

Møen, Jarle; Schindler, Dirk; Schjelderup, Guttorm; Wamser, Georg

Working Paper

The Tax-Efficient Use of Debt in Multinational Corporations

CESifo Working Paper, No. 7133

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Møen, Jarle; Schindler, Dirk; Schjelderup, Guttorm; Wamser, Georg (2018) : The Tax-Efficient Use of Debt in Multinational Corporations, CESifo Working Paper, No. 7133, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/181333>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

The Tax-Efficient Use of Debt in Multinational Corporations

Jarle Møen, Dirk Schindler, Guttorm Schjelderup, Georg Wamser

Impressum:

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de

Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl

www.cesifo-group.org/wp

An electronic version of the paper may be downloaded

- from the SSRN website: www.SSRN.com
- from the RePEc website: www.RePEc.org
- from the CESifo website: www.CESifo-group.org/wp

The Tax-Efficient Use of Debt in Multinational Corporations

Abstract

Some multinationals use the parent company as a lender to the group, whereas others set up an internal bank in a low tax jurisdiction. This paper discusses the link between capital structure choices and tax planning motives in multinational groups. We model the trade-off between the use of external debt, parental debt and an internal bank. We test the theory model using data on the universe of German multinationals. The empirical analysis largely supports our model in that: (i) smaller firms often rely on parental debt financing; (ii) larger multinationals are more likely to use internal banks; (iii) parental debt and external debt are substitutes and the mix depends on the relative cost of raising capital through the parent and the affiliates; (iv) both parental debt and external debt increase when the tax rate increases, all else equal.

JEL-Codes: H250, G320, F230.

Keywords: corporate taxation, multinationals, capital structure, international debt-shifting, parental debt.

Jarle Møen

*Department of Business and Management
Science, NHH Norwegian School of
Economics
Bergen / Norway
jarle.moen@nhh.no*

Dirk Schindler

*Department of Accounting, Auditing and
Law, NHH Norwegian School of Economics
Bergen / Norway
dirk.schindler@nhh.no*

*Guttorm Schjelderup**

*Department of Business and Management
Science, NHH Norwegian School of
Economics
Bergen / Norway
guttorm.schjelderup@nhh.no*

Georg Wamser

*School of Business and Economics
University of Tübingen
Tübingen / Germany
georg.wamser@uni-tuebingen.de*

*corresponding author

June 21, 2018

1. Introduction

Affiliates of multinational corporations (MNCs) borrow considerable amounts from both their parent company and other group affiliates. The choice between using the parent or an affiliate as a lender has received little attention in the literature. It is well known, however, that tax savings are an important explanation for internal lending. The tax savings will be maximized if lending is undertaken by the affiliate facing the lowest tax rate in the group because the saving depends on the tax rate differential between the borrowing and the lending affiliate. If the parent lends to its affiliates, the net tax saving is at best the same as if the affiliates borrowed directly from a local market. Thus, the use of parental debt is hard to explain unless the parent company is located in a low-tax jurisdiction, or there are non-tax costs and benefits related to parental debt and affiliate debt.

In this paper, we investigate the tax-efficient use of debt in MNCs with an emphasis on internal lending and borrowing. We show that 42% of affiliates of German MNCs receive parental debt, and that the average share of parental debt in total assets is 19% for these affiliates.¹ Looking at the group level, the share of MNCs using parental debt is 30%. In contrast, only 14% lend internally from affiliates such as an internal bank. We set up a theory model as a guide to get to grips with the mechanisms behind the use of parental debt and separate lending entities. We, then, explore the predictions of the model using a dataset that includes information on all German MNCs.

Our theory model allows affiliates of a multinational to be heterogeneous with respect to productivity, and it embeds all the costs and benefits of debt as described in the previous corporate finance literature.² It adds to the theory of MNCs' tax-efficient capital structure by modeling separately parental debt, non-parental internal debt, and external debt, taking into account non-tax costs and benefits, as well as modeling the set-up costs of using an affiliate as a group bank.

The theory model shows that the tax-efficient financing structure for MNCs that face transaction costs related to both external and parental debt entails the use of both types of debt. Optimal behavior by the parent is to borrow in the financial market and reroute its borrowed funds to its affiliates. We also find that affiliate external debt and parental debt are substitutes, and that the mix between them depends on differences in capital market

¹The average parental debt-to-asset ratio in U.S. MNCs for the period 1982 and 1994 was 8%, which is about 18% of the external debt-to-asset ratio (Desai et al., 2004, Table 1). The average share of parental debt across *all* affiliates of German MNCs for the period 1999 to 2012 was also 8%, which equals 21% of average external borrowing.

²The trade-off theory in finance proposes a balancing of tax debt shields and non-tax costs and benefits of debt. See, e.g., Kraus and Litzenberger (1973). Recent empirical evidence for the trade-off theory is provided by van Binsbergen et al. (2010) and Korteweg (2010).

transaction costs.³ For given transaction costs, the theory model shows that higher tax rates increase the use of parental and external debt so that they are complements with respect to their debt tax shields.

A central implication from the theory model is that parental debt is not only used to save tax, but also to avoid costs related to capital market imperfections. Thus, policies to prevent multinationals from using the internal capital market to shift taxable income have to be carefully designed. Such rules may come at the cost of a less efficient allocation of financing capital within multinationals that face capital market transaction constraints on the debt level of their affiliates.

Another theoretical result is that MNCs whose parent faces a relatively high corporate tax rate are most likely to set up an internal bank. If there are scale economies in internal banks, large multinationals are more likely than small multinationals to use an internal bank.

We explore the theoretical results using a unique micro-level dataset provided by Deutsche Bundesbank. In contrast to most other firm-level datasets, the Bundesbank data report information on almost all German MNCs and their foreign affiliates. Furthermore, it contains information on external debt, as well as on internal debt from both parent companies and other affiliates within the group. Our main sample consists of 195,516 observations over a time span of 14 years (1999-2012). These observations relate to 4,699 MNCs, and 32,748 foreign affiliates located in 129 host countries.

The empirical analysis confirms the main predictions from our theory. Although host country taxes are not clearly correlated with different types of debt financing, we see a relatively clear pattern when tax incentives arising at the firm level, such as the minimum tax within an MNC, are considered. This is strikingly illustrated by the 65 German MNCs that have operated on the Cayman Islands where the tax on corporate income is equal to zero. At a global level, these 65 MNCs hold 5,570 affiliates that are located in 140 countries. The internal-debt-to-asset ratio of the latter affiliates is 17%, on average. This is more than 6 percentage points higher than the grand sample mean.

The most important findings of our regression analysis, which conditions on affiliate-specific heterogeneity and exploits changes in taxes over time for identification, suggest the following: First, we find that a 1 percentage point higher statutory tax rate in the host country of an affiliate leads approximately to a 0.14 percentage point higher parental debt ratio. In a second set of tests, we show that this result is weakened if the parent is credit constrained. In this case, the tax sensitivity of parental debt in the affiliates is reduced,

³If, for example, the headquarters cannot credibly commit to bail out its affiliates, parental debt can serve as a commitment device (see Gertner et al. 1994; Chowdhry and Nanda 1994). Inefficiencies in local credit markets, typically in developing countries, may also be a real constraint for external debt at the affiliate level (see Desai et al, 2004).

while the one of external debt increases. This is in line with our theory that parental and external debt are substitutes.

Second, parental debt is mainly used by smaller MNCs, and in the absence of an internal lending entity. Third, the size of the MNC is a key determinant of whether a firm operates an internal bank for the purpose of lending to high-tax affiliates.⁴

We provide a large number of additional checks, which largely confirm basic mechanisms of our theory model. These tests show, for example, that the tax-response function of parental debt becomes flatter if affiliates carry forward losses, and hence benefit less from interest deductions. The results also prove robust to variations in how we measure the tax incentives, where alternative measures adjust for possible implications of German CFC rules, endogeneity issues, and preferential tax treatment of some countries.

The remainder of this paper is organized as follows: Section 2 presents related literature. Section 3 outlines the model. Section 4 suggests an empirical estimation approach. Section 5 presents the data, definitions and descriptive statistics. Section 6 summarizes basic results. Section 7 is central to our understanding of internal capital market mechanisms. Section 8 discusses different issues in measuring tax incentives. Section 9 concludes.

2. Related literature

There is a growing literature on how MNCs use debt financing to save taxes.⁵ A major difference between domestic firms and MNCs is that the latter can use both external and internal debt to shift profits across jurisdictions.

The use of internal debt was first studied empirically by Collins and Shackelford (1997) and then both theoretically and empirically by Mintz and Smart (2004). The study by Mintz and Smart (2004) shows that MNCs should structure their internal lending activities such that borrowing occurs in high-tax jurisdictions and all internal debt is provided by the entity facing the lowest tax within the group. This implies, of course, that all interest income is declared at the low-tax jurisdiction. Hence, the firm maximizes the value of the tax-deductible interest and minimizes the tax paid on interest income within the group. They exploit data on Canadian provinces and provide evidence for their theoretical predictions. In line with Mintz and Smart (2004), Egger et al. (2010) find that foreign-owned firms, on average, exhibit a significantly higher debt ratio than their domestically owned counterparts

⁴This finding also corroborates earlier studies on tax avoidance in general. For example, Rego (2003) shows that larger MNCs report lower effective tax rates due to tax avoidance strategies and Dyreng et al. (2008, p. 79) suggest that there are economies of scale to tax avoidance.

⁵See, e.g., Desai et al. (2004), Buettner et al. (2009), Mintz and Weichenrieder (2010), Park et al. (2013), and Buettner and Wamser (2013). A meta survey is provided by Feld et al. (2013).

in the host country, and that the debt-to-asset ratios of affiliates of MNCs are more tax-sensitive than the ones of domestic firms. Unlike our data, the data used by Egger et al. (2010) do not include information on internal debt at the firm level.

Egger et al. (2014) argue more generally that internal capital markets are established for reasons which can be broadly grouped into two categories: (i) profit shifting via debt shifting and tax savings; (ii) frictions in economic fundamentals with consequences for efficient resource allocation. Their model suggests that differences in economic fundamentals – such as weak institutional quality, underdeveloped financial markets, or high productivity – produce different levels of excess returns at host locations. Internal debt should be allocated to those entities where this excess return is highest.

Huizinga et al. (2008) study how differences in national tax systems affect the use of external debt and introduce the concept of external debt shifting. They assume that the parent firm provides explicit and implicit credit guarantees for the debt of all of its affiliates, and that a higher total debt-to-asset ratio for the group increases the risk of bankruptcy. This leads them to predict that MNCs will balance external debt across affiliates by taking into account the tax rate in all the countries where they are present. They test their model on firm data from 32 European countries in the Amadeus database covering the years 1994 to 2003. Their empirical investigation shows that tax changes do indeed lead to a re-balancing of debt. Following up on Huizinga et al. (2008), Sorbe et al. (2017) find evidence that external debt shifting increases total debt within the whole MNC. Like Egger et al. (2010), Huizinga et al. (2008) only have data on total debt and cannot empirically distinguish between mechanisms related to external and internal debt.

In contrast to the studies above, Møen et al. (2011) study the use of both internal and external debt. They show that both types of debt are of equal importance in MNCs' tax planning activities and that previous studies neglecting one type of debt suffer from an omitted variable bias when analyzing total debt.

The use of parental debt has not received much attention in the literature, and the relationship between internal lending within the group and parental debt is a neglected issue. Chowdhry and Nanda (1994) predict that parental debt is a good commitment device that reduces bankruptcy risk in affiliates. Gertner et al. (1994) argue that parental debt can be used as a residual control right to decrease borrowing and agency costs of external debt.

In an empirical study, Desai et al. (2004) show that US multinationals replace external debt by internal debt coming from the parent. Their interpretation is that parental debt is used to overcome capital market imperfections and weak institutional settings (typically in developing countries). Aggarwal and Kyaw (2008) confirm the findings in Desai et al. (2004) using more recent data. Neither of these papers are able to explain the substantial

use of parental debt in developed countries. Desai et al. (2004) also find that parental debt reacts to tax incentives and is used to save taxes. Their data does not provide information on internal borrowing from other affiliates, however, so it remains unclear whether parental debt is used to substitute for internal debt from an internal bank, or replaces affiliates' external borrowing from the capital market.

Dewaelheyns and van Hulle (2010) use Belgian data and focus on groups that have all their affiliates within Belgium. Despite the fact that there is no tax incentive for using internal debt in this case, affiliates are still financed by internal debt from the parent. Dewaelheyns and van Hulle (2010) argue that internal debt is used to minimize borrowing costs and that parental debt is rerouted external debt. Their study indicates that parental debt replaces external debt at least in purely domestic groups.

None of the papers above explain how the use of parental debt fits into a tax-efficient financial structure of a multinational. Nor do these papers explain why a high-taxed firm should be willing to incur additional tax payments by using parental debt as a debt-shifting device, instead of locating all internal lending in a separate internal bank in a low-tax jurisdiction.

3. The model

A multinational company has its parent domiciled in country p , and has fully-owned affiliates in $i = 1, \dots, n$ countries. We assume that the MNC operates one affiliate per country, which allows us to use index i for affiliates and host countries. Without loss of generality, we assume that the parent is a pure holding company and that all affiliates are directly owned by the parent, i.e., there are no ownership chains.

The parent company owns technology $\theta \in [\underline{\theta}, \bar{\theta}]$ that increases the productivity of capital at each affiliate. Each affiliate has fixed assets K_i , which are used to produce a homogenous good with production function $y_i = f(\theta K_i)$, $f_K > 0$ and $f_{KK} < 0$. We assume that the production function is not too concave, so that a higher productivity parameter θ of the MNC implies higher optimal investment $K_i(\theta)$ in all its affiliates, i.e., $\frac{\partial K_i(\theta)}{\partial \theta} > 0$, $\forall i$.⁶ Our assumption here is in line with recent empirical evidence from the trade literature, which shows that more productive firms are more likely to become MNCs and greater in size than less productive firms.⁷

In line with the literature, we assume that rental costs of capital are exogenous (small country assumption) and equal to r . Capital $K_i(\theta)$ in each affiliate is financed by equity

⁶See Appendix 1 for a proof. To focus on the capital structure choice, we neglect the optimal investment decision in the main model.

⁷See, e.g., Tomiura (2007) and Syverson (2011), particularly p. 335.

E_i , external (third party) debt D_i^E , debt from the parent (parental debt) D_i^P , and debt D_i^I borrowed from related affiliates (internal debt). The balance sheet of affiliate i is then $K_i(\theta) = E_i + D_i^E + D_i^P + D_i^I$, whereas the balance sheet of the parent p is $\sum_{i \neq p} E_i = E_p + D_p^E + D_p^I$.

Using external, internal, and parental debt entails different types of costs and benefits. Internal debt has many of the same properties as equity, but it is tax-deductible.⁸ In line with the literature, we assume that the cost of internal debt is additively separable from the costs of other types of debt, and that the different cost functions of debt are convex in the debt-to-asset ratios, but proportional to capital employed.⁹

Internal debt financing from an internal bank is associated with costs related to tax-engineering expenses (for example, lawyers and accountants) incurred to avoid thin-capitalization rules and/or controlled-foreign-company (CFC) rules (see, e.g., Mintz and Smart, 2004; Fuest and Hemmelgarn, 2005). We express the cost function of internal debt as

$$C^I(b_i^I) = \frac{\eta}{2} \cdot (b_i^I)^2 \cdot K_i(\theta), \quad \text{if } b_i^I > 0, \quad \text{and} \quad C^I(b_i^I) = 0, \quad \text{if } b_i^I \leq 0, \quad (1)$$

where $b_i^I = \frac{D_i^I}{K_i(\theta)}$ represents the internal debt-to-asset ratio in affiliate i , and η is a positive constant. Notice that setting up one of the affiliates as an internal bank is costly. We capture this by adding a fixed set-up cost $C_B \geq 0$ at the level of the parent.

In contrast to internal debt, external debt is assumed to be beneficial in reducing informational asymmetries between managers and shareholders and in enforcing discipline on overspending managers (see Jensen and Meckling, 1976; Jensen, 1986). However, too much external debt may induce managers to behave too risk-averse by refraining from profitable investments or create debt-overhang problems (Myers, 1977). As pointed out by Kraus and Litzenberger (1973), the tax preferences given to debt over equity may lead to excessive borrowing and higher risk of bankruptcy.¹⁰

With respect to parental debt, we should note that if the sole purpose of intra group lending is to save tax, the debt tax shield would be maximized if all internal lending was undertaken by the affiliate facing the lowest tax rate in the group rather than the parent (Mintz and Smart, 2004). This is so because the tax saving depends on the tax rate difference between the borrowing and the lending affiliate. If parental debt is financed by equity at the

⁸See Gertner et al. (1994) for a discussion on internal debt and how it relates to external debt and equity. Chowdhry and Coval (1998, pp. 87f) and Stonehill and Stitzel (1969) argue that internal debt should be seen as tax-favored equity.

⁹See, e.g., Fuest and Hemmelgarn (2005), and Huizinga et al. (2008), for similar assumptions.

¹⁰The ‘trade-off’ theory of capital structures balances bankruptcy costs with returns from the tax shield. See, for instance, Graham (2000), who estimates a tax shield value (before personal taxes) close to 10% of the value of the firm.

parent level, the debt tax shield is always inferior to the debt tax shield of a lending affiliate because the parent cannot deduct interest expenses on equity. This means that parental debt must be financed by external debt that is rerouted to its affiliates. An efficient capital market would realize this so the structure of the cost function for parental debt will mimic that of external debt.¹¹

Summarizing our discussion, there is an optimal *total* external debt-to-asset ratio in each affiliate in absence of taxation, defined as b^* . Affiliate-specific costs of debt depend on the deviation from the non-tax related ‘optimal’ debt-to-asset ratio (b^*). It is important to note that total external debt includes parental debt as it shares many common features with external debt (raised in the local, host market). Of course, parental debt is provided within the MNC by the parent. We add cost terms for the affiliates that reflect costly access to the external capital market, either via external or parental debt. Denoting the external and parental debt-to-asset ratios in affiliate i by $b_i^E = \frac{D_i^E}{K_i(\theta)}$ and $b_i^P = \frac{D_i^P}{K_i(\theta)}$, respectively, the cost function for parental and external debt (i.e., total external debt) is

$$C^E(b_i^E, b_i^P) = \left[\frac{\mu}{2} \cdot (b_i^E + b_i^P - \bar{b})^2 + \frac{\delta_E}{2} \cdot (b_i^E)^2 + \frac{\delta_P}{2} \cdot (b_i^P)^2 \right] \cdot K_i(\theta), \quad (2)$$

where $\bar{b} = \left(1 + \frac{\delta_E \delta_P}{\mu(\delta_E + \delta_P)}\right) b^*$ is the adjusted optimal debt-to-asset ratio in absence of taxation, μ is a positive constant on the costs of deviating from this debt-to-asset ratio, and δ_E and δ_P are cost parameters for the access to the capital market via external and parental debt, respectively.

Following Huizinga et al. (2008), we assume that the parent firm is willing to bail out any affiliate facing bankruptcy. Different from Huizinga et al. (2008), we incorporate parental and non-parental internal debt in the analysis. Let C_f be the overall bankruptcy cost at the parent level. It depends on the firm-wide debt-to-asset ratio defined as $b_f = \frac{\sum_i (D_i^E + D_i^P)}{\sum_i K_i(\theta)}$. As in Huizinga et al. (2008, p. 94), we assume that the overall bankruptcy costs are a convex function of the firm-wide debt-to-asset ratio and proportional to the MNC’s overall assets. The overall bankruptcy cost is specified at the holding (parent) level as

$$C_f = \frac{\gamma}{2} \cdot b_f^2 \cdot \sum_i K_i(\theta) \quad (3)$$

¹¹In contrast to parental debt, internal debt constitutes ‘tax-preferred equity’ and is mostly granted by small special-purpose entities that are established for tax reasons, unable to provide much monitoring. Prime examples are the financial coordination centers of the Norwegian MNCs Statkraft and Statoil that are located in Belgium. In 2012, these entities lent 61 billion NOK (USD 11.0 billion) and 85 billion NOK (USD 15.3 billion), respectively, to other related affiliates within their MNCs, but they had only six and 20, respectively, employees on their payrolls (Bjørnstad, 2012).

where γ is a positive constant.

True and taxable profit in affiliate i , π_i^e and π_i^t , respectively, are defined as

$$\pi_i^e = f(\theta K_i(\theta)) - r \cdot K_i(\theta) - C^E(b_i^E, b_i^P) - C^I(b_i^I), \quad \pi_i^t = f(\theta K_i(\theta)) - r \cdot (D_i^E + D_i^P + D_i^I),$$

where the rental costs of equity are not tax-deductible as is the case in most real-world tax systems. We also assume that costs C^E and C^I related to both types of debt are not tax-deductible. This assumption is necessary to derive well-defined structural equations for the empirical analysis.¹²

We let V_i^L and V_i^U be the values of an affiliate with and without debt financing in country i , and define t_i as the statutory corporate tax rate in country i . Affiliate i 's profit after corporate taxation in country i is then

$$\begin{aligned} \pi_i &= \underbrace{\pi_i^e - t_i \cdot \pi_i^t}_{=V_i^L} \\ &= \underbrace{(1 - t_i) \cdot f(\theta K_i(\theta)) - r \cdot K_i(\theta)}_{=V_i^U} + t_i \cdot r \cdot (D_i^E + D_i^P + D_i^I) - C^E(b_i^E, b_i^P) - C^I(b_i^I), \end{aligned} \tag{4}$$

where it is seen from (4) that affiliate-specific debt costs, $C^E(b_i^E, b_i^P) + C^I(b_i^I)$, reduce potential dividend payouts.

In a static one-period model such as this, the value of an MNC (V^L) and the MNC's after tax profit (Π_p) are identical and can be calculated by summing up profits across all affiliates. Repatriated dividends π_i can, in principle, be subject to a non-resident withholding tax, a parent tax rate on repatriated dividends (possibly adjusted for various credit schemes), and the corporate tax rate t_i . However, in the empirical section, we focus mainly on countries that apply the exemption method and withholding taxes do often not matter (e.g., among countries of the European Union). We assume that it is costly to set up an internal bank and that the parent incurs costs $C_B \geq 0$. In reality, these costs may be specific to a country, but for simplicity we shall not index them. We discuss the implication of country-specific set-up costs in the empirical section.

The value of the consolidated MNC is

$$\Pi_p = V^L = \sum_i V_i^L - C_f - \mathbb{1}_I \cdot C_B = \sum_i \pi_i - C_f - \mathbb{1}_I \cdot C_B, \tag{5}$$

where $\mathbb{1}_I$ is an indicator function that equals one if there is an internal bank and zero otherwise. The MNC will set up an internal bank and incur costs C_B if the net tax savings

¹²The assumption is in line with the literature (see, e.g., Huizinga et al., 2008).

of the internal bank covers the fixed set-up costs plus the opportunity cost of not lending from the parent. The condition for an internal bank is:

$$\sum_i [(t_i - \tau)rD_i^I - C^I(b_i^I)] \geq C_B + \sum_{i=p}^n [(t_i - t_p)rD_i^I - C^I(b_i^I)], \quad (6)$$

where τ represents the tax rate on interest income received by the internal bank (the lending entity within the firm).

Taking into account that the overall sum of lending and borrowing from related companies must be equal to zero ($\sum_i r \cdot D_i^I = 0$) and that the participation constraint for setting up an internal bank, equation (6), must hold, the maximization problem can be stated as¹³

$$\begin{aligned} \max_{D_i^E, D_i^P, D_i^I} \Pi_p &= \sum_i \left\{ (1 - t_i) \cdot f(\theta K_i(\theta)) - r \cdot K_i(\theta) + t_i \cdot r \cdot (D_i^E + D_i^P + D_i^I) \right. \\ &\quad - \left[\frac{\mu}{2} \cdot (b_i^E + b_i^P) - \bar{b} \right]^2 + \frac{\delta_E}{2} \cdot (b_i^E)^2 + \frac{\delta_P}{2} \cdot (b_i^P)^2 \Big] K_i(\theta) \\ &\quad - \frac{\eta}{2} \cdot (b_i^I)^2 \cdot K_i(\theta) \Big\} - \frac{\gamma}{2} \cdot b_f^2 \cdot \sum_i K_i(\theta) - \mathbb{1}_I \cdot C_B \\ s.t. \quad &\sum_i r \cdot D_i^I = 0, \quad D_i^I \geq 0, \quad (\lambda_1) \\ &- \sum_i \left[(t_i - \tau)r b_i^I - \frac{\eta}{2} \cdot [b_i^I]^2 \right] K_i(\theta) + C_B \\ &\quad + \sum_{i=p}^n \left[(t_i - t_p)r b_i^I - \frac{\eta}{2} \cdot [b_i^I]^2 \right] K_i(\theta) \leq 0, \quad (\lambda_2) \end{aligned}$$

where we used equations (1) to (4) in equation (5).

The resulting first-order conditions are

$$D_i^E : t_i \cdot r - \mu \cdot (b_i^E + b_i^P - b^*) - \delta_E \cdot b_i^E - \gamma \cdot b_f = 0, \quad (7)$$

$$D_i^P : t_i \cdot r - \mu \cdot (b_i^E + b_i^P - b^*) - \delta_P \cdot b_i^P - \gamma \cdot b_f = 0, \quad (8)$$

$$D_i^I : \{t_i \cdot r - \eta \cdot b_i^I - \lambda_1 \cdot r - \lambda_2 \cdot [(t_p - \tau)r]\} D_i^I = 0, \quad \text{and} \quad (9)$$

$$PC : \quad (10)$$

$$\lambda_2 \cdot \left\{ - \sum_i \left[(t_i - \tau)r b_i^I - \frac{\eta}{2} \cdot (b_i^I)^2 \right] K_i(\theta) + C_B + \sum_{i=p}^n \left[(t_i - t_p)r b_i^I - \frac{\eta}{2} \cdot (b_i^I)^2 \right] K_i(\theta) \right\} = 0,$$

¹³It can be shown that maximizing profits of the MNC after global corporate taxation, and maximizing the net pay-off on equity investment after opportunity costs and personal (income) taxes, i.e., approaching the problem from a shareholder's point of view, yield identical results, given some weak assumptions.

where λ_1 is the Lagrangian multiplier associated with the internal lending constraint $\sum_i r \cdot D_i^I = 0$ and λ_2 is the Lagrangian multiplier associated with the internal bank condition (6).

Examining the slackness condition (10), we see that the Lagrange multiplier is positive, $\lambda_2 > 0$, whenever the condition for setting up the internal bank (6) is binding. In this case, it is not tax-efficient to set up an internal bank because costs are too high. Formally, $D_i^I = 0 \forall i \neq p$, and $\mathbb{1}_I = 0$. A binding internal bank constraint and $\lambda_2 > 0$ imply that there is no internal debt in affiliates where $t_i \leq t_p$, see equation (9).

From the internal bank constraint follows that a minimum productivity $\hat{\theta}$, and a minimum size of the MNC (in terms of capital installed), are necessary in order to find it profitable to set up an internal bank. The break-even condition is:

$$\sum_i \left[(t_i - \tau) r b_i^I - \frac{\eta}{2} \cdot (b_i^I)^2 \right] K_i(\hat{\theta}) = C_B + \sum_{i=p}^n \left[(t_i - t_p) r b_i^I - \frac{\eta}{2} \cdot (b_i^I)^2 \right] K_i(\hat{\theta}). \quad (11)$$

The equation shows that the net marginal benefit of profit shifting by internal debt (left hand side) should at least equal its opportunity costs (right hand side). The condition implies that only productive ($\theta \geq \hat{\theta}$) MNCs that have substantial fixed assets $\sum_i K_i(\theta)$, and a sufficiently high tax rate t_p in the parent country, will establish internal banks.¹⁴

3.1. The case of an internal bank

If there is an internal bank, $\lambda_2 = 0$, the multiplier $\lambda_1 = \tau > 0$ gives the shadow price of shifted interest expenses. The first-order condition (9) simplifies to

$$(t_i - \lambda_1) \cdot r - \eta \cdot b_i^I = 0, \quad (12)$$

and in optimum we have $\lambda_1 = \tau = \min_i t_i$. Hence, the value of the debt tax shield is maximized by letting the affiliate with the lowest effective tax rate be the internal bank (see Mintz and Smart, 2004). To simplify the analysis to follow, we denote the affiliates facing the lowest tax rate by 1, i.e., $\min_i t_i = t_1$. Thus, the profitability of an internal bank is given by the net tax advantage $(t_i - t_1)$. In the empirical part of the paper, we shall refer to (t_1) as the minimum tax.¹⁵

¹⁴Small MNCs with few fixed assets use too little internal debt to cover the costs of operating an internal bank. MNCs with a very low parent tax rate save too little taxes by using an internal bank compared to using parental debt.

¹⁵With affiliate-specific set-up costs (as opposed to the affiliate-independent costs in our model), the affiliate with the lowest effective tax rate may not be chosen as the place for the internal bank. Countries like Belgium, Luxembourg and the Netherlands are prime locations for internal banks (see, e.g., Ruf and Weichenrieder, 2012, Table 4). These countries have institutions which lower the costs of setting up and running an internal bank.

Examining the condition for internal debt in equation (9), we derive the optimal debt-to-asset ratio for internal debt b_i^I in the presence of an internal bank as

$$b_i^I = \frac{r}{\eta} \cdot (t_i - \lambda_1) = \frac{r}{\eta} \cdot (t_i - t_1) > 0, \forall i > 1. \quad (13)$$

Equations (11) and (13) show that it is profit maximizing to use internal debt in all affiliates (except for the internal bank) as long as the MNC is large enough.

It also follows from equation (13) that the internal debt-to-asset ratio in the internal bank (b_1^I) is always zero, since it is not optimal for this affiliate to hold internal debt. The amount of lending (L_1) by the internal bank is given by

$$L_1 = \sum_{i>1} D_i^I. \quad (14)$$

In order to derive optimal external and parental debt-to-asset ratios, we subtract FOC (8) from FOC (7) to establish the relationship

$$-\delta_E b_i^E + \delta_P b_i^P = 0 \quad \Rightarrow \quad b_i^P = \frac{\delta_E}{\delta_P} \cdot b_i^E. \quad (15)$$

From equation (15), it follows that both parental and external debt are used to fund any affiliate i . As long as there are transaction costs for both types of debt, external and parental debt will be used according to the ratio of their transaction costs. Hence, external and parental debt are substitutes with respect to capital market conditions. In some cases, affiliates of multinationals may face close to zero transaction costs in the financial market. Such multinationals would not use parental debt.

By rearranging the first-order conditions (7) and (8), making use of equation (15), we obtain the optimal external debt-to-asset ratio as¹⁶

$$b_i^E = \beta_0 + \beta_1 \cdot t_i + \beta_2 \cdot \sum_{j \neq i} \rho_j (t_i - t_j), \quad (16)$$

where $\beta_0 = \frac{\mu \delta_P}{(\mu + \gamma)(\delta_E + \delta_P) + \delta_E \delta_P} \bar{b} \geq 0$; $\beta_1 = \frac{\delta_P \cdot r}{(\mu + \gamma)(\delta_E + \delta_P) + \delta_E \delta_P} \geq 0$, and $\beta_2 = \frac{\gamma \delta_P (\delta_E + \delta_P) r}{[\mu(\delta_E + \delta_P) + \delta_E \delta_P][(\mu + \gamma)(\delta_E + \delta_P) + \delta_E \delta_P]} \geq 0$ and where we have denoted $\rho_j = \frac{K_j(\theta)}{\sum_j K_j(\theta)}$ as the share of real capital employed in affiliate j as share of total real capital in the MNC.

When we insert equation (16) into equation (15), the optimal parental debt-to-asset ratio

¹⁶Details of the derivation are given in Appendix 2.

follows as

$$b_i^P = \frac{\delta_E}{\delta_P} \cdot b_i^E = \frac{\delta_E}{\delta_P} \cdot \left(\beta_0 + \beta_1 \cdot t_i + \beta_2 \cdot \sum_{j \neq i} \rho_j (t_i - t_j) \right). \quad (17)$$

As seen from the equations above, external and parental debt are complements with respect to a change in the optimal debt-to-asset ratio in absence of taxation, b^* , and changes in tax shields. Both the external debt-to-asset ratio (16) and the parental debt-to-asset ratio (17) contain the standard tax shield mechanism as well as the external debt shifting mechanism. The *standard tax shield* mechanism is represented by the respective second term on the RHS of equations (16) and (17) and can be used by domestic firms as well. The higher the corporate tax rate in country i , the larger is the external debt tax shield and, all else equal, the higher are b_i^E and b_i^P .

The external debt shifting mechanism is given by the respective third terms, the *weighted tax difference*. For a given level of overall bankruptcy costs C_f , there is an incentive to allocate most of the externally funded debt to affiliates that produce the highest absolute tax savings (i.e., have the largest tax differentials).

In the absence of taxation, ($t_i = t_j = 0$) and overall bankruptcy costs ($\gamma = 0$), the optimal debt-to-asset ratios are $b_i^E = \frac{\delta_P b^*}{\delta_E + \delta_P}$ and $b_i^P = \frac{\delta_E b^*}{\delta_E + \delta_P}$, and $b_i^E + b_i^P = b^*$.

Collecting the results above, the total debt-to-asset ratio $b_i = b_i^E + b_i^P + b_i^I$ of affiliate i can be written as

$$b_i = \left(1 + \frac{\delta_E}{\delta_P} \right) \left(\underbrace{\beta_0 + \underbrace{\beta_1 \cdot t_i}_{(i)}}_{(ii)} + \underbrace{\beta_2 \cdot \sum_{j \neq i} \rho_j (t_i - t_j)}_{(ii)} \right) + \underbrace{\beta_3 \cdot (t_i - t_1)}_{(iii)}, \quad (18)$$

where $\beta_3 = \frac{r}{\eta}$.

From equation (18), it follows that the total debt-to-asset ratio increases in: (i) the domestic tax rate t_i due to the standard tax shield effect; (ii) the capital-weighted tax-differential to all affiliates $\sum_{j \neq i} \rho_j (t_i - t_j)$ due to the overall bankruptcy costs; and (iii) the tax-differential $(t_i - t_1)$ due to the use of internal bank lending.

3.2. Multinationals without an internal bank

Small MNCs or MNCs with the parent company located in a low-tax jurisdiction (very low tax rate t_p) will not find it profitable to set up an internal bank, see equation (11). Their strategy is to use the parent company as the internal bank. In this case, parental debt has a dual role. It reroutes external debt (D_i^P) to its affiliates, but it also uses parental debt D_i^{PI} to replace equity in affiliate i . In the absence of an internal bank, $\lambda_2 = 1$, while $\lambda_1 = \tau = t_p$.

It then follows from the first-order condition (9) that

$$(t_i - t_p) \cdot r - \eta \cdot b_i^{PI} = 0 \quad \forall i \geq p \quad \text{and} \quad D_i^{PI} = 0 \quad \forall i < p. \quad (19)$$

Consequently, a ‘parental-internal’ debt-to-asset ratio $b_i^{PI} = D_i^{PI}/K_i(\theta)$ is optimal in all affiliates that have a higher tax rate than the parent company, so that the ‘parental-internal’ debt tax shield becomes $t_i - t_p > 0$. Thus, in MNCs with a productivity $\theta < \hat{\theta}$, the optimal total debt-to-asset ratio in an affiliate i is

$$b_i = \left(1 + \frac{\delta_E}{\delta_P}\right) \left(\beta_0 + \beta_1 \cdot t_i + \beta_2 \cdot \sum_{j \neq i} \rho_j (t_i - t_j)\right) + \mathbb{1}_{PI} \cdot \underbrace{\beta_3 \cdot (t_i - t_p)}_{=b_i^{PI}}, \quad (20)$$

where $\mathbb{1}_{PI}$ is an indicator function with $\mathbb{1}_{PI} = 0$ if $t_i < t_p$.

4. Empirical analysis

The empirical part of this paper is concerned with estimating the tax determinants of debt financing using equations (13)-(18) as the points of departure. Our data allows us to distinguish between three different types of debt: (i) External debt b_{it}^E , (ii) Parental debt b_{it}^P , i.e., internal debt provided by the parent firm, and (iii) Internal debt provided by other entities within an MNC, b_{it}^I . Total debt is $b_{it}^T = b_{it}^E + b_{it}^P + b_{it}^I$. We are interested in estimating the effects of explanatory variables denoted by \mathbf{x}_{it} on b_{it}^d with $d \in \{E, P, I\}$. The vector \mathbf{x}_{it} includes tax measures, additional affiliate- and country-specific variables, as well as aggregate time effects. Details regarding the control variables are given in Section 5.

The debt variables b_{it}^d are defined as ratios which are bounded between 0 and 1. The bounded nature of the debt ratio is best addressed using the empirical approach of Papke and Wooldridge (2008). The conditional expectation of b_{it}^d is

$$E(b_{it}^d | \mathbf{x}_{it}, c_i) = \Phi(\mathbf{x}_{it}\boldsymbol{\beta} + c_i), \quad t = 1, \dots, T, \quad (21)$$

where an unobserved fixed effect c_i for affiliate i enters additively in a standard normal *cdf* denoted as Φ . In such a model, partial effects depend on the levels of covariates and on the unobserved effect c_i . Dropping the affiliate index i , we are interested in the partial effect of a continuous variable x_{tk} on $E(\cdot)$

$$\frac{\partial E(b_t^d | \mathbf{x}_t, c)}{\partial x_{tk}} = \beta_k \phi(\mathbf{x}_t \boldsymbol{\beta} + c), \quad (22)$$

where ϕ denotes the probability density function of the standard normal. Another quantity we are interested in is the effect of a discrete change of an explanatory variable from $\mathbf{x}_t^{(0)}$ to $\mathbf{x}_t^{(1)}$, which can be computed as

$$\Phi(\mathbf{x}_t^{(1)}\boldsymbol{\beta} + c) - \Phi(\mathbf{x}_t^{(0)}\boldsymbol{\beta} + c). \quad (23)$$

Our model may produce partial effects for different values of x_k . When presenting the empirical results below, we will usually provide estimates where we average the partial effects across the distribution of explanatory variables and across the distribution of c , to obtain *average partial effects* (APEs).

In order for the coefficients $\boldsymbol{\beta}$ and the APEs to be identified, we need to assume strict exogeneity of \mathbf{x}_{it} , conditional on c_i :

$$E(b_{it}^d | \mathbf{x}_i, c_i) = E(b_{it}^d | \mathbf{x}_{it}, c_i), \quad t = 1, \dots, T. \quad (24)$$

This assumption is common to fixed effects panel models. Note that $\mathbf{x}_i \equiv (\mathbf{x}_{i1}, \dots, \mathbf{x}_{iT})$ denotes the set of covariates in all time periods.

We also need to make a conditional normality assumption about the distribution of c_i , conditional on explanatory variables (see Chamberlain, 1980):

$$c_i | (\mathbf{x}_{i1}, \mathbf{x}_{i2}, \dots, \mathbf{x}_{iT}) \sim \text{Normal}(\psi + \bar{\mathbf{x}}_i \xi, \sigma_a^2). \quad (25)$$

In (25), $\bar{\mathbf{x}}_i$ denotes time averages for the T explanatory variables (formally, $\bar{\mathbf{x}}_i \equiv T^{-1} \sum_{t=1}^T \mathbf{x}_{it}$) and σ_a^2 denotes the conditional variance of c_i , $\sigma_a^2 = \text{Var}(c_i | \mathbf{x}_i)$. There are other ways of specifying (25), but Papke and Wooldridge (2008) argue that adding the conditional normality assumption leads to especially straightforward estimation and allows for calculating APEs that are comparable to linear models.

Assumptions (21) (functional form), (24) (strict exogeneity), and (25) (conditional normality assumption on c_i) place no restrictions on the serial dependence in b_{it}^d and allow us to have arbitrary correlation between c_i and x_{it} by assuming a conditional normal distribution with linear expectation and constant variance (see Wooldridge, 2002).

Papke and Wooldridge (2008) show that the APEs and the $\boldsymbol{\beta}$ s are identified up to a positive scale factor. It is also worth mentioning that Chamberlain's (1980) version of (25) assumes a normal distribution for c_i , conditional on the vector of explanatory variables in all t . We, on the other hand, follow Mundlak (1978) who suggests a more parsimonious version of this assumption by conditioning on unit i averages $\bar{\mathbf{x}}_i$ over $t = 1, \dots, T$ periods.

5. Data, measurement issues, and descriptive statistics

Our empirical analysis is based on the *MiDi* database (*Microdatabase Direct investment*) provided by Deutsche Bundesbank, which is the German central bank. *MiDi* reports balance sheets of foreign affiliates of German MNCs and has two key advantages for our analysis. First, German firms are required to report their foreign investments once they are above a reporting threshold according to German law.¹⁷ This allows us to obtain a relatively complete picture of entire groups and their investments across countries. Second, we can distinguish between three different types of debt financing at the level of the borrowing entity i : (E) external debt provided by external creditors, (P) internal debt provided by the German parent firm, and (I) internal debt provided by affiliated entities within the same multinational firm. Adding up (E), (P), and (I) gives us total debt used by entity i .

We start out calculating our tax incentive variables using a sample where all entities of the multinational firms are included. This sample has 313,586 observations, and the time span is 14 years.¹⁸ Unfortunately, there is no information on the debt financing of the German parents. We can therefore not include the parent firms in the regressions.¹⁹ We lose additional observations as the focus of our analysis is on majority-held foreign investments and on affiliates whose sales are non-zero. This leaves us with 195,516 observations in the empirical analysis. These observations relate to 4,699 MNCs, and 32,748 foreign affiliates located in 129 host countries.

Table 1 summarizes the loss of observations due to data limitations and restrictions. The size of the estimation sample is quite stable over time, but grows somewhat during the early years. There are 10,723 observations in the first year, 1999, 14,932 observations in 2002 and 14,903 observations in 2012, which is the last year.

Table 2 presents mean values and standard deviations of the dependent variables, both for all affiliates and for sub-samples of small and large MNCs in which only the 25% smallest and largest MNCs are considered. In addition, we report the share of affiliates that have a positive level of external, parental, and internal debt, respectively. As can be seen from Table 2, 63% of the affiliates receive internal debt and 42% of the affiliates have parental debt.²⁰

¹⁷Lipponer (2011) provides a summary of the reporting requirements and the data. The reporting requirements have been changed a few times in the past. Since 2002, German firms have to report their international capital links if the balance-sheet total of the direct investment enterprise exceeds 3 million Euros.

¹⁸At this point, our sample includes 5,321 MNCs, and 43,029 foreign affiliates, operating in 163 host countries.

¹⁹Since 2004, *MiDi* includes information on the parent's turnover, the number of employees, and the balance sheet total.

²⁰Note, however, from Section 7 that the affiliates with internal debt belong to only 14% of the MNCs, while about 30% of the MNCs use parental debt. Conditional on positive parental debt, the average parental

Table 1: *FROM RAW DATA TO ESTIMATION SAMPLE*

The table provides descriptive statistics for the different steps going from raw data to the estimation sample. Note that the parent-year observations discussed above are formally not part of *MiDi* and not reported here. They are added to the analysis for the purpose of calculating tax incentives within the MNCs.

	<i>Observations</i>	<i>Percent</i>
All observations included in <i>MiDi</i> (time period 1999 to 2012)	369,044	100
(a) Uniform reporting threshold	−44,333	12
(b) Missing macro and micro information	−63,953	17
(c) Zero-sales affiliates	−41,272	11
(d) Minority-owned affiliates	−23,970	7
<i>Estimation sample</i>	195,516	53

Table 2: *DEPENDENT VARIABLES*

The table reports descriptive statistics on the dependent variables used in the regression analysis. The debt variables are defined as ratios where the numerator corresponds to the respective value of debt reported in *MiDi* and the denominator corresponds to total capital defined as the sum of “subscribed or called-up capital, endowment capital and contributions by partners”, “capital reserves”, “revenue reserves”, “profit carried forward”, and “liabilities”. Columns denoted by *SMALL MNCs* and *LARGE MNCs* correspond to sub-samples where only the 25% smallest and largest MNCs are considered. Whether an affiliate is assigned to small (large) is determined along the distribution of the parents’ total assets. The column denoted by *POSITIVE DEBT* provides the shares of affiliate-year observations that use the various types of debt. The total number of observations is 195,516.

	<i>ALL OBS.</i>		<i>SMALL MNCs</i>		<i>LARGE MNCs</i>		<i>POSITIVE DEBT</i>
	Mean	(sd)	Mean	(sd)	Mean	(sd)	Share
Share of external debt (b_{it}^E or ED_{it})	0.384	(0.280)	0.411	(.274)	0.371	(0.297)	0.983
Share of parental debt (b_{it}^P or PD_{it})	0.081	(0.175)	0.072	(.168)	0.059	(0.146)	0.421
Share of internal debt (b_{it}^I or ID_{it})	0.106	(0.198)	0.053	(.138)	0.172	(0.248)	0.626

Table 3: *EXPLANATORY VARIABLES*

The table reports descriptive statistics on the explanatory variables used in the regression analysis. TAX_{it} is the statutory tax rate faced by affiliate i at a given host country. $MINTAX_{it}$ is the minimum tax rate observed within the MNC that affiliate i belong to. $WTAX_{it}$ is the total-asset-weighted tax differential between the tax faced by affiliate i and the taxes at other locations within a multinational firm (see above, for a precise definition of this variable). $\log Sales_{it}$ is the log of the sales reported for affiliate i at time t . $Loss\ Carryforward_{it}$ is a binary indicator with value 1 if a loss carryforward is reported in our data for affiliate i at time t , and zero otherwise. $Tangibility_{it}$ is calculated as the share of fixed assets relative to total assets of affiliate i in year t . $Inflation_{it}$ measures the average percentage changes in consumer prices. $Corruption_{it}$ measures freedom from corruption (higher values are associated with more freedom) at a location. $GDP\ growth_{it}$ measures the growth of the gross domestic product at the location of affiliate i . The total number of observations is 195,516. More detailed definitions of the explanatory variables (including data sources) are provided in the text.

TAX_{it}	0.304	(0.076)
$MINTAX_{it}$	0.181	(0.106)
$WTAX_{it}$	- 0.043	(0.071)
$\log Sales_{it}$	2.956	(1.437)
$Loss\ Carryforward_{it}$	0.304	(0.460)
$Tangibility_{it}$	0.251	(0.252)
$Inflation_{it}$	3.158	(4.163)
$Corruption_{it}$	64.147	(20.701)
$GDP\ growth_{it}$	2.716	(3.163)

Table 3 presents mean values and standard deviations of the tax variables and control variables. The local statutory tax rate faced by affiliate i in period t is denoted TAX_{it} in the tables and empirical specifications. This variable corresponds to t_i in the theory model. The minimum or lowest tax rate within a multinational company p (including the parent as an entity), is denoted $MINTAX_{it}$. This corresponds to t_1 in the theory model. The number of affiliates related to parent p may change over time, t . The third tax variable we are interested in is the weighted tax rate. This is denoted $WTAX_{it}$ and is a measure of the relative tax-position of entity i within the MNC. The variable corresponds to $\sum_{j \neq i} \rho_j (t_i - t_j)$ in the theory model. The weights ρ_{jt} are determined using the share of total assets of entity j , TA_{jt} , relative to firm p 's total assets. Hence, $\rho_{jt} = TA_{jt} / \sum_{jt} TA_{jt}$.

Our theory model focuses on how tax incentives and bankruptcy costs affect the optimal capital structure of affiliates of MNCs, but there are, of course, other relevant determinants of capital structure choice. To account for this, we augment our regression model with a set of control variables often used in the empirical literature. Our selection of controls is especially inspired by the papers by Rajan and Zingales (1995), Huizinga et al. (2008), and Buettner and Wamser (2013). We condition on the following time-varying affiliate- and country-specific characteristics: $\log Sales_{it}$, $Loss\ Carryforward_{it}$, $Tangibility_{it}$, $Inflation_{it}$, $Corruption_{it}$ and $GDP\ growth_{it}$. The first three variables are

debt-to-asset ratio of the affiliates is 19%.

calculated using information from *MiDi*.

The log of the sales of affiliate i is included to capture size effects. Size is expected to be positively related to the ease of borrowing from external creditors (e.g., Graham and Harvey 2001; Frank and Goyal, 2009). At the same time, good access to external debt may imply that parental or internal debt is not needed.²¹ Furthermore, higher sales may also imply that a firm is able to retain earnings and therefore relies less on debt financing (the impact on external debt may then be negative as well).

The tax benefit of debt will be reduced if losses are carried forward for tax purposes (MacKie-Mason, 1990). The variable *Loss Carryforward_{it}* is defined as an indicator variable, which equals one if a loss carryforward is reported, and zero otherwise. For the interpretation of this regressor, it is important to note that losses from previous periods may also capture other subsidiary characteristics such as its maturity.

The last subsidiary-specific control is *Tangibility_{it}*. It is calculated as the ratio of fixed assets to total assets of subsidiary i . A higher share of fixed assets might imply easier access to external debt because fixed assets are used as collateral (Rajan and Zingales, 1995). However, high tangibility could be associated with more depreciation allowances and investment tax credits for investment in fixed assets. This might crowd out the value of the debt tax shield, in which case the impact of *Tangibility_{it}* on all types of debt would be negative (see De Angelo and Masulis, 1980).

We also control for three time-varying country-specific regressors. *Inflation_{it}* measures average percentage changes in consumer prices and is provided by the IMF (World Economic Outlook database). Desai et al. (2004) argue that foreign affiliates of MNCs borrow more externally and less internally in countries with high inflation. The underlying assumption is that external debt is often denominated in the local currency so that affiliates can hedge inflation risk through greater external borrowing. Huizinga et al. (2008) as well as Aggarwal and Kyaw (2008) argue that countries with higher inflation tend to have a higher risk premium and higher business risk in general, which discourages external borrowing.

The variable *Corruption_{it}* is provided by the Heritage Foundation. It measures perceived freedom from corruption. The maximum score of 100 indicates that a country is free of corruption. The minimum score is 0. We expect that less corruption (an increase in *Corruption_{it}*) is associated with a lower external-debt-to-asset ratio. If more corruption is associated with more political risk, our reasoning is in line with the findings of Desai et al. (2004) who argue that more risk should lead to more external debt financing as some of the risk may be shifted to external capital providers.²² Again, we can not apply this argument to

²¹This argument has been made in previous studies, concluding that external and internal debt are substitutes; e.g., Desai et al. (2004), or Buettner et al. (2009).

²²See also Kesternich and Schnitzer (2010), as well as Desai et al. (2008), for similar arguments; Aggarwal

parental and internal debt. If the latter two types of debt are used to substitute for external debt, we expect the opposite impact of $Corruption_{it}$.

Finally, we include $GDP\ growth_{it}$, which measures annual growth of a country's GDP. If a higher value of $GDP\ growth_{it}$ is associated with future growth, the effect on borrowing should be positive (Harris and Raviv, 1991). Rajan and Zingales (1995) as well as Myers (2001) suggest using the market-to-book-ratio of a firm as a proxy for growth opportunities, but this variable is not available in our data. In line with the debt-overhang theory of Myers (1977), they find that their measure is negatively related to borrowing. The $GDP\ growth$ variable is taken from the World Bank's World Development indicators and may capture very generally the economic situations at host countries.

Pearson correlation coefficients between all variables are provided in Table 4. One interesting insight is that the debt variables are negatively correlated. This suggests that firms may avoid restrictions on one type of debt by using other types of debt financing. Another important finding is that the correlations between the other variables are not very high. The entry with the highest value, 0.70, is the correlation coefficient between TAX and $WTAX$.

Table 5 presents some first descriptive evidence on how taxes affect average debt financing measured as the share of debt in total capital. A first remarkable result from Table 5 is that affiliates in high tax countries ($TAX_{it} > 35\%$) are not very different from affiliates in low-tax countries ($TAX_{it} \leq 25\%$) with respect to average debt shares.²³ Parental and internal debt of affiliates located in high-tax countries exceed the average values of those affiliates located in low-tax countries by only 0.6 and 2.3 percentage points, and they exhibit an external debt-to-asset ratio that is lower than that of their low-tax counterparts. A possible explanation for the lack of a clear pattern is that the debt shares are conditioned on host-country tax incentives rather than MNC-specific ones.

The next two sub-samples present average debt shares conditional on different values of $MINTAX_{it}$. Line three reports average debt shares for all observations with $MINTAX_{it} = 0$. This condition implies that at least one of the affiliated entities within an MNC must be located in a country that does not tax corporate profits. Line four shows average debt shares for affiliates belonging to MNCs where all entities are located in countries with a tax rate exceeding 35%. The latter condition implies that tax savings related to cross-border income shifting are rather modest.

Several findings stand out. First, the number of observations with $MINTAX_{it} = 0\%$ is relatively high when considering that the total number of affiliate-year observations is

and Kyaw (2008) make the point that this is particularly true if corruption means that there is an increased risk of expropriation.

²³A country with a tax rate below 25% is considered as being a country with 'low' taxes according to the German CFC legislation (see below).

Table 4: *CORRELATION MATRIX*

	<i>ED</i>	<i>PD</i>	<i>ID</i>	<i>TAX</i>	<i>MINTAX</i>	<i>WTAX</i>	<i>log Sales</i>	<i>Loss CF</i>	<i>Tangibility</i>	<i>Inflation</i>	<i>Corruption</i>	<i>GDP growth</i>
<i>ED</i>	1.000											
<i>PD</i>	-0.089	1.000										
<i>ID</i>	-0.057	-0.148	1.000									
<i>TAX</i>	-0.070	0.015	0.028	1.000								
<i>MINTAX</i>	-0.025	0.068	-0.157	0.302	1.000							
<i>WTAX</i>	0.088	-0.070	0.034	0.701	0.036	1.000						
<i>log Sales</i>	0.111	-0.075	0.074	0.034	-0.208	0.083	1.000					
<i>Loss CF</i>	0.027	0.098	0.107	0.055	0.004	0.031	-0.067	1.000				
<i>Tangibility</i>	-0.019	-0.020	-0.027	-0.035	0.083	-0.024	-0.115	0.114	1.000			
<i>Inflation</i>	-0.023	0.031	-0.005	-0.065	-0.059	-0.065	-0.023	0.037	0.044	1.000		
<i>Corruption</i>	-0.030	-0.035	0.034	0.114	0.096	0.054	0.050	-0.084	-0.117	-0.375	1.000	
<i>GDP growth</i>	-0.099	0.008	-0.005	-0.086	-0.017	-0.237	-0.047	0.048	0.045	0.109	-0.305	1.000

Table 5: *TAXES AND AVERAGE DEBT*

The debt variables are defined as ratios where the numerator corresponds to the respective value of debt reported in *MiDi* and the denominator corresponds to total capital defined as the sum of “subscribed or called-up capital, endowment capital and contributions by partners”, “capital reserves”, “revenue reserves”, “profit carried forward”, and “liabilities”. TAX_{it} is the statutory tax rate faced by affiliate i at a given host country. $MINTAX_{it}$ is the minimum tax rate observed within an MNC that applies to affiliate i .

		Share of <i>total</i> <i>debt</i> (Mean)	Share of <i>parental</i> <i>debt</i> (Mean)	Share of <i>internal</i> <i>debt</i> (Mean)	Share of <i>external</i> <i>debt</i> (Mean)	Obs. (N)
if TAX_{it}	$\leq 25\%$	0.553	0.069	0.093	0.391	74,778
if TAX_{it}	$> 35\%$	0.539	0.075	0.116	0.348	71,308
if $MINTAX_{it}$	$= 0\%$	0.580	0.056	0.162	0.362	47,138
if $MINTAX_{it}$	$> 35\%$	0.508	0.091	0.045	0.372	12,735

195,516. Second, internal debt financing seems to be clearly related to whether the MNC is operating a tax haven affiliate or not. The difference in the average internal-debt-to-asset ratio is huge: almost 12 percentage points. Third, parental debt is often used by those MNCs that do not operate low-tax affiliates, and finally there is no big difference between the average shares of external debt between the two groups.

6. Main regressions

We start out presenting regression results for external, parental, and internal debt based on the specification suggested by our theory model.

6.1. *External debt*

The left part of Table 6 contains regression results for the external-debt-to-asset ratio estimated with the fractional response model explained in Section 4. We report both estimated coefficients and average partial effects (APEs).

The first two columns show that an increase in the local tax rate, TAX_{it} , is associated with a larger share of external debt financing. This is the tax shield effect which has been found in previous literature on capital structure choice and taxes. In the next two columns, we add the within group minimum tax rate $MINTAX_{it}$, and the weighted tax rate, $WTAX_{it}$, so that all three tax measures are included.

The specification for the linear index in the fractional response model is given by

$$ED_{it} = \beta_1 \cdot TAX_{it} + \beta_2 \cdot MINTAX_{it} + \beta_3 \cdot WTAX_{it} + \beta_{\mathbf{x}} \cdot \mathbf{X}_{it} + c_i + d_t + \epsilon_{it},$$

Table 6: *BASIC RESULTS FOR EXTERNAL AND PARENTAL DEBT*

The table presents results from a fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced in Section 4. Dependent variable is the external-debt-to-asset ratio or the parental-debt-to-asset ratio of affiliate i at time t . All regressions include aggregate year dummies and affiliate-specific fixed effects using the approach described in Section 4. Definitions and descriptive statistics on the explanatory variables are provided in Section 5. Standard errors are reported in parentheses. They are based on panel bootstrapping clustered at the affiliate level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	<i>EXTERNAL DEBT</i>				<i>PARENTAL DEBT</i>			
	Coeff.	APE	Coeff.	APE	Coeff.	APE	Coeff.	APE
TAX_{it}	1.023*** (.092)	.378*** (.034)	.036 (.145)	.013 (.053)	.926*** (.139)	.137*** (.021)	5.521*** (.234)	.807*** (.034)
$MINTAX_{it}$			.131*** (.044)	.048*** (.016)			-.112 (.072)	-.016 (.010)
$WTAX_{it}$			.393*** (.121)	.144*** (.044)			-4.568*** (.210)	-.668*** (.031)
$\log Sales_{it}$	.092*** (.004)	.034*** (.002)	.100*** (.004)	.037*** (.002)	-.001 (.006)	-.0002 (.001)	-.001 (.006)	-.0002 (.001)
$Loss\ Carryforward_{it}$	.043*** (.005)	.016*** (.002)	.043*** (.006)	.016*** (.002)	.111*** (.008)	.016*** (.001)	.110*** (.008)	.016*** (.001)
$Tangibility_{it}$	.118*** (.022)	.044*** (.008)	.095*** (.023)	.035*** (.008)	.089** (.036)	.013** (.005)	.103*** (.036)	.015*** (.005)
$Inflation_{it}$	.001 (.001)	.0002 (.0002)	.001 (.001)	.0002 (.0002)	.002*** (.001)	.0004*** (.0001)	.002** (.001)	.0003** (.0001)
$Corruption_{it}$	-.003*** (.001)	-.001*** (.0002)	-.003*** (.001)	-.001*** (.0002)	-.0002 (.001)	-.00002 (.0001)	-.001 (.001)	-.0001 (.0001)
$GDP\ growth_{it}$	.003*** (.001)	.001*** (.0004)	.00006 (.001)	.00002 (.0003)	-.004*** (.001)	-.001*** (.0002)	-.002 (.001)	-.0002 (.0002)

where ED_{it} denotes the external-debt-to-asset ratio, c_i is an affiliate-specific effect, d_t are aggregate time effects, ϵ_{it} is an idiosyncratic error term, and \mathbf{X}_{it} captures the set of exogenous controls.

Our theory suggests that TAX_{it} and $WTAX_{it}$ have a positive effect on external debt, while $MINTAX_{it}$, should not be related to external debt. We see that $WTAX_{it}$ is positive and significant as expected, but TAX_{it} loses significance once we control for $WTAX_{it}$. We think this is due to limited within-affiliate variation in TAX_{it} combined with high correlation between TAX_{it} and $WTAX_{it}$ as is evident from Table 4.²⁴ Møen et al. (2011) use a similar model and find that TAX_{it} and $WTAX_{it}$ are both positive and significant when using group specific fixed effects instead of affiliate specific fixed effects.

The APE of .144 for $WTAX_{it}$ implies that a one-percentage point increase in the weighted tax differential is associated with a 0.14 percentage point higher external-debt-to-asset ratio. Expressed as a semi-elasticity, a one percentage point higher weighted tax incentive leads to a 0.38 percent higher debt ratio. Although our estimates refer to external debt and to $WTAX_{it}$, it is worth noting that Feld et al. (2013), in their meta study, find a typical semi-elasticity of total debt with respect to the local tax that is very similar in magnitude.

In contrast to the theoretical prediction, we find a small, positive and statistically significant coefficient on $MINTAX_{it}$. This suggests a substitutive relationship between internal and external debt. See Desai et al. (2004) for a similar empirical result.

Most of the control variables are significantly related to external debt financing as expected. An increase in sales as well as an increase in the tangible assets ratio improve borrowing conditions at the level of the affiliate. Less corruption (an increase in $Corruption_{it}$) is negatively related to the external-debt-to-asset ratio. Inflation and GDP-growth, however, do not seem to have a strong impact.

6.2. Parental debt

The right side of Table 6 presents results where the dependent variable is the parental-debt-to-asset ratio. According to our theory model, parental debt is rerouted external debt and should be governed by the same determinants as external debt. Hence, TAX_{it} and $WTAX_{it}$ should have a positive effect, while $MINTAX_{it}$, should not be related.

²⁴The specification that comes out of our theory model for *total debt* is $b_i = \beta_1 \cdot t_i + \beta_2 \sum_{j \neq i} \rho_j (t_i - t_j) + \beta_3 \cdot (t_i - t_1)$. The ideal empirical specification would rather be $b_i = \beta_1 \cdot t_i + \beta_2 \sum_{j \neq i} \rho_j t_j + \beta_3 \cdot t_1$ so as to have the most distinct variation in the tax incentives. The estimate of β_1 would in this case capture a composite effect of the different debt mechanisms at play, and of the different weights. Using this specification for external debt gives the following coefficients and standard errors: 0.822 (0.093) for β_1 , -0.244 (0.073) for β_2 , and 0.222 (0.044) for β_3 . Unfortunately, it is not possible to interpret such an estimate in light of our theory.

Looking at the first specification for parental debt where only the local tax, TAX_{it} , is included, the estimated APE implies that a 1 percentage point higher statutory tax rate leads to a 0.14 percentage point higher parental debt ratio. The corresponding elasticity (at mean values) is about 0.5. This is broadly in line with earlier findings such as Desai et al. (2004).

Moving on to the next two columns where the three tax variables are included simultaneously, we see that TAX_{it} is still positive and significant as expected. In line with theory, we also find that the lowest tax within the firm, $MINTAX_{it}$, is not significantly related to parental debt. However, $WTAX_{it}$ has a large, negative and significant impact rather than the positive coefficient that is predicted by theory. Knowing that $WTAX_{it}$ and TAX_{it} are highly correlated and noticing that one becomes large and positive while the other becomes large and negative, the coefficient on $WTAX_{it}$ should be interpreted with caution. Taken at face value, however, the negative impact of $WTAX_{it}$ indicates that external debt substitutes for parental debt under certain conditions. This is also consistent with the negative correlation between parent and external debt shown in Table 4. The strong responsiveness to TAX_{it} , relative to previous results, indicates that parent firms can flexibly respond to changes in tax rates by using parental debt.

In order to assess the estimated joint effect of TAX_{it} and $WTAX_{it}$ we can look at the effect of a tax reform on a typical firm.²⁵ This firm holds 10 affiliates in 9 different countries, where one is a tax haven country (with zero tax). The average tax over all affiliates is 23%, and we may focus on a change in the corporate tax rate faced by the affiliate in the country with the highest tax rate. Assume that TAX_{it} in that country equals 34% and is reduced by a reform to 20% ($\Delta TAX = 0.14$). If, ceteris paribus, we use the APEs from the last specification in Table 6, the total effect is a reduction of parental debt of approximately 0.02 ($0.668 \cdot 0.14 - 0.807 \cdot 0.14 = -0.01946$).

Looking briefly at the control variables, one remarkable finding is that sales are not related to parental debt. This contrasts the effect of sales on external debt, but makes sense as high sales are a positive signal to external creditors only. The variables *Loss Carryforward_{it}* and *Tangibility_{it}*, on the other hand, affect parental debt financing in a similar way as they affect external debt. This supports our theory model, and one explanation may be that higher values of these variables indicate higher demand for debt financing in general.

²⁵We define a typical firm in a given year as the median firm in terms of number of foreign affiliates held by the MNC.

6.3. Internal debt

The left part of Table 7 contains regression results for the internal-debt-to-asset ratio. According to theory, the level of internal debt supplied by non-parent entities is determined by $MINTAX_{it}$ only, and profit-shifting is the driving mechanism. This prediction comes through in the data. The coefficients on TAX_{it} and $WTAX_{it}$ are insignificant with the latter also being very close to zero. The coefficient on $MINTAX_{it}$ is negative and significant, meaning that the internal-debt-to-asset-ratio increases when the lowest tax rate within the firm falls and therefore the tax differential and scope for tax arbitrage increases. The latter finding is in line with Buettner and Wamser (2013).²⁶

From a quantitative perspective, the implied effect of $MINTAX_{it}$ is not huge – a one-standard-deviation higher minimum tax rate implies a reduction of internal debt by 0.6 percentage points. Expressed as an elasticity, we find that a 1 percent increase in $MINTAX_{it}$ leads to 0.05 percent less internal debt financing. Yet, we should mention that the interpretation of the APE does not take into account the specific situation of a firm in a specific country. Obviously, not all MNCs operate entities in tax haven countries.

Taken together, the results presented in Tables 6 and 7 suggest that firms arbitrage not only across countries and taxes, but also over different types of debt financing, depending on other determinants. For example, the tangibility variable does not have any effect on internal debt, while it determines external and parental debt financing to a significant degree. The results also suggest that parental debt is in many ways similar to external debt and distinct from other internal debt. This may be important when designing tax policy.

6.4. Total debt

The right side of Table 7 presents results for the total-debt-to-asset ratio. The findings confirm that if only the local tax incentive is included, it is highly significant and positively related to debt financing. This is no longer the case when all three tax variables are included. The estimates suggest that the $WTAX_{it}$ mechanism becomes prevalent and absorbs the variation of TAX_{it} almost completely. Again, we may argue that the fixed effects technique is too strict a requirement for identification of both TAX_{it} and $WTAX_{it}$ in one specification. The estimated coefficient for the former is still positive, but not statistically significant. Even though all three tax coefficients are separately identified, it is worth noting that the estimated standard errors for TAX_{it} when comparing specifications 1 and 2 (for total debt) increase

²⁶The analysis of Buettner and Wamser (2013) is also based on *MiDi* data, but they focus exclusively on internal debt, use a different time span, a different specification and a different estimation technique.

Table 7: *BASIC RESULTS FOR INTERNAL AND TOTAL DEBT*

The table presents results from a fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced in Section 4. Dependent variable is the internal-debt-to-asset ratio or the total-debt-to-asset ratio of affiliate i at time t . All regressions include aggregate year dummies and affiliate-specific fixed effects using the approach described in Section 4. Definitions and descriptive statistics on the explanatory variables are provided in Section 5. Standard errors are reported in parentheses. They are based on panel bootstrapping clustered at the affiliate level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	<i>INTERNAL DEBT</i>				<i>TOTAL DEBT</i>			
	Coeff.	APE	Coeff.	APE	Coeff.	APE	Coeff.	APE
TAX_{it}	.593*** (.142)	.107*** (.026)	.062 (.200)	.011 (.035)	.246** (.096)	.097** (.038)	.102 (.141)	.040 (.056)
$MINTAX_{it}$			-.168*** (.057)	-.030*** (.010)			-.138*** (.042)	-.054*** (.016)
$WTAX_{it}$			.005 (.165)	.001 (.029)			.192* (.110)	.076* (.043)
$\log Sales_{it}$	.020*** (.006)	.004*** (.001)	.027*** (.006)	.005*** (.001)	.101*** (.004)	.040*** (.002)	.100*** (.004)	.040*** (.002)
$Loss\ Carryforward_{it}$	.093*** (.008)	.017*** (.001)	.094*** (.008)	.017*** (.001)	.087*** (.005)	.034*** (.002)	.087*** (.005)	.034*** (.002)
$Tangibility_{it}$	.023 (.028)	.004 (.005)	-.0002 (.028)	-.00004 (.005)	.086*** (.021)	.034*** (.008)	.085*** (.021)	.034*** (.008)
$Inflation_{it}$	.002 (.001)	.0003 (.0002)	.002* (.001)	.0003* (.0002)	.001* (.001)	.0004* (.0002)	.001* (.001)	.0004* (.0002)
$Corruption_{it}$	-.001 (.001)	-.0002 (.0001)	-.001 (.001)	-.0002 (.0001)	-.002*** (.001)	-.001*** (.0002)	-.002*** (.001)	-.0009*** (.0002)
$GDP\ growth_{it}$	.002 (.002)	.0004 (.0003)	-.0005 (.001)	-.0001 (.0003)	-.010*** (.001)	-.004*** (.0004)	-.010*** (.001)	-.004*** (.0004)

by a factor of about 1.5.²⁷ $MINTAX_{it}$ remains negative and highly significant. Also, all the non-tax control variables are now statistically significant.

7. A closer look at the internal capital market mechanisms

The main regressions in Section 6 study intensive margin adjustments for different types of debt in response to changes in tax incentives. As highlighted in our theory, there are fixed costs associated with setting up a tax optimizing internal debt scheme. In this section, we explore what factors influence the choice of using parental and non-parental internal debt. We start out exploring the characteristics of internal lenders.

7.1. Who are the internal lenders?

We define a binary variable, $LEND_{it}$, to indicate whether the balance sheet of affiliate i shows positive lending in period t ($LEND_{it} = 1$) or not ($LEND_{it} = 0$). With this definition, 12,036 affiliate-year observations are identified as lenders. These relate to 4,183 affiliates held by 1,425 MNCs and constitute about 6% of the affiliate-year regression sample.

The entities with $LEND_{it} = 1$ should be the ones that provide internal debt to other borrowing affiliates within a firm, i.e., the internal banks. Although our census-type data provides a relatively complete picture of MNCs, the bilateral lending-borrowing relationships are unobserved. This prevents a clear test of hypotheses related to the lending behavior. What we can examine, however, is whether the pattern of lending is consistent with what we would generally expect to be a relevant determinant of positive lending.

Column 1 in Table 8 refers to a pooled probit estimation including time dummies; column 2 refers to an estimation which includes affiliate-specific effects (i.e., the means of the explanatory variables as additional regressors as suggested in our approach from above); column 3 adds $MINTAX_{it}$ and a dummy variable indicating whether affiliate i is the lowest-tax affiliate within the MNC. The results in Table 8 show the following. First, the probability of being a lender is higher when entity i is located in a low-tax country. The marginal effect of TAX_{it} evaluated at mean values is -.0008, which seems to be a rather modest effect. Second, the probability of positive lending is increasing in sales. Sales may be a proxy for affiliate size or may indicate that an affiliate is more able to retain earnings (which are then provided as internal debt). Third, the share of tangible assets is negatively related to lending. Fourth, the higher the minimum tax within the MNC, the lower is the probability that i has positive

²⁷When specifying the estimation equation as $b_i = \beta_1 \cdot t_i + \beta_2 \sum_{j \neq i} \rho_j t_j + \beta_3 \cdot t_1$ (as for external debt), we find $\beta_1 = 0.481$ (0.095), $\beta_2 = -0.149$ (0.075), and $\beta_3 = -0.096$ (0.040).

Table 8: *DETERMINANTS OF POSITIVE INTERNAL LENDING*

The table reports estimates from a Probit model with $LEND_{it}$ as dependent variable. All regressions include aggregate year dummies; specifications II and III add affiliate-specific fixed effects using the approach described in Section 4. Definitions and descriptive statistics on the explanatory variables are provided in Section 5. Robust standard errors are reported in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	I	II	III
TAX_{it}	-.471*** (.134)	-.678** (.292)	-.418 (.301)
$\log Sales_{it}$	.095*** (.007)	.044*** (.011)	.044*** (.011)
$Loss\ Carryforward_{it}$	-.114*** (.018)	-.041** (.017)	-.041** (.017)
$Tangibility_{it}$	-.381*** (.039)	-.764*** (.071)	-.776*** (.071)
$Inflation_{it}$	-.003 (.002)	-.004 (.002)	-.004 (.002)
$Corruption_{it}$	.006*** (.001)	-.002 (.002)	-.002 (.002)
$GDP\ growth_{it}$	-.014*** (.003)	-.010*** (.003)	-.011*** (.003)
$MINTAX_{it}$			-.835*** (.136)
$Lowest-tax\ affiliate_{it}$			.136*** (.027)

lending. And finally, being the lowest-tax affiliate within the MNC makes it rather likely that internal lending is provided.²⁸

7.2. Who are the MNCs that operate lending entities?

The regressions shown in Table 8 are based on subsidiary-level observations. It is also interesting to analyze whether parent p is operating a lending entity or not. To examine this we define a new binary variable at the group level. $LEND_{pt}$ is one if MNC p is operating at least one lending entity and zero otherwise. $LEND_{pt} = 1$ for about 14% of the MNCs in our data.

As above, we use a binary response model. Note, however, that our dataset provides only limited information about parent firms. This means that the list of potential p -specific determinants of $LEND_{pt}$ is limited.

Table 9 suggests that firms are more likely to operate at least one affiliate with positive lending if (i) the balance-sheet total of the whole corporate group, BST_{pt} , is larger; (ii) the

²⁸Note that in column III TAX is no longer significantly related to the probability of positive lending once $MINTAX$ and $Lowest-tax\ affiliate$ are included. The estimated coefficient on $MINTAX$ is generally difficult to interpret since it is measured at the group level while the dependent variable $LEND$ is measured at the affiliate level. We find it plausible, however, that the negative estimate of $MINTAX$ to some extent captures the effect of TAX which remains negative, but becomes insignificant.

Table 9: WHO OPERATES A LENDING ENTITY?

The table reports estimates from a Probit model with $LEND_{pt}$ (measured at the level of the parent p) as dependent variable. All regressions include aggregate year dummies. Definitions of the explanatory variables are provided in Section 7.2. The ‘*bar*’ indicates that variables are means at the MNC level. Robust standard errors are reported in parentheses. * * * denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 31,245 (I and II) and 30,760 (III) observations.

	I	II	III
$\log BST_{pt}$	.077*** (.007)	.056*** (.008)	.060*** (.008)
$\overline{\log TA}_{pt}$		.161*** (.025)	.115*** (.029)
$\overline{\log FA}_{pt}$			.115*** (.022)
\overline{TAX}_{pt}	-1.025*** (.296)	-1.013*** (.293)	-1.133*** (.306)
$\overline{\log Sales}_{pt}$	.039** (.017)	-.052** (.022)	-.111*** (.025)
$\overline{Loss\ Carryforward}_{pt}$	-.072* (.041)	-.061 (.040)	-.053 (.041)
$\overline{Tangibility}_{pt}$	-.413*** (.081)	-.534*** (.082)	-1.283*** (.148)
$\overline{Inflation}_{pt}$	-.003 (.006)	-.004 (.006)	-.003 (.006)
$\overline{Corruption}_{pt}$	.003** (.001)	.002* (.001)	.003*** (.001)
$\overline{GDP\ growth}_{pt}$	-.016* (.008)	-.016** (.008)	-.017** (.008)

average entity of p is larger in terms of total assets, TA_{pt} , and in terms of average fixed assets of the foreign affiliates, FA_{pt} .²⁹ This confirms the general expectation that being large facilitates operating an internal capital market.³⁰

²⁹The variable BST_{pt} is measured in logs at the consolidated corporate group level, while TA_{pt} and FA_{pt} refer to averages over all affiliates that belong to an MNC, also in logs. The regressions also condition on aggregate time effects and averages of the country-specific variables where the averages are calculated over all countries the MNC is holding affiliates in, weighted by the number of affiliates in these countries. The estimated coefficients on most of these averages at the level of countries (e.g., average GDP growth or corruption perception) should not be interpreted, but are included for the sake of controlling for average conditions in host countries. Apart from that, we believe that the negative tax effect makes sense. As the average tax level in the group increases towards the level of Germany, the tax differential within the group becomes smaller and there will be little to gain from setting up an internal bank.

³⁰Note that we have decided against including $MINTAX_{it}$ as an additional regressor. Even though we argue that all estimates presented in Table 9 should primarily be interpreted as correlations, $MINTAX_{it}$ is obviously determined simultaneously with the choice of location for the lending entity. It is therefore endogenous. In this respect, it is important to note that all regressions in the previous sections are estimated at the affiliate level and analyze different outcomes. We believe that the endogeneity issue is far less relevant there, and we provide endogeneity tests in the online appendix that support this view. Note also that if we add $MINTAX_{it}$ to the specifications in Table 9, we get a coefficient of -5.82 with standard error (.30). As one would expect, a high minimum tax makes it unlikely that the MNC operates a lending entity.

7.3. Determinants of parental debt

The average share of parental debt financing in our sample is about 8%, and our data suggest that many MNCs provide parental lending from Germany even if the affiliates face relatively low taxes in their host countries.³¹ The share of parental debt is negatively correlated with both external and internal debt (see Table 4).

As pointed out in the theory section, it would be tax-efficient to provide all internal debt from the lowest-taxed entity within the group in a world without capital market frictions. Our theory model offers two explanations of why we observe lending from parent companies in situations where the parent is not the lowest-taxed entity within the group. First, parent companies may have a cost advantage in raising external capital in their home market compared to the affiliates raising external capital in their local markets. Going back to the model, this relative cost is given by δ_E/δ_P and the larger the ratio, the larger is the cost advantage of the parent and the higher is the optimal parental debt-to-asset ratio, cf. equation (17). This mechanism captures that parental debt and external debt are substitutes. Second, there may be fixed costs associated with setting up an internal bank. For small multinational companies and companies with modest within-group tax differences, therefore, the tax advantage of setting up an internal bank may not be sufficiently large to warrant the cost. It may then be optimal to finance affiliates directly from the parent. Such ‘parental internal debt’ will be financed through parent equity and is used instead of equity in the affiliate.

The relative cost advantage of the parent company will vary with the degree to which the parent is credit constrained in its home market. We therefore proxy the parent cost advantage ratio with a credit constraint indicator provided by the German economic research institute, Ifo. Ifo conducts regular surveys of Germany businesses to assess banks’ lending policies. The variable CCI_{pt} (Credit Constraint Indicator) measures the share of firms (in the home market) that feel that credit access is restrictive. Note, thus, that the variable applies to the parent p . On average in our sample, 37.6% of firms report that this is the case. Although all parent firms are operating from Germany, CCI_{pt} varies over time and is measured for different levels of company size (firms are classified as small if their turnover is below 10 million euros, and the number of employees is below 50; firms are classified as large if their turnover is above 50 million euros and the number of employees is above 249; firms in-between these values are defined as medium sized).

³¹For about 37% of the MNCs in our data, Germany is the minimum-tax country. While this seems to be a significant share, this number may be biased as it assumes an average local business tax in Germany. In reality, the local business tax varies across German municipalities, but we do not have information about the municipality in which an MNC is located.

Table 10, Panel A, presents results where we first explore the effect of CCI_{pt} on parental and external debt in affiliate level regressions conditioning on all the non-tax control variables used in Table 6.³² The findings are consistent with our theory. An increase in the credit constraint indicator CCI_{pt} (a reduction in δ_E/δ_P) is associated with significantly less parental debt financing, and more external debt financing. This suggests that favorable access to credit capital at the parent location is an important reason for why parental debt is used.

Table 10: *CREDIT CONSTRAINT INDICATORS AND DEBT*

The table presents results from a fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced in Section 4. Dependent variable is the parental-debt-to-asset ratio or the external-debt-to-asset ratio of affiliate i at time t . The variable CCI_{pt} measures the share of firms that feel that credit access is restrictive. The variable $SATA_{pt}$ is an alternative credit constraint measure defined as the sales over total assets of the parent firm. All regressions include the standard set of control variables used in Table 6. These are not reported. All regressions also include aggregate year dummies and affiliate-specific fixed effects using the approach described in Section 4. Definitions and descriptive statistics on the explanatory variables are provided in Section 5. Standard errors are reported in parentheses. They are based on panel bootstrapping clustered at the affiliate level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	PARENTAL DEBT				EXTERNAL DEBT			
	Coeff.	APE	Coeff.	APE	Coeff.	APE	Coeff.	APE
PANEL A								
CCI_{pt}	-.023*** (.001)	-.003*** (.0001)	-.019*** (.001)	-.003*** (.0002)	.013*** (.001)	.005*** (.0002)	.013*** (.001)	.005*** (.0003)
$CCI_{pt} \times TAX_{it}$			-.012*** (.003)	-.002*** (.0004)			-.001 (.002)	-.001 (.001)
TAX_{it}			.347** (.164)	.051** (.024)			.848*** (.101)	.313*** (.037)
PANEL B								
$SATA_{pt}$	.191*** (.019)	.027*** (.003)	-.042 (.053)	-.006 (.008)	.020* (.012)	.007* (.004)	.092** (.041)	.034** (.015)
$SATA_{pt} \times TAX_{it}$			.747*** (.170)	.106*** (.024)			-.276** (.129)	-.102** (.048)
TAX_{it}			.580*** (.178)	.083*** (.025)			1.155*** (.097)	.426*** (.036)

Next we add TAX_{it} and the interaction between TAX_{it} and CCI_{pt} .³³ This takes us closer to equation (17) and tests whether the responsiveness of parental and external debt to taxes depends on whether the parent is credit constrained or not. The findings suggest that the parental debt tax-responsiveness of affiliate i is significantly reduced if the parent is credit constrained. This is in line with our theory. In the external debt regression, the interaction term is insignificant.

The estimates in Table 10, Panel B, replicate the specifications from above, but now

³²These are not reported to save space. Estimated coefficients hardly change compared to the basic results.

³³Note that for reasons of simplicity and interpretability, we have not included the other tax incentives here.

include $SATA_{pt}$ as an alternative variable to capture the financial situation of the parent. $SATA_{pt}$ is defined as the sales over total assets of the parent firm. High values of $SATA_{pt}$ may be interpreted as high financial solvency and better access to external credit at home and in the host country. As we do not have information on the fixed assets at the level of the parent, we use $SATA_{pt}$ as a proxy for future cash flows. Creditors at home as well as in the host country may interpret high values thereof as a signal that future cash flows are high as well, which increases their willingness to lend. The results support this reasoning: In the left part of Table 10, it is demonstrated that an increase in $SATA_{pt}$ leads to more parental debt financing at foreign locations (better access to external borrowing at the parent). The right part of the table demonstrates that this is also the case when examining external debt (facilitated access to external borrowing in the host market through collateral provided by the parent).³⁴ Note that the latter interpretation does not apply to the variable CCI_{pt} as it directly measures access to credit at home, while this is not necessarily the case for $SATA_{pt}$.

We finally run regressions where interactions of $SATA_{pt}$ and TAX_{it} are included as above. From these estimates, we may conclude that if higher values of $SATA_{pt}$ are associated with better access to external debt, it is only passed on to affiliates (as parental debt) if there is a tax incentive to do so. The opposite is the case for external debt, for which we find that the tax responsiveness is reduced if $SATA_{pt}$ is high, which is consistent with the previous finding that parental debt is provided to foreign affiliates and substitutes for external debt.

7.4. Who is using parental debt?

Our theory predicts that small MNCs should be more inclined to use parental debt financing than large MNCs as they cannot bear the fixed cost of setting up an internal lending entity. Likewise, MNCs with small within-group tax differences will also have a reduced likelihood of setting up an internal bank. To see whether this is a pattern we find in our data, we use an approach similar to that in Table 9 and run regressions on the extensive margin of parental debt usage. We define a binary indicator $PDEBT_{pt}$ and assign a value of 1 if at least one affiliate receives parental debt financing and zero if none of the affiliates within the MNC shows a positive amount of parental debt financing. Almost 30% of our parent-year observations have $PDEBT_{pt}$ equal to 1.

Using the same set of controls as in Table 9, the estimates provided in Table 11 suggest that parental debt is used by smaller firms, as $\log BST_{pt}$, $\log TA_{pt}$, and $\log FA_{pt}$ are all negatively related to $PDEBT_{pt}$. To further support the argument that parental debt is used mainly in the absence of an internal lending entity, column 4 in the same table includes $LEND_{pt}$, i.e., the dependent variable from above, to show that it is negatively correlated

³⁴This will also be true if $SATA_{pt}$ is just a good proxy for the parent's fixed assets.

Table 11: *WHO IS USING PARENTAL DEBT?*

The table reports estimates from a Probit model with $PDEBT_{pt}$ (measured at the level of the parent p) as dependent variable. All regressions include aggregate year dummies. All explanatory variables are means at the MNC level except BST_{pt} which is the balance-sheet total of the corporate group, see Section 6.2 for definitions. Robust standard errors are reported in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.

	I	II	III	IV
$\log BST_{pt}$	-.042*** (.006)	-.017*** (.006)	-.019*** (.007)	-.015** (.007)
$\log TA_{pt}$		-.234*** (.029)	-.207*** (.034)	-.195*** (.033)
$\log FA_{pt}$			-.070*** (.019)	-.062*** (.018)
$LEND_{pt}$				-.397*** (.041)
TAX_{pt}	1.319*** (.281)	1.361*** (.287)	1.526*** (.290)	1.431*** (.287)
$\log Sales_{pt}$	-.050*** (.015)	.083*** (.023)	.110*** (.023)	.100*** (.023)
$Loss\ Carryforward_{pt}$	.237*** (.038)	.225*** (.038)	.219*** (.038)	.215*** (.038)
$Tangibility_{pt}$	-.162** (.075)	.049 (.082)	.454*** (.125)	.361*** (.125)
$Inflation_{pt}$	-.009 (.007)	-.008 (.007)	-.008 (.006)	-.008 (.006)
$Corruption_{pt}$	-.004*** (.001)	-.004*** (.001)	-.004*** (.001)	-.004*** (.001)
$GDP\ growth_{pt}$	.006 (.008)	.008 (.008)	.009 (.008)	.007 (.008)
$No.ofobservations$	31,245	31,245	30,760	30,760

with $PDEBT_{pt}$. Hence, we can conclude that parental debt is used if firms are small and cannot afford an internal lending entity. The latter is in line with our theory.

With a final test, we want to provide a last piece of evidence that the negative impact of $WTAX$ in Table 6 has to be interpreted in light of these findings. Running a regression as in the last two columns of Table 6 and adding an interaction term between $LEND_{pt}$ and $WTAX_{it}$ suggests that the negative $WTAX$ effect is driven by those MNCs that do not operate a lending entity.³⁵ Thus, the effect is caused by affiliates in which parent debt has a dual role and is a mix of re-routed external debt and replaced equity. Interactions with variables capturing size (e.g., number of affiliates per MNC) show a positive coefficient as well.³⁶

³⁵The regression is not reported, but we estimate the following coefficients and standard errors: $WTAX_{it} = -4.571$ (0.205), $LEND_{pt} \times WTAX_{it} = 2.806$ (0.634).

³⁶When we examine the probability of positive lending at the level of the MNC in Table 11, we have decided against including $MINTAX_{it}$. This is because the argument presented in footnote 30 naturally applies to this analysis as well. However, if we ignore the endogeneity concern and include $MINTAX_{it}$, we estimate a coefficient of 3.71 with a standard error of (.34). This suggests that a higher minimum tax makes it more likely that the MNC uses parental debt, something which confirms all our previous findings.

8. Robustness

In this section we explore the robustness of our main findings with respect to a number of measurement issues concerning the tax incentives. First, we test for heterogeneity in tax incentives depending on whether affiliates carry forward losses. Second, we test whether tax incentives are inaccurately measured because of the German CFC legislation. In an online appendix, we also test for possible endogeneity of the minimum tax, we allow for preferential tax treatment in Belgium, the Netherlands, Luxembourg, and Switzerland, and we provide tests for sub-samples of our data.

8.1. *Tax-responsiveness under losses*

The empirical analysis we have presented before can be understood as an approach where statutory tax incentives are used to capture the value of a one-unit reduction in taxable profits. This view should be the correct one for a forward-looking firm that is choosing its capital structure. In the short-run, however, the marginal tax incentive may not be fully captured by TAX . For example, if affiliate i carries forward losses, we would expect that the short-run tax incentive to use additional debt goes to zero, as the marginal benefit of interest deduction under losses is zero in the short-run. Table 12 aims at illustrating whether this pattern can be found in the data. A graphical representation of how this changes the tax-response function can be found in the online appendix.³⁷ For reasons of simplicity and interpretability, we use a parsimonious specification in which we include an interaction term between TAX_{it} and $Loss\ Carryforward_{it}$.

We find that $TAX_{it} \times Loss\ Carryforward_{it}$ has a negative sign, meaning that affiliates whose tax bases, and therefore marginal tax rates, go to zero are less responsive to taxes. This result holds for external and parental debt financing. For internal debt, $TAX_{it} \times Loss\ Carryforward_{it}$ is insignificant. Additional, non-reported regressions show that an interaction between $MINTAX_{it}$ and $Loss\ Carryforward_{it}$ is not significantly related to internal debt financing.

8.2. *Minimum tax and the German CFC rule*

German tax law and particularly §§7 – 14 of the German Foreign Transactions Tax Act (*Außensteuergesetz, AStG*) aims at preventing MNCs from an excessive use of internal lending and borrowing for reasons of tax planning and profit shifting. §§7 – 14 of AStG is the statutory body of the controlled foreign company (CFC) legislation in Germany. It generally

³⁷The graphs nicely illustrate non-linearities in the marginal effects of taxes.

Table 12: *LOSSES AND DEBT TAX-RESPONSIVENESS*

The table presents results from a fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced above. Dependent variables are the external-debt-to-asset ratio, the parental-debt-to-asset ratio and the internal-debt-to-asset ratio, of affiliate i at time t . All regressions include the standard set of control variables used in Table 6. Except for *Loss Carryforward_{it}*, these are not reported. All regressions also include aggregate year dummies and affiliate-specific fixed effects using the approach described above. Standard errors are reported in parentheses. They are based on panel bootstrapping clustered at the affiliate level. * * * denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	<i>EXTERNAL DEBT</i>				<i>PARENTAL DEBT</i>			
	Coeff.	APE	Coeff.	APE	Coeff.	APE	Coeff.	APE
$TAX_{it} \times Loss\ Carryforward_{it}$	-.565*** (.062)	-.209*** (.022)	-.546*** (.063)	-.201*** (.023)	-.351*** (.114)	-.052*** (.017)	-.373*** (.112)	-.054*** (.016)
TAX_{it}	1.170*** (.094)	.432*** (.035)	.161 (.145)	.059 (.053)	1.041*** (.142)	.154*** (.021)	5.641*** (.237)	.824*** (.035)
$MINTAX_{it}$			.135*** (.044)	.050*** (.016)			-.108 (.072)	-.016 (.010)
$WTAX_{it}$			.418*** (.120)	.154*** (.044)			-4.563*** (.210)	-.667*** (.031)
$Loss\ Carryforward_{it}$	.216*** (.020)	.080*** (.007)	.210*** (.020)	.077*** (.007)	.219*** (.036)	.032*** (.005)	.225*** (.036)	.033*** (.005)

	<i>INTERNAL DEBT</i>			
	Coeff.	APE	Coeff.	APE
$TAX_{it} \times Loss\ Carryforward_{it}$	.045 (.089)	.008 (.016)	.087 (.089)	.015 (.016)
TAX_{it}	.578*** (.148)	.104*** (.027)	.032 (.203)	.006 (.036)
$MINTAX_{it}$			-.169*** (.057)	-.030*** (.010)
$WTAX_{it}$			.006 (.165)	.001 (.029)
$Loss\ Carryforward_{it}$	.080*** (.029)	.014*** (.005)	.067** (.029)	.012** (.005)

applies to passive income such as interest income from internal lending associated with profit shifting, and to foreign affiliates facing low taxation.³⁸ If a foreign entity is treated under CFC law, the exemption of foreign source income is no longer granted and foreign income is included in the taxable income of the German parent (for taxes paid in the foreign country, a tax credit is provided).

In line with §8(3) of the German CFC law, Table 13 presents estimates that account for German CFC legislation by using an interaction term between an indicator variable called CFC_{it} and TAX_{it} . $CFC_{it} = 1$ if $MINTAX_{it}$ is below 25% (30% until 2000), and zero otherwise. The idea behind this approach is that MNCs would be fully prevented from using foreign affiliates as financing entities if CFC rules were perfectly binding. In our sample, $CFC_{it} = 1$ in about 22% of the cases. If the average firm is affected by Germany's CFC rule, we would expect that an interaction term between CFC_{it} and $MINTAX_{it}$ is positive and significant, as the impact of $MINTAX_{it}$ should become less negative. We can confirm a positive relationship, but the estimated coefficient is not significant at any common level of statistical significance. The negative impact of CFC_{it} confirms that the average internal-debt-to-asset ratio is negatively affected. But again, the estimated coefficient is not statistically significant. This suggests that either the German CFC rule is inefficient or at least that our indicator variable CFC_{it} is a too crude a measure to capture the effect. Anecdotal evidence actually suggests that the CFC rule is often not binding and many MNCs find ways to avoid it. We can support this argument by using an example: Our data suggests that substantial (financial) assets are located on the Cayman Islands where TAX is equal to zero (hence, $CFC = 1$). There, we observe 274 German affiliates of 65 MNCs over all years in our sample. At a global level, these 65 MNCs hold 5,570 affiliates (located in 140 countries) whose internal-debt ratio is almost 17% (more than 6 percentage points higher compared to the grand sample mean).³⁹

8.3. Additional tests and results in the online appendix

More tests and additional results are presented in an online appendix. In these tests we address (i) endogeneity issues of the minimum tax variable by accounting for potential selection into setting up a new minimum tax affiliate, (ii) the possibility of preferential tax treatment in some countries, (iii) variations in the sample. It seems that endogeneity is not an important issue and that the results are not driven by countries providing preferential

³⁸There are two exemption clauses that need to be considered as well. Since determining treatment at the firm level is rather complicated and also associated with a number of measurement issues (see Egger and Wamser, 2015), considering this would exceed the scope of this paper. We therefore focus on the tax threshold only.

³⁹Note that this statistic refers to the raw data, not the estimation sample.

Table 13: *CFC RULES & INTERNAL DEBT*

The table presents results from a fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced above. Dependent variable is the internal-debt-to-asset ratio of affiliate i at time t . All regressions include aggregate year dummies and affiliate-specific fixed effects using the approach described above. Standard errors are reported in parentheses. They are based on panel bootstrapping clustered at the affiliate level. * * * denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 195,516 observations.

	Coeff.	APE	Coeff.	APE	Coeff.	APE
TAX_{it}	.544*** (.165)	.098*** (.030)	-.033 (.177)	-.006 (.031)	.013 (.210)	.002 (.037)
CFC_{it}	-.051 (.078)	-.009 (.014)	-.014 (.026)	-.003 (.005)	-.010 (.026)	-.002 (.005)
$CFC_{it} \times TAX_{it}$	.347 (.325)	.062 (.058)				
$CFC_{it} \times MINTAX_{it}$			.174 (.124)	.031 (.022)	.171 (.125)	.030 (.022)
$MINTAX_{it}$			-.221*** (.051)	-.039*** (.009)	-.189*** (.049)	-.033*** (.009)
$WTAX_{it}$					.087 (.136)	.015 (.024)
$\log Sales_{it}$	.021*** (.006)	.004*** (.001)	.028*** (.006)	.005*** (.001)	.027*** (.006)	.005*** (.001)
$Loss\ Carryforward_{it}$	.093*** (.008)	.017*** (.001)	.094*** (.008)	.017*** (.001)	.094*** (.008)	.017*** (.001)
$Tangibility_{it}$	.020 (.034)	.004 (.006)	-.005 (.034)	-.001 (.006)	-.001 (.033)	-.0001 (.006)
$Inflation_{it}$	.002* (.001)	.0003* (.0002)	.002* (.001)	.0003* (.0002)	.002* (.001)	.0003* (.0002)
$Corruption_{it}$	-.001* (.001)	-.0002* (.0001)	-.001 (.001)	-.0002 (.0001)	-.001 (.001)	-.0002 (.0001)
$GDP\ growth_{it}$	.001 (.001)	.0002 (.0003)	-.001 (.001)	-.0003 (.0003)	-.001 (.001)	-.0002 (.0003)

tax treatment. With respect to varying the sample, the results suggest that profit shifting through internal non-parental lending usually involves a low-tax or tax haven location outside the OECD area.

9. Conclusions

The main objective of this paper is to explain the use of parental debt and the functioning of an internal capital market within MNCs. For this purpose, we first propose a rich theory model, which not only explains the determinants of optimal debt structure of MNCs, but also provides guidance on what influences the extensive margins of using an internal bank or the parent as a lender. While previous research has provided evidence on the intensive margins of internal debt, external debt, or total debt of affiliates of MNCs, none of the earlier studies have provided evidence on debt financing provided by the parent firm.

In the empirical part, we find the following: First, parental debt financing is responsive to tax incentives, and acts as a substitute for external debt in response to capital market

conditions. Second, parental debt is mainly used by smaller firms, and in the absence of an internal lending entity. Third, the size of the MNC is a key determinant of whether a firm operates an internal bank (which is operated for the purpose of lending to high-tax affiliates). Fourth, we find evidence that parental debt provided to foreign affiliates is raised through external borrowing at the location of the parent firm.

We can only to some extent explain the fact, however, that about 58% of all affiliates do not use parental debt. Several factors could explain why this is the case. One, already built into the model as a corner solution, may be that some multinationals' affiliates do not face transaction costs in accessing the external capital market. Another could be that external lenders are better at monitoring than the parent, and that the difference in monitoring capability may be group- or affiliate-specific. To incorporate the latter features into a modeling framework is left for future work.

The central policy implication from our research is that policies to prevent firms from using an internal capital market to shift profits have to be carefully designed. We provide a number of results suggesting that parental debt, while responding to taxes, is primarily used to avoid capital market imperfections. Too strict measures may come at the cost of a less efficient allocation of financing capital within MNCs.

Appendix 1. Optimal investment and differences in productivity

Denote effective capital costs, evaluated at the tax-efficient capital structure, by \tilde{r} . Then, the maximization problem of parent company p for optimal production and investment of real capital K_i can be stated as

$$\max_{K_i} \Pi_p = \sum_i \{(1 - t_i) \cdot f(\theta K_i) - \tilde{r} \cdot K_i\}, \quad (26)$$

and the first-order conditions read

$$f_K(\theta K_i) \cdot \theta = \frac{\tilde{r}}{1 - t_i}, \quad \forall i. \quad (27)$$

Straightforward comparative statics shows that

$$\frac{dK_i}{d\theta} = -\frac{f_{KK} \cdot \theta K_i + f_K}{f_{KK} \cdot \theta^2} > 0 \quad \forall i, \quad (28)$$

as long as the production function is not too concave, i.e., as long as f_{KK} is not too large in absolute terms. The condition is fulfilled for any Cobb-Douglas production function $f(\theta K_i) = (\theta K_i)^\alpha$ with $\alpha > 0$, for example.

Hence, under mild conditions, an increase in productivity θ will increase capital investment in all affiliates of the parent company p . The implication is that more productive MNCs are also larger and have a higher demand for financial capital.

Appendix 2. Optimal external debt-to-asset ratio

In order to derive the optimal external debt-to-asset ratio of affiliate i , b_i^E , we subtract equation (7) evaluated for affiliate j from equation (7) evaluated for affiliate i . This delivers

$$\begin{aligned}(t_i - t_j)r - \mu(b_i^E - b_j^E) - \mu(b_i^P - b_j^P) - \delta_E(b_i^E - b_j^E) &= 0, \\ (t_i - t_j)r - \frac{\mu(\delta_E + \delta_P) + \delta_E\delta_P}{\delta_P}(b_i^E - b_j^E) &= 0,\end{aligned}$$

where we used $b_i^P = \frac{\delta_E}{\delta_P}b_i^E$ from equation (15) to replace b_i^P . Hence, we find

$$b_j^E = b_i^E - \frac{\delta_P}{\mu(\delta_E + \delta_P) + \delta_E\delta_P} \cdot (t_i - t_j) \cdot r. \quad (29)$$

Next, we define the relative capital share of an affiliate i in total real capital employed by the MNC as $\rho_i = \frac{K_i(\theta)}{\sum_i K_i(\theta)}$ and rearrange the first-order condition (7) to

$$\begin{aligned}\frac{\mu(\delta_P + \delta_E) + \delta_E\delta_P}{\delta_P} \cdot b_i^E &= \mu\bar{b} + t_i \cdot r - \frac{\gamma(\delta_E + \delta_P)}{\delta_P} \cdot b_i^E \cdot \rho_i - \frac{\gamma(\delta_E + \delta_P)}{\delta_P} \sum_{i \neq j} b_j^E \cdot \rho_j \\ &= \mu\bar{b} + t_i \cdot r - \frac{\gamma(\delta_E + \delta_P)}{\delta_P} \cdot b_i^E \cdot \rho_i - \frac{\gamma(\delta_E + \delta_P)}{\delta_P} \sum_{i \neq j} b_i^E \cdot \rho_j \\ &\quad + \frac{\gamma(\delta_E + \delta_P)}{\delta_P} \cdot r \sum_{i \neq j} \frac{(t_i - t_j)\rho_j \cdot \delta_P}{\mu(\delta_E + \delta_P) + \delta_E\delta_P},\end{aligned} \quad (30)$$

where we have used equation (29) to replace b_j^E in the first line.

Utilizing that by definition $\sum_i \rho_i = 1$ so that $\sum_{i \neq j} \rho_j = 1 - \rho_i$, we can further collect terms and rearrange expression (30) to

$$\frac{(\mu + \gamma)(\delta_P + \delta_E) + \delta_E\delta_P}{\delta_P} \cdot b_i^E = \mu\bar{b} + t_i \cdot r + \frac{\gamma(\delta_E + \delta_P)}{\mu(\delta_E + \delta_P) + \delta_E\delta_P} \cdot r \sum_{i \neq j} (t_i - t_j)\rho_j. \quad (31)$$

Division by $\frac{(\mu + \gamma)(\delta_P + \delta_E) + \delta_E\delta_P}{\delta_P}$ and defining $\beta_0 = \frac{\mu\delta_P}{(\mu + \gamma)(\delta_E + \delta_P) + \delta_E\delta_P}\bar{b}$, $\beta_1 = \frac{\delta_P \cdot r}{(\mu + \gamma)(\delta_E + \delta_P) + \delta_E\delta_P}$ and $\beta_2 = \frac{\gamma\delta_P(\delta_E + \delta_P)r}{[\mu(\delta_E + \delta_P) + \delta_E\delta_P][(\mu + \gamma)(\delta_E + \delta_P) + \delta_E\delta_P]}$ according to the main text, delivers the optimal external debt-to-asset ratio (16).

References

- Aggarwal, R., Kyaw, N.A., 2008. Internal capital networks as a source of MNC competitive advantage: Evidence from foreign subsidiary capital structure decisions. *Research in International Business and Finance* 22, 409–439.
- Aggarwal, R., Kyaw, N.A., 2010. Capital structure, dividend policy and multinationality: Theory versus empirical evidence. *International Review of Financial Analysis* 19, 140–150.
- Altshuler, R., Grubert, H., 2003. Repatriation taxes, repatriation strategies and multinational financial policy. *Journal of Public Economics* 87, 73–107.
- Auerbach, A.J., 2002. Taxation and corporate financial policy. In: Auerbach, A.J., Feldstein, M. (Eds.), *Handbook of Public Economics Volume 3*. North-Holland, Amsterdam, pp. 1251–1292.
- van Binsbergen, J.H., Graham, J.R., Yang, J., 2010. The cost of debt. *Journal of Finance* 65, 2089–2136.
- Bjørnstad, S., 2012. Norske statsselskaper krymper skatten i Belgia. *Aftenposten*, August 13, 2012, 22–23.
- Buettner, T., Wamser, G., 2013. Internal debt and multinationals' profit shifting - Empirical evidence from firm-level panel data. *National Tax Journal* 66, 63–95.
- Buettner, T., Overesch, M., Schreiber, U., Wamser, G., 2009. Taxation and capital structure choice – Evidence from a panel of German multinationals. *Economics Letters* 105, 309–311.
- Buettner, T., Overesch, M., Wamser, G., 2011. Tax status and tax response heterogeneity of multinationals' debt finance. *FinanzArchiv* 67, 103–122.
- Chamberlain, G., 1980. Analysis of covariance with qualitative data. *Review of Economic Studies* 47, 225–238.
- Chowdhry, B., Coval, J.D., 1998. Internal financing of multinational subsidiaries: Debt vs. equity. *Journal of Corporate Finance* 4, 87–106.
- Chowdhry, B., Nanda, V., 1994. Financing of multinational subsidiaries: Parent debt vs. external debt. *Journal of Corporate Finance* 1, 259–281.
- Collins, J.H., Shackelford, D., A., 1997. Global organizations and taxes: An analysis of the dividend, interest, royalty, and management fee payments between U.S. multinationals' foreign affiliates. *Journal of Accounting and Economics* 24(10), 151–173.
- DeAngelo, H., Masulis, R.W., 1980. Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics* 8, 3–29.
- Desai, M.A., Foley, C.F., Hines jr., J.R., 2004. A multinational perspective on capital structure choice and internal capital markets. *Journal of Finance* 59, 2451–2487.
- Desai, H.A., Foley, C.F., Hines jr., J.R., 2008. Capital structure with risky foreign investment. *Journal of Financial Economics* 88, 534–553.
- Devereux, M.P., Griffith, R., Klemm, A., 2002. Corporate income tax reforms and international tax competition. *Economic Policy* 35, 451–495.

- Dewaelheyns, N., van Hulle, C., 2010. Internal capital markets and capital structure: Bank versus internal debt. *European Financial Management* 16, 345–373.
- Dischinger, M., Knoll, B., Riedel, N., 2014. There’s no place like home: The profitability gap between headquarters and their foreign subsidiaries. *Journal of Economics and Management Strategy* 23, 369–395.
- Dyreng, S.D., Hanlon, M., Maydew, E.L., 2008. Long-Run Corporate Tax Avoidance. *The Accounting Review* 83, 61–82.
- Egger, P., Eggert, W., Keuschnigg, C., Winner, H., 2010. Corporate taxation, debt financing and foreign plant ownership. *European Economic Review* 54, 96–107.
- Egger, P., Keuschnigg, C., Merlo, V., Wamser, G., 2014. Corporate taxes and internal borrowing within multinational firms, *American Economic Journal: Economic Policy* 6(2), 54–93.
- Egger, P., Wamser, G., 2015. The impact of controlled foreign company legislation on real investments abroad: A two-dimensional regression discontinuity design. *Journal of Public Economics* 129, 77–91.
- Feld, L.P., Heckemeyer, J.H., Overesch, M., 2013. Capital structure choice and company taxation: A meta study. *Journal of Banking and Finance* 37, 2850–2866.
- Frank, M.Z., Goyal, V.K., 2009. Capital structure decisions: Which factors are reliably important? *Financial Management* 38, 1–37.
- Fuest, C., Hemmelgarn, T., 2005. Corporate tax policy, foreign firm ownership, and thin capitalization. *Regional Science and Urban Economics* 35, 508–526.
- Gertner, R.H., Scharfstein, D.S., Stein, J.C., 1994. Internal versus external capital markets. *Quarterly Journal of Economics* 109, 1211–1230.
- Gopalan, R., Nanda, V., Seru, A., 2007. Affiliated firms and financial support: Evidence from Indian business groups. *Journal of Financial Economics* 86, 759–795.
- Graham, J.R., 2000. How big are the tax benefits of debt? *Journal of Finance* 55, 1901–1941.
- Graham, J.R., 2003. Taxes and corporate finance: A review. *Review of Financial Studies* 16, 1075–1129.
- Graham, J.R., Harvey, C.R., 2001. The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics* 60, 187–243.
- Harris, M., Raviv, A., 1991. The theory of capital structure. *Journal of Finance* 46, 297–355.
- Helpman, E., Melitz, M.J., Yeaple S.R., 2004. Export Versus FDI with Heterogeneous Firms. *American Economic Review* 94, 300–316.
- Hovakimian, A., Hovakimian, G., Theranian, H., 2004. Determinants of target capital structure: The case of dual debt and equity issues. *Journal of Financial Economics* 71, 517–540.
- Huizinga, H., Laeven, L., Nicodème, G., 2008. Capital structure and international debt-shifting. *Journal of Financial Economics* 88, 80–118.
- Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance and takeovers. *American Economic Review* 76, 323–329.

- Jensen, M.C., Meckling, W.H., 1976. The theory of the firm: Managerial behavior, agency costs and capital structure. *Journal of Financial Economics* 3, 305–360.
- Jog, V., Tang, J., 2001. Tax reforms, debt shifting and tax revenues: Multinational corporations in Canada. *International Tax and Public Finance* 8, 5–25.
- Johannesen, N., 2014. Tax avoidance with cross-border hybrid instruments. *Journal of Public Economics* 112, 40–52.
- Kesternich, I., Schnitzer, M., 2010. Who is afraid of political risk? Multinational firms and their choice of capital structure. *Journal of International Economics* 82, 208–218.
- Korteweg, A., 2010. The net benefits to leverage. *Journal of Finance* 65, 2137–2170.
- Kraus, A., Litzenberger, R.H., 1973. A state-preference model of optimal financial leverage. *Journal of Finance* 28, 911–922.
- Lipponer, A., 2011. Microdatabase direct investment – MiDi. A brief guide. Unpublished Working Paper. Economic Research Centre, Deutsche Bundesbank, Frankfurt.
- MacKie-Mason, J.K., 1990. Do taxes affect corporate financing decisions? *Journal of Finance* 45, 1471–1493.
- Malherbe, J., 2002. Harmful tax competition and the future of financial centres in the European Union. *Intertax* 30, 219–224.
- Mintz, J.M., Smart, M., 2004. Income shifting, investment, and tax competition: Theory and evidence from provincial taxation in Canada. *Journal of Public Economics* 88, 1149–1168.
- Mintz, J.M., Weichenrieder, A.J., 2010. The Indirect Side of Direct Investment – Multinational Company Finance and Taxation. MIT Press, Cambridge, MA.
- Møen, J., D. Schindler, G. Schjelderup, and J. Tropina. 2011. International debt shifting: Do multinationals shift internal or external debt? CESifo Working Paper Series No. 3519.
- Mundlak, Y., 1978. On the pooling of time series and cross section data. *Econometrica* 46, 69–85.
- Myers, S.C., 1977. The determinants of corporate borrowing. *Journal of Financial Economics* 5, 147–175.
- Myers, S.C., 1993. Still searching for optimal capital structure. *Journal of Applied Corporate Finance* 1, 4–14.
- Myers, S.C., 2001. Capital structure. *Journal of Economic Perspectives* 15, 81–102.
- Park, S., Suh, J., Yeung, B., 2013. Do multinational and domestic corporations differ in their leverage policies? *Journal of Corporate Finance* 20, 115–139.
- Papke, L.E., Wooldridge, J.M., 2008. Panel data methods for fractional response variables with an application to test pass rates. *Journal of Econometrics* 145, 121–133.
- Petersen, M.A., 2009. Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies* 22, 435–480.
- Quaghebeur, M., 2005. Belgium renovates and generalizes coordination center regime. Practical European Tax Strategies. Report on tax planning for international companies operating in Europe 7, 14–19.

- Rajan, R.G., Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. *Journal of Finance* 50, 1421–1460.
- Rego, S.O., 2003. Tax-avoidance activities of U.S. multinational corporations. *Contemporary Accounting Research* 20, 805–833.
- Ruf, M., 2008. How can firms choose their leverage? Tax planning for implementing tax induced debt finance. Unpublished working paper. University of Mannheim (SSRN).
- Ruf, M., Weichenrieder, A.J., 2012. The taxation of passive foreign investment. Lessons from German experience. *Canadian Journal of Economics* 45, 1504–1528.
- Sorbe, S., Johansson, Å, Skeie, Ø, 2017. Debt and tax planning by multinationals. OECD Economics Department Working Papers No. 1357, OECD Publishing, Paris.
- Stonehill, A., Stitzel, T., 1969. Financial structure and multinational corporations. *California Management Review* 12, 91–96.
- Styczen, M.P., 2010. Financial centers in Belgium. A comprehensive case study of multinationals' financial centers in Belgium. Institute for Research in Economics and Business Administration. Working Paper No 31/10.
- Syverson, C., 2011. What determines productivity? *Journal of Economic Literature* 49, 326–365.
- Tomiura, E., 2007. Foreign outsourcing, exporting, and FDI: A productivity comparison at the firm level. *Journal of International Economics* 72, 113–127.
- Wooldridge, J.M., 2002. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge, MA.
- Wooldridge, J.M., 2015. Control function methods in applied econometrics. *Journal of Human Resources* 50, 420–445.

The tax-efficient use of debt in multinational corporations

Appendix intended for online publication

Jarle Møen* Dirk Schindler† Guttorm Schjelderup‡ Georg Wamser§

June 21, 2018

*Department of Finance and Management Science, Norwegian School of Economics: jarle.moen@nhh.no.

†Department of Accounting, Auditing and Law, Norwegian School of Economics: dirk.schindler@nhh.no.

‡Corresponding author. Department of Finance and Management Science, Norwegian School of Economics, Helleveien 30, N-5045 Bergen, Norway. Email: guttorm.schjelderup@nhh.no.

§School of Business and Economics, University of Tübingen: georg.wamser@uni-tuebingen.de.

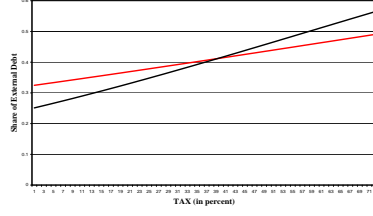
Tax-responsiveness under losses: Graphical illustration

To get an idea about what the coefficient in Table 12 in the paper implies for marginal effects over the range of taxes, we have produced Figure 1. Figure 1 consists of 4 sub-figures. The first two figures (denoted by I) demonstrate how the predicted shares of external debt (left side) and parental debt (right side) vary in the tax rate (measured along the horizontal axis). We allow the tax rate to vary from 1 % to a hypothetical value of 70 %. Each of the graphs includes two lines, one in red color, the other one in black. The red line corresponds to the predicted external- or parental-debt-to-asset ratio for subsidiaries that carry forward a loss ($Loss\ Carryforward_{it} = 1$). The black line corresponds to the predicted external- or parental-debt-to-asset ratio for subsidiaries that report a loss carryforward of zero. The figures show that the tax responsiveness becomes significantly flatter when losses are carried forward (it does not become horizontal, however). This is what we would expect. Even though $Loss\ Carryforward_{it} = 1$ has a positive impact on debt financing, we predict a higher share of external (parental) debt when TAX_{it} exceeds a value of about 38 % (64 %) for subsidiaries that exhibit $Loss\ Carryforward_{it} = 0$. The difference in the predicted share of external debt between affiliates with $Loss\ Carryforward_{it} = 1$ and $Loss\ Carryforward_{it} = 0$ is more than 7 percentage points for $TAX_{it} = 0$. One very interesting finding is that the tax-responsiveness curve is almost linear for external debt. It has, however, a convex shape when parental debt is considered. This (non-) linearity is highlighted in the two figures denoted by II. What we have plotted there is the gradient of the tax-response functions displayed in (I). Both figures emphasize that the marginal tax effect is positive. In case of parental debt, the marginal tax effect is clearly increasing in TAX_{it} .

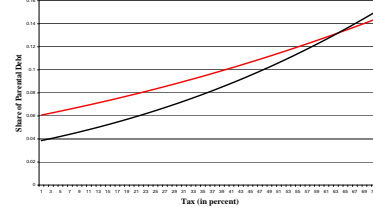
Figure 1: TAX-RESPONSE UNDER LOSSES

I) IMPACT ON THE SHARE OF DEBT FINANCING

(red line: loss carryforward=1; black line: loss carryforward=0)



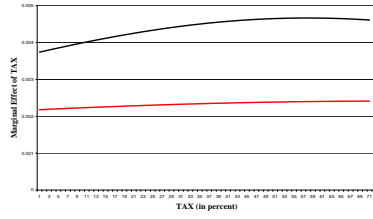
(a) External debt



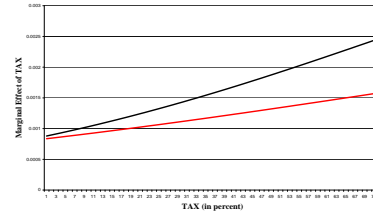
(b) Parental debt

II) MARGINAL TAX EFFECTS

(red line: loss carryforward=1; black line: loss carryforward=0)



(c) External debt



(d) Parental debt

Additional tests and results

Endogeneity of the minimum tax variable

Although we may expect that our estimates on *MINTAX* are unbiased as c_i should capture all time-invariant MNC heterogeneity, it may be that an MNC faces a positive shock in period t that allows the firm to newly set up a tax-haven affiliate in t or afterwards. In such a case, it could be that *MINTAX* is no longer estimated without bias.

In the following, we suggest three tests to find out about whether our estimates are affected by a sample-selection problem as described above. For this, we define the variable S_p . This variable equals 1 if three conditions are met for at least one affiliate within MNC p : First, there is an affiliate i that newly enters our dataset in any period $t > 1999$; second, the new affiliate i becomes the minimum-tax affiliate within MNC p ; third, the new affiliate exhibits some positive lending; otherwise, S_p equals zero. $S_p = 1$ for 650 observations or 126 affiliates.

In Table 1, columns 1 and 2, we account for the potential endogeneity problem by removing all observations where $S_p = 1$ (650 observations). The results are fully robust to the removal of these observations and the estimated APE on *MINTAX* is almost the same, compared to the benchmark estimates above.

The second approach aims at accounting for the selection into setting up a new minimum-tax affiliate by using a control function approach (see Wooldridge, 2015). For this, we define yet another variable \tilde{S}_{pt} , which equals one if $S_p = 1$ and if period t is the period in which the new low-tax entity enters the dataset; or any period after that event. The objective is to capture selection into the sample. We use \tilde{S}_{pt} as dependent variable in a first-stage probit regression and TAX_{it} , $\log Sales_{it}$, $Loss\ Carryforward_{it}$, $Tangibility_{it}$, $Inflation_{it}$, $Corruption_{it}$, and $GDP\ growth_{it}$ as independent variables. We then predict the probability of $Pr(\tilde{S}_{pt} = 1)$, $\hat{\tilde{S}}_{pt}$, and include this probability as an additional regressor in the basic specification for internal debt.

To be specific, columns 3 and 4 in Table 1 include $\hat{\tilde{S}}_{pt}$, columns 5 and 6 include $\hat{\tilde{S}}_{pt}^2$, and $\hat{\tilde{S}}_{pt}^3$. The results are not sensitive to this control function approach, the estimated APEs for *MINTAX* _{it} become slightly more negative.

Preferential tax treatment

Our next test relates to possible preferential tax treatment in Belgium, the Netherlands, Luxembourg and Switzerland. To be precise, we set TAX_{it} (before calculating *MINTAX* _{it} and *WTAX* _{it}) equal to 10% if $LEND_{it} > 0$ & $SALES_{pt} > 240,000,000$ (the latter refers to

Table 1: *ENDOGENEITY OF MINTAX*

Fractional response model estimated by QMLE. Columns denoted by APE present average partial effects as introduced above. Dependent variable is the internal-debt-to-asset ratio of affiliate i at time t . All regressions include aggregate year dummies and affiliate-specific fixed effects using the approach described above. Standard errors (reported in parentheses) are based on panel bootstrapping clustered at the affiliate level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Estimates are based on 194,866 (columns 1 and 2) and 195,516 (columns 3-6) observations. \hat{S}_{pt} (from a first-stage probit regression) included in columns 3 and 4; \hat{S}_{pt} , \hat{S}_{pt}^2 , and \hat{S}_{pt}^3 (from a first-stage probit regression) included in columns 5 and 6. The estimated coefficients (standard errors) on the control functions are 14.790*** (3.949); 28.683* (15.736), -853.840 (1641.186), and 340.114 (54289.530).

	Coeff.	APE	Coeff.	APE	Coeff.	APE
TAX_{it}	.030 (.200)	.005 (.035)	.195 (.204)	.035 (.036)	.272 (.216)	.048 (.038)
$MINTAX_{it}$	-.165*** (.060)	-.029*** (.011)	-.177*** (.057)	-.031*** (.010)	-.180*** (.057)	-.032*** (.010)
$WTAX_{it}$	.039 (.174)	.007 (.031)	.012 (.164)	.002 (.029)	.019 (.165)	.003 (.029)
$\log Sales_{it}$	.027*** (.005)	.005*** (.001)	.038*** (.006)	.007*** (.001)	.043*** (.007)	.008*** (.001)
$Loss\ Carryforward_{it}$	.094*** (.007)	.017*** (.001)	.100*** (.008)	.018*** (.001)	.104*** (.009)	.018*** (.002)
$Tangibility_{it}$	.001 (.034)	.0002 (.006)	.025 (.028)	.004 (.005)	.037 (.030)	.007 (.005)
$Inflation_{it}$	.002* (.001)	.0003* (.0002)	.002** (.001)	.0004** (.0002)	.003*** (.001)	.001*** (.0002)
$Corruption_{it}$	-.001 (.001)	-.0002 (.0001)	-.001* (.001)	-.0002* (.0001)	-.001* (.001)	-.0002* (.0001)
$GDP\ growth_{it}$	-.0004 (.001)	-.0001 (.0002)	-.002 (.002)	-.0004 (.0003)	-.003* (.002)	-.001* (.0003)

total sales at the MNC level).¹ While the change applies only to 3,202 single observations, the adjustment will affect more than these 3,200 affiliates through new incentives in *MINTAX* and *WTAX*. The results are available upon request.

The findings for external debt are fully unaffected by this adjustment, so are the regressions for parental debt. In case of internal debt we can confirm the negative impact of *MINTAX_{it}*. However, we now find a weakly significant positive impact of *WTAX_{it}*. This might suggest that – for this specific sample and tax adjustment – the relative position within a firm’s tax- and assets-distribution determines the allocation of internal debt. But we can not rule out the possibility that tax incentives are misspecified when making the preferential tax adjustment.²

Focus on wholly-owned subsidiaries

Let us briefly discuss some additional tests on the robustness of our results. While these are not reported here, they are available upon request. The first test focuses on wholly- or 100%-held subsidiaries. This implies a loss of about 33,300 observations. Previous work has argued that many minority shareholders involved in firm decisions give rise to conflicts of interest. In particular, different shareholders may have different goals with respect to profit shifting or financial choices in general. When focussing on wholly-owned foreign subsidiaries and excluding all observations with an ownership share smaller than 100%, we confirm the basic pattern found in Tables 6 and 7. Most importantly, we can show that *WTAX_{it}* determines external debt, that parental debt is mainly driven by *TAX_{it}*, and that *MINTAX_{it}* is the relevant tax incentive when internal debt financing is examined.

Focus on MNCs that hold affiliates in OECD countries only

The last test focusses on MNCs whose operations are exclusively within OECD member countries. To be precise, once we observe that an MNC has established an investment in a country outside the OECD, we drop this firm from our sample. Of course, this results in a significant loss of 133,717 observations (or almost 70% of the basic sample). When analyzing this sub-sample, the most interesting finding is that the minimum tax is no longer significant, irrespective of the type of debt we are examining. Particularly the finding that *MINTAX_{it}* becomes insignificant in case of internal debt suggests that profit shifting usually involves a

¹Using this threshold is motivated by the definition of a coordination center in Belgium (see Quaghebeur, 2005). We also require that the affiliate is operating in the financial services sector.

²In fact, the latter is very likely as the total number of coordination centers in Belgium is about 400 (see Styczen, 2010). Most of these firms are non-German, so only very few of the 571 affiliates we observe in our data in Belgium will actually benefit from preferential tax treatment. Note that our confidential dataset does not allow us to identify single MNCs which are known to operate coordination centers in Belgium.

low-tax or tax-haven location and it happens mainly outside the OECD. This is in line with the finding that CFC rules in case of debt shifting are not binding, on average (see above). The insignificance of $MINTAX_{it}$ in case of external debt is in line with the argument that external debt substitutes for internal debt if there is no access to a low-tax or tax-haven entity within the group. Given that all such entities are excluded in our OECD sample, this result is very reassuring with respect to the understanding of the $MINTAX_{it}$ mechanism.