary country	0.002	0.552*	-0.222*	0.349*	0.382*	-0.030*	-0.062*	1.000		
Female directors	-0.068*	0.548*	-0.001	0.424*	0.455*	0.147*	-0.016	0.387*	1.000	
Audit committee size	0.069*	0.446*	-0.102*	0.196*	0.346*	0.035*	-0.024*	0.346*	0.248*	1.000

Table A3: Examples of the profit shifting calculation of MNE

	Calculations for the:	Mean parent firm	Parent firm at the top 10% of subsidiaries	Parent firm at the top 1% of subsidiaries
1.	DID estimation for profit shifting for 1% increase of parent earnings:	0.059%	0.059%	0.059%
2.	DID estimation for profit shifting for 10% increase of parent earnings:	0.590%	0.590%	0.590%
3.	Sample mean subsidiary EBT:	31,512,000	31,512,000	31,512,000
4.	Average profit-shifting per subsidiary ((2)*(3)):	185,921	185,921	185,921
5.	Average number of subsidiaries owned by each global ultimate owner (parent):	12.2	56.2	157.5
6.	The mean fraction of low-tax subsidiaries:	55%	55%	55%
7.	**Profit-shifting per parent ((4)*(5)*(6)):**	**1,247,530**	**5,746,818**	**16,074,730**
8.	**Predicted governance effect on profit-shifting:**	**-11.06%**	**-11.06%**	**-11.06%**
9.	**USD predicted reduction of profit-shifting per parent firm((7)*(8)):**	**140,000**	**640,000**	**1,780,000**

Table A4: Decomposition of the corporate governance variation

The Table reports the overall, the between, and the within variation for the main corporate governance variables. N, n, and T-bar is the number of total observations, the number of subsidiaries, and the mean observations per firm in our sample.

Variable		Mean	Std. Dev.	Min.	Max.	Observations
Profit-shifting	overall	1,506	469.3	1,000	2,284	N = 18,134
	between		458.8	1,000	2,279	n = 6,631
	within		94.09	599.2	2,394	T-bar = 2.735
NEDs audit experts	overall	0.570	0.727	0.000	4.000	N = 18,134
	between		0.698	0.000	4.000	n = 6,631
	within		0.241	-0.930	1.970	T-bar = 2.735
Board size	overall	13.20	5.810	4.000	30.00	N = 18,134
	between		5.607	4.000	30.00	n = 6,631
	within		0.645	7.003	17.00	T-bar = 2.735
Duality	overall	0.507	0.500	0.000	1.000	N = 18,134
	between		0.478	0.000	1.000	n = 6,631
	within		0.165	-0.293	1.307	T-bar = 2.735
Tenure	overall	7.113	3.129	0.800	25.70	N = 18,134
	between		3.093	1.080	21.03	n = 6,631
	within		0.756	2.922	15.92	T-bar = 2.735
Number of directorships	overall	3.232	2.816	1.000	70.50	N = 18,094
	between		3.082	1.000	70.50	n = 6,617
	within		0.566	-11.99	16.09	T-bar = 2.734
Network size	overall	9.059	7.489	0.063	38.68	N = 18,134
	between		7.222	0.063	36.46	n = 6,631
	within		0.963	1.685	15.41	T-bar = 2.735
Female directors	overall	1.918	1.440	0.000	9.000	N = 18,134
	between		1.348	0.000	9.000	n = 6,631
	within		0.566	-0.749	4.918	T-bar = 2.735
Audit committee size	overall	4.010	1.494	0.000	8.000	N = 18,134
	between		1.444	0.000	8.000	n = 6,631
	within		0.391	1.610	6.010	T-bar = 2.735
Mean age of the board	overall	59.14	3.993	39.80	80.00	N = 18,134
	between		4.166	40.74	80.00	n = 6,631
	within		0.960	49.39	68.89	T-bar = 2.735
Directors from subsidiary country	overall	2.251	1.513	0.000	8.000	N = 18,134
	between		1.476	0.000	8.000	n = 6,631
	within		0.373	-0.415	4.751	T-bar = 2.735

Table A5: Identifying reverse causality (adding more controls)

The Table reports coefficient estimates and *t*-statistics (in brackets) of regressions based on Poisson Maximum likelihood (columns 1-4), logistic (column 5), and OLS (column 6) with robust standard errors. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variables are specified in the 2nd line of the Table. The lower part of the Table indicates the type of fixed effects used in each regression. Year indicates a full set of year fixed effects. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

Estimation:	**Poison Maximum Likelihood**				**Logit**	**OLS**
Dependent variable:	**NEDs audit experts**	**Board size**	**Number of directorships**	**Network size**	**Duality**	**Tenure**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Profit-shifting	-0.027	-0.003	-0.048	0.011	6.428	0.001
	[-0.575]	[-0.289]	[-1.546]	[0.662]	[0.463]	[0.533]
NEDs audit experts		1.466***	-0.303	6.295***	-11.660	0.259***
		[3.634]	[-0.367]	[7.624]	[-0.186]	[4.260]
Board size	-1.525		4.670***	6.264***	108.436***	-0.147***
	[-0.994]		[18.376]	[16.063]	[2.788]	[-5.511]
Duality	33.030***	-5.051***	-18.367***	16.497***		-0.418***
	[3.775]	[-8.116]	[-19.130]	[13.891]		[-5.531]
Tenure	8.679***	-0.457**	0.575*	-0.486	97.514***	
	[6.339]	[-2.361]	[1.842]	[-1.604]	[4.290]	
Number of directorships	-0.241	0.156***		-0.278***	-32.414***	-0.012***
	[-1.636]	[8.601]		[-6.760]	[-6.371]	[-4.395]
Network size	7.013***	1.039***	-0.699***		22.944	-0.037***
	[6.919]	[9.444]	[-2.922]		[1.415]	[-2.808]
Total number of females	-11.800***	2.555***	-5.436***	-3.594***	39.886	-0.001
	[-4.874]	[20.132]	[-18.567]	[-10.178]	[0.818]	[-0.031]
Audit committee size	31.232***	1.367***	-3.641***	-1.414**	-49.077	-0.082**
	[17.647]	[4.817]	[-6.150]	[-2.392]	[-0.744]	[-2.282]
Mean age of the board	-4.020***	-0.553***	-0.158	0.687***	-42.253***	0.365***
	[-3.807]	[-3.821]	[-0.612]	[2.734]	[-2.675]	[14.678]
Directors from subsidiary country	-10.208***	-0.488***	-4.823***	3.171***	-116.228	-0.002
	[-5.139]	[-2.813]	[-10.757]	[8.702]	[-1.635]	[-0.058]
Parent total assets	0.174***	0.058***	0.002	0.065***	-6.839***	0.002*
	[2.848]	[7.718]	[0.098]	[3.685]	[-4.015]	[1.868]
Parent leverage	0.302***	-0.064***	0.549***	0.006	-3.308	0.015***
	[2.906]	[-2.751]	[8.222]	[0.148]	[-1.111]	[5.814]
Growth of parent total assets	-0.012***	-0.003***	0.010***	-0.004***	4.563***	0.000
	[-8.277]	[-3.574]	[5.265]	[-2.922]	[5.263]	[0.211]
Subsidiary total assets	-0.020	0.003	0.009	-0.004	0.087	0.000
	[-0.955]	[1.389]	[1.305]	[-0.683]	[0.284]	[0.298]
Subsidiary leverage	-0.018	-0.005	0.007	-0.009	0.720	0.002
	[-0.253]	[-0.738]	[0.392]	[-0.570]	[0.637]	[1.336]
Subsidiaries' industry ROA	0.011**	0.001	-0.004**	0.002	0.191**	0.000
	[2.332]	[0.719]	[-2.408]	[1.402]	[2.238]	[0.928]
Parents' industry ROA	0.010**	0.007***	-0.004*	0.008***	-0.848***	0.000
	[2.195]	[9.053]	[-1.936]	[5.841]	[-6.319]	[1.613]
Sub. country GDP per capita	0.580	-0.072*	-0.016	0.023	-4.638	-0.013*
	[1.508]	[-1.829]	[-0.133]	[0.232]	[-0.867]	[-1.897]
Estimation:	**Poison Maximum Likelihood**				**Logit**	**OLS**
Dependent variable:	**NEDs audit experts**	**Board size**	**Number of directorships**	**Network size**	**Duality**	**Tenure**

	(1)	(2)	(3)	(4)	(5)	(6)
Sub. country population	-1.005	0.016	-0.334	0.047	5.483	0.012
	[-0.907]	[0.135]	[-1.057]	[0.186]	[0.328]	[0.691]
Parent country GDP per capita	-3.456***	0.041	-0.030	-0.780***	223.073***	0.006
	[-4.320]	[0.643]	[-0.210]	[-5.335]	[8.737]	[0.684]
Parent country population	-12.498***	-0.638***	2.243***	1.173***	415.394***	-0.124***
	[-4.318]	[-4.461]	[6.947]	[3.894]	[6.562]	[-6.158]
Sub. country government debt	-0.001	0.000*	-0.000	0.001*	0.025	-0.000***
	[-1.017]	[1.724]	[-0.388]	[1.868]	[1.475]	[-4.654]
Observations	6,065	12,619	12,613	12,619	1,908	12,619
Number of subsidiaries	1,986	4,135	4,132	4,135	542	4,135
Subsidiary effects	√	√	√	√	√	√
Year effects	√	√	√	√	√	√

Table A6: Sensitivity for profit-shifting using triple interactions

The Table reports coefficient estimates and *t*-statistics (in brackets) with robust standard errors. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in Table 1. The dependent variable is EBT. In columns (2) and (4) we cluster our standard errors at the country-year level. For expositional brevity, the corporate governance variables are divided by 100. Industry-year effects indicate a full set of industry-year fixed effects at the 2-digit NACE level. Country-year effects represent a full set of country-year fixed effects for the subsidiary's country. The ***, **, and * mark denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Good Board Structure		**Experienced Board Directors**	
	(1)	**(2)**	**(3)**	**(4)**
Low-tax subsidiary * Parent profits * Good structure	-0.071*	-0.071*		
	[-1.857]	[-1.751]		
Low-tax subsidiary * Parent profits * Experienced Directors			0.081**	0.081**
			[2.176]	[2.080]
Low-tax subsidiary * Parent profits	0.077***	0.077***	0.044*	0.044*
	[3.092]	[3.731]	[1.702]	[1.925]
Low-tax subsidiary	-1.043***	-1.043***	-0.621*	-0.621**
	[-3.162]	[-3.798]	[-1.820]	[-2.044]
Parent profits	-0.006	-0.006	0.025	0.025
	[-0.215]	[-0.223]	[0.791]	[0.764]
Good structure	-0.807*	-0.807*		
	[-1.725]	[-1.675]		
Low-tax subsidiary * Good structure	0.909*	0.909*		
	[1.801]	[1.693]		
Parent profits * Good structure	0.066*	0.066*		
	[1.812]	[1.770]		
Experienced Directors			1.123**	1.123**
			[2.460]	[2.286]
Low-tax subsidiary * Experienced Directors			-1.182**	-1.182**
			[-2.253]	[-2.123]
Parent profits * Experienced Directors			-0.078**	-0.078**
			[-2.385]	[-2.210]
Tenure	-0.593	-0.593		
	[-0.709]	[-0.724]		
Number of directorships	0.080	0.080		
	[0.605]	[0.568]		
Network size	0.090	0.090		
	[0.172]	[0.172]		
NEDs audit experts			-3.112	-3.112
			[-1.394]	[-1.372]
Board size			-0.001	-0.001
			[-0.002]	[-0.001]
Observations	15,744	15,744	15,744	15,744
Adjusted R-squared	0.887	0.887	0.887	0.887
Number of Subsidiaries	4,739	4,739	4,739	4,739
S.E. Clustering by	Subsidiary	Country	Subsidiary	Country
Corporate governance controls	√	√	√	√
Subsidiary controls	√	√	√	√
Parent controls	√	√	√	√
Subsidiary effects	√	√	√	√
Industry-year effects	√	√	√	√
Country-year effects	√	√	√	√