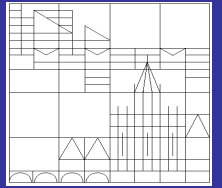




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Debt Shifting and Ownership Structure*

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Abstract

Previous theoretical studies on the debt shifting behavior of multinationals have assumed affiliates of multinationals to be wholly owned. We develop a model that allows a multinational firm to determine both the leverage and ownership structure in affiliates endogenously. A main finding is that affiliates with minority owners have less debt than wholly owned affiliates and therefore a less tax-efficient financing structure. This is due to an externality that arises endogenously in our model, where costs and benefits of debt shifting are shared asymmetrically between minority and majority owners. Our findings provide a theory framework for recent empirical findings.

Keywords: Multinationals, tax-efficient financing structures, minority ownership

JEL classification: H25, F23

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1 Introduction

It is well known that multinationals can use internal debt to save tax payments by utilizing differences in national tax rates.¹ The mechanism at play under debt shifting is that interest income is earned in low-tax countries and deducted in high-tax countries so that the tax savings arising from the deductions in high-tax countries exceed the corresponding tax payments in low-tax countries. Previous literature has studied debt shifting when affiliates of multinationals are wholly owned.² Multinationals, however, often have the option to own 100%, the majority, or to be in a minority position in (newly created) foreign entities. Empirical evidence shows that all three combinations of ownership structures are selected,³ and there is therefore a need for a theory that can explain how different ownership structures affect tax-efficient financing structures in multinationals.

This paper presents a theory model that determines jointly the ownership structure and financing structure in affiliates of multinational firms. We show that affiliates of multinationals with minority owners have less internal debt and a different financing structure than do affiliates of multinationals that are wholly owned. The intuition is that (local) minority owners benefit from a classical free-riding externality related to the use of internal debt. Minority owners benefit in full from tax planning strategies involving internal debt, but they do not fully share the related financing costs. This is so because the tax savings in borrowing affiliates benefit minority owners in proportion to their equity share. However, the corresponding lending transactions give rise to interest revenues and tax payments in the multinational's financial center where minority owners who benefit from the tax deductions do not hold equity. Minority owners do not hold equity in lending affiliates because it is not profitable for them to do so. It is this asymmetric sharing of costs and benefits between minority and majority owners, which arises endogenously in our model, that leads to the externality. This result, which has not been shown before, provides a theoretical explanation for recent empirical findings where affiliates with minority owners have been shown to have a less tax sensitive debt-to-asset ratio than wholly owned affiliates (see section 2).

In a second step of the analysis, we use the result that affiliates with minority owners use less internal debt to show that the effective rental rate of capital is higher in such affiliates. All else equal, this makes it less attractive to share equity. We also show that an optimal financing structure (independently of ownership shares) implies that affiliates

¹Empirical studies on European and U.S. data have documented that multinationals structure their leverage so as to minimize tax payments globally. See Barion et al. (2010), Egger et al. (2010), Büttner et al. (2009), Mintz and Weichenrieder (2005), and Desai et al. (2004a).

²See e.g., Mintz (2004) and Mintz and Smart (2004). A survey of the literature is provided by Mintz and Weichenrieder (2010).

³For evidence on ownership structure in the U.S. see Desai et al. (2004b), and for German multinationals see Mintz and Weichenrieder (2005).

of multinationals have higher internal and overall debt ratios as well as lower effective rental rates of physical capital than comparable domestic firms, and that they have a more capital-intensive production structure.

Our results emerge from a model where a headquarters of a multinational firm decides both on ownership and financing structure of its affiliates. The headquarters, in its decision making about whether or not to share equity, balances costs and gains from sharing equity.⁴ The benefits of forming a joint venture are related to fundamentals such as cost reductions (or increased productivity), whilst the costs pertain to the coordination of worldwide debt shifting activities.

The rest of the paper is organized as follows. Section 2 surveys some of the related literature. Section 3 describes the basic framework and discusses the basis for cooperation and the use of debt. Section 4 derives the optimal financing and investment choices for the multinational firm, while section 5 derives optimal ownership shares. Section 6 provides a discussion of our findings, and section 7 offers some concluding remarks.

2 Related literature

Our main finding that affiliates of multinationals with minority owners have less internal debt and are less tax sensitive has been documented in several studies. Büttner and Wamser (2007) use the German MiDi (Bundesbank) data base and find that minority ownership exerts a negative (level) effect on the use of internal debt. In particular, they find that the leverage ratio of internal debt is 5 (respectively 2) percentage points higher in wholly owned (respectively partially-owned) subsidiaries compared to non-majority owned ones (Büttner and Wamser, 2007, p. 22). With respect to the tax sensitivity of internal debt, Hebous and Weichenrieder (2010) find that a 10% increase in the corporate tax rate in emerging markets increases the ratio of debt-to-assets of wholly owned affiliates of multinationals by 27 percentage points. In contrast, they cannot find any evidence of debt shifting for partially owned affiliates. Such marked differences in behavior between partially and wholly owned affiliates are also obtained by Weichenrieder (2009), Büttner and Wamser (2007), Mintz and Weichenrieder (2005), and Desai et al. (2004b) studying affiliates of German and U.S. multinationals.

Desai et al. (2004b) analyze the determinants of partial ownership of the foreign affiliates of U.S. multinationals and in particular the marked decline in the use of joint ventures over a 20-year period. Their analysis is empirical and suggests that there is an increased appetite for control by multinational parents. They attribute this to three

⁴Our modeling approach relates to the literature on costs and benefits of co-ownership. See Williamson (1975), Holmstrom (1982), Svejnar and Smith (1984), Grossman and Hart (1986), Gomes-Casseres (1989), and Ramachandran (1993). However, we neglect costs and benefits of asymmetric information related to time-consistent taxation as in Konrad and Lommerud (2001).

different types of coordination costs. First, costly conflicts may arise between minority owners and multinational enterprises, since multinationals have an incentive to shift profits away from affiliates with minority owners. Second, multinationals run the risk of having their technology appropriated by local partners. Finally, multinationals have a desire to structure production worldwide and this desire holds the potential for conflict with minority owners. Our analysis is related to Desai et al. (2004b) in that we show there is a fourth cost element at play namely a fiscal externality related to minority ownership and debt shifting that makes it more attractive to wholly own affiliates.⁵

Our analysis is also linked to the transfer pricing literature and the corporate governance literature, where a major concern has been that majority owners would exploit minority owners. For example, in the transfer pricing literature it has been shown that minority ownership gives the headquarters of a multinational firm incentives to shift income away from minority owners by mispricing intra-firm transactions (Kant, 1988, 1990; Bertrand et al., 2002). The reason is that minority ownership works like a profit tax in the sense that the multinational keeps only a fraction of the affiliate's income. The transfer pricing literature, therefore, finds that minority ownership aggravates the incentives for trade mispricing and leads to more tax evasion.⁶ In a similar fashion, one would expect that minority ownership should increase tax planning by debt. Our result, however, is the opposite. Minority ownership leads to less tax planning, since the multinational firm dampens the externality from joint ownership by shifting less debt. The economic reasoning, however, is the same as in the transfer pricing literature. In both cases the multinational firm would like to avoid sharing profit income with minority owners.

Debt shifting in wholly owned affiliates of multinationals is investigated by Mintz and Smart (2004). They study corporate income taxation when firms operating in multiple jurisdictions can shift income by lending among affiliates, and show that debt shifting affects real investment, government income, and tax base elasticities. They test their model on Canadian data finding support for the hypothesis that this type of income shifting has pronounced effects on provincial tax bases. Related to this study is Mintz (2004), who investigates how a multinational parent can use conduit companies to create a chain of companies for the purpose of shifting funds and claiming deduction of interest at least twice.⁷

More recently, Barion et al. (2010) use a dynamic trade-off model that describes a multinational's financing strategies in wholly owned affiliates and test their model on

⁵As pointed out by one of our referees, a possible fifth explanation for the appetite of control may be that parent firms (in the case of co-owners) do not want to inject internal debt that acts like equity, but grants no voting rights.

⁶Manipulation of transfer prices for the purpose of shifting profit income is according to most OECD countries' legislation an illegal activity (tax evasion).

⁷See also Mintz and Weichenrieder (2010) for a more elaborate model of holding companies and ownership chains. Less related but in the same vein are Fuest and Hemmelgarn (2005) who study profit shifting through thin capitalization in a setting of tax competition.

European data. A main finding is that subsidiaries' leverage increases with the statutory tax rate in the host country, but that this effect is dampened the higher the tax rate in the country where the parent firm is located. In the same vein, Weichenrieder (2009) uses a model where affiliates may share equity and shift profit by transfer pricing. Using German data on inbound and outbound FDI, he finds a strong empirical correlation between the home country tax rate of the parent and the net profitability of its German affiliate that is consistent with profit shifting behavior.

3 The Model

We consider a multinational firm (henceforth MNC) where the headquarters (henceforth HQ) decides on the leverage structure and investments in n countries. When investing, the HQ must decide whether or not to let some or all of its affiliates share equity. Minority owners may be local investors, local firms or another multinational firm.

In general, partial ownership may be exogenously or endogenously determined. An example of the former is legal requirements where a country requires a certain local ownership stake as is the case in China.⁸ Endogenous minority ownership depends on the costs and benefits of cooperation between a local firm and the MNC. The gains from forming a joint venture may be related to the fact that local firms have more experience in their local markets (familiarity with local customs, network connections etc.), whilst MNCs may have an edge in terms of industry-specific skills developed in their worldwide operations. As a whole, benefits from minority ownership may be in the form of a cost saving and/or as a rise in productivity or sales relative to a wholly owned operation.⁹

We shall assume that the basis for cooperation is cost savings, but we show in an appendix that allowing the benefits of cooperation to be productivity enhancing does not affect our results qualitatively. We model cost savings by assuming that there are market entry costs C_i^M in market i that are decreasing in minority ownership J_i in the following way:

$$C_i^M = C_i^M(J_i) > 0, \quad \text{where} \quad \frac{\partial C_i^M}{\partial J_i} < 0, \quad \text{and} \quad \frac{\partial^2 C_i^M}{\partial J_i^2} > 0.$$

In each affiliate, the MNC employs K_i units of capital and L_i units of labor in order to produce $F(K_i, L_i)$ units of an homogenous output good whose price is normalized to one. The production function $F(K_i, L_i)$ exhibits positive and decreasing returns to each input, i.e., $F_a > 0$ and $F_{aa} < 0$ for $a \in \{K_i, L_i\}$. Capital is assumed to be perfectly mobile and the rental cost of capital per unit is $r > 0$ and is assumed to be fixed (i.e., the usual

⁸See Kant (1995) for a discussion of exogenous ownership requirements.

⁹Note that a joint venture may differ from a M&A. A joint venture has a local partner whereas an acquired firm is a foreign firm. This may affect how local firms and customers act towards the firm. It may also be the case that a M&A may affect goodwill and political support by the hosting government to a different degree than if the firm is a joint venture.

small country assumption). A fixed interest rate means that we do not model market imperfections such as weak creditor rights or shallow capital markets. Our focus here is on how tax incentives affect capital structure in joint ventures when capital markets are well functioning.

The firm finances its investments in country i by equity E_i or debt D_i . In setting up affiliate i as a joint venture, equity is shared with minority owners, i.e., the MNC injects $(1 - J_i) \cdot E_i$ units of equity and minority shareholders contribute $J_i \cdot E_i$ units. Debt can be classified as external debt (D_i^E) or internal debt (D_i^I), where internal debt is obtained by borrowing from related affiliates. We define K_i as the total capital employed by affiliate i , and let $\alpha_i = D_i^E/K_i$ be the external debt to capital ratio, and $\sigma_i = D_i^I/K_i$ the internal debt to capital ratio. The overall leverage ratio of the firm can be expressed as $b_i = \alpha_i + \sigma_i = (D_i^E + D_i^I)/K_i$. Within the MNC, it must be the case that the sum of interest payments on internal borrowing and lending is zero across all affiliates, that is,

$$\sum_i r \cdot D_i^I = \sum_i \sigma_i \cdot r \cdot K_i = 0.$$

We follow most of the literature on debt structure by assuming that there are costs per unit capital associated with borrowing that are given by the function $C = C(\alpha_i, \sigma_i)$.¹⁰ For internal debt, these costs may be due to the use of lawyers and accountants in order to avoid that such transactions are restricted by thin capitalization or controlled foreign company rules (often referred to as CFC rules).¹¹ For external debt these costs may pertain to informational asymmetries between investors and managers of the firm. As is common in the literature, we assume that there is an optimal leverage ratio $\bar{\alpha}_i$ for external debt in the absence of taxes (see, e.g., Hovakimian et al., 2004, and Fuest and Hemmelgarn, 2005). The reason is that external debt is useful in order to discipline local managers from lax management and “empire-building” strategies. However, if the leverage ratio goes up, the risk of bankruptcy increases and may cause bankruptcy costs, or induce a debt-overhang problem that cause local managers to miss good investment opportunities.¹² Starting from a leverage ratio $\alpha_i < \bar{\alpha}_i$, a rise in external debt will therefore decrease debt costs, whereas the opposite is the case if $\alpha_i \geq \bar{\alpha}_i$.

It follows from the discussion above that the costs and benefits of internal and external debt are very different. Internal debt does not restrict the free cash flow of the firm, nor does it affect the risk of bankruptcy. Neither can the firm benefit from the monitoring by external creditors. As a consequence, internal debt does not tie the hands of managers,

¹⁰See for example Mintz and Smart (2004) and Fuest and Hemmelgarn (2005).

¹¹For a recent survey on US rules see Haufler and Runkel (2008); and Weichenrieder and Windischbauer (2008) on the German tax code. Gouthière (2005) and Dourado and de la Feria (2008) describe thin capitalization rules for most OECD and EU countries.

¹²Note that external debt costs can also be affected by an increase in the interest rate, which is driven by an increasing leverage ratio. We omit this in our analysis, but it can be shown that taking such effects into account does not affect our main results.

nor does it reduce any informational asymmetry. Therefore, internal debt should rather be seen as tax-favored equity.¹³

In our model, we embed taxation as well as costs of financial distress and bankruptcy, but, otherwise, the capital market is assumed to be perfect. This assumption in combination with our reasoning above leads to that the cost function is additively separable in external and internal debt, that is $C(\alpha_i, \sigma_i) = C_\alpha(\alpha_i) + C_\sigma(\sigma_i)$.¹⁴ We also assume that the cost function is separable across countries. For internal debt this is not a strong assumption, since thin capitalization rules varies across countries and do not interact. For external debt, separability of the cost function across affiliates is invoked in order to ease exposition, and our main results do not rely on this assumption.¹⁵

In the analysis, we assume that the cost function is convex in α and in σ . The convexity related to internal debt (σ) is due to the fact that additional effort needs to be made to conceal the true nature of the transaction from the tax authorities, whilst the convexity for external debt (α) can be associated with a higher premium due to informational asymmetries. Formally, the properties applied to the cost function can be summarized as

Assumption 1 *External credit markets are assumed to be perfect except for the debt tax shield and financial distress costs. The cost function related to borrowing external and internal debt in affiliate i is additively separable, $C(\alpha_i, \sigma_i) = C_\alpha(\alpha_i) + C_\sigma(\sigma_i)$, and exhibits*

$$\begin{array}{ll}
C_\alpha(\alpha_i) > 0 & \text{with} \\
C_\sigma(\sigma_i) > 0 & \text{with} \\
C_\alpha(\alpha_i) > 0 & \text{with} \\
C_\sigma(\sigma_i) = 0 & \text{with}
\end{array}
\quad
\begin{array}{ll}
C'_\alpha(\alpha_i) > 0, & C''_\alpha(\alpha_i) > 0, & \text{if } \alpha_i \geq \bar{\alpha}_i, \\
C'_\alpha(\alpha_i) < 0, & C''_\alpha(\alpha_i) > 0, & \text{if } \alpha_i < \bar{\alpha}_i, \\
C'_\sigma(\sigma_i) > 0, & C''_\sigma(\sigma_i) > 0, & \text{if } \sigma_i > 0, \\
C'_\sigma(\sigma_i) = 0, & C''_\sigma(\sigma_i) = 0, & \text{if } \sigma_i \leq 0.
\end{array}$$

It follows from Assumption 1 that there are no costs associated with tax engineering in the affiliate that conducts internal lending.

4 Optimal Investments

Since MNCs are either owned by many institutional investors, or by shareholders located in different countries, we assume that the HQ maximizes the value of the MNC after

¹³Gertner et al. (1994) show that internal debt does not display the same properties as external debt and that internal debt should be seen as equity. In line with this, Chowdhry and Coval (1998) p. 87f, and Stonehill and Stitzel (1969) argue that internal debt can be interpreted as tax-favored equity.

¹⁴Desai et al (2004a) make the point that separability between internal and external debt does not hold if capital markets are shallow and underdeveloped.

¹⁵An appendix is obtainable upon request from the authors that shows this.

corporate taxes, neglecting any effect that personal taxes may have.¹⁶ For the MNC to structure its production and financing decisions in the most efficient manner, it must be the case that the HQ controls all the affiliates it includes in its maximization problem. This amounts to assuming that if affiliate i is a joint venture, the sum of minority shares in affiliate i , that is J_i , is less than fifty percent ($J_i < 50\% \forall i$).¹⁷ The ownership share in each affiliate is still endogenously given by the cost and gains from having minority owners, but subject to this condition. Worldwide profits of the MNC are given by

$$\Pi = \sum_{i=1}^n (1 - J_i) (\pi_i - t_i \pi_i^t), \quad (1)$$

where π_i is economic profit in subsidiary i , π_i^t is taxable profit, and t_i is the corporate tax rate in country i . Many countries as well as the European Union use the tax-exemption principle whereby repatriated dividends to a parent firm are exempted from home taxation. We shall also assume that the tax-exemption principle applies in our model.¹⁸

The profit equation (1) relies on linear profit sharing rules. An alternative to minority ownership would be to use contractual channels for transferring the capabilities of each firm. Both the MNC and the local firm contribute capabilities to the cooperative joint venture and we shall assume that it is more costly to transfer these capabilities through contracts than through shared equity.¹⁹ One reason for this can be that it is impossible to write contracts that cover all contingencies that the cooperation must take into account (see Gomes-Casseres, 1989).

True economic profit is given by revenue from the sale of an output good minus labor costs, the user costs of capital and market entry costs,

$$\pi_i = F(K_i, L_i) - w_i \cdot L_i - [r + C_\alpha(\alpha_i) + C_\sigma(\sigma_i)] \cdot K_i - C_i^M(J_i),$$

where w_i is the wage rate. Taxable profit differs from true economic profit in that only labor expenses, borrowing costs and market entry costs are tax deductible. In line with most countries' tax code, we shall assume that the user costs of equity E_i are not tax

¹⁶From the viewpoint of a shareholder in a MNC, 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, may yield identical results. This will happen if the personal tax rate on dividends, capital gains and interest income is the same (see Miller, 1977). Note also that many shareholders in MNCs are institutional investors who are not liable to personal taxation.

¹⁷The same argument is used by Kant (1990) and Konrad and Lommerud (2001). This exogenous restriction does not affect the analysis to come, but it implements the OECD- and IMF-definitions of a MNC, see Navaretti and Venables (2004, ch. 1.1).

¹⁸The use of the exemption principle implies that we do not need to consider where the HQ is located. The tax exemption principle is given by the Parent-Subsidiary Directive in the European Union. Altshuler and Grubert (2003) study the effects of repatriation taxes and the strategies used to avoid them using US data.

¹⁹There is a large literature that discusses when contractual channels are likely to be costlier. This literature is surveyed in Lax and Sebenius (1986).

deductible, which means that we can write taxable profit as

$$\pi_i^t = F(K_i, L_i) - w_i \cdot L_i - r \cdot (D_i^E + D_i^I) - [C_\alpha(\alpha_i) + C_\sigma(\sigma_i)] \cdot K_i - C_i^M(J_i).$$

In defining taxable profit, we have assumed that costs per unit of capital associated with both external and internal borrowing are tax deductible. Such costs may in part be associated with informational asymmetries between investors and managers or with acts in violations of the tax code, and it could be argued that such costs should not be tax deductible. It is straightforward to show by examination of the equations to follow that the inclusion of these as tax deductible does not affect our results. Rearranging the expression for taxable profit, we obtain

$$\pi_i^t = F(K_i, L_i) - w_i \cdot L_i - [r \cdot (\alpha_i + \sigma_i) + C_\alpha(\alpha_i) + C_\sigma(\sigma_i)] \cdot K_i - C_i^M(J_i),$$

where capital invested in country i is financed either by debt $D_i = D_i^I + D_i^E$ or by equity E_i ,

$$K_i = D_i^I + D_i^E + E_i.$$

In the next subsections, the objective is to characterize the optimal financial structure and production decision of the MNC. Our focal point, however, will be on how the MNC can legally save tax payments through tax planning and the use of an internal banking system (financial center). We start by considering the profit maximizing financial structure and then proceed by examining optimal supply of the final good.

4.1 Profit maximizing financial structure

The maximization procedure of the firm can be seen as a two-tier process where the financial structure is first optimized and then, in a second step, the firm decides on how much of the final good to produce in each country. Taking real investment K_i (as well as labor demand L_i and minority ownership share J_i) as fixed initially, the firm's optimal financial structure is found by maximizing equation (1). Inserting for π_i and π_i^t and collecting terms, the maximization problem is given by

$$\begin{aligned} \max_{\alpha_i, \sigma_i} \sum_i (1 - J_i) \cdot \{ & (1 - t_i) \cdot [F(K_i, L_i) - w_i \cdot L_i - C_i^M(J_i)] \\ & - K_i [r(1 - t_i \cdot [\alpha_i + \sigma_i]) + (1 - t_i) \cdot (C_\alpha(\alpha_i) + C_\sigma(\sigma_i))] \} \\ \text{s.t. } \sum_i \sigma_i \cdot r \cdot K_i & = 0 \end{aligned} \quad (2)$$

It is seen from equation (2) that minority ownership in country i reduces the MNC's share of profit income in country i , but it also increases profit income in country i due

to the cost reducing effect of $C_i^M(J_i)$. It does not, however, affect the constraint that all interest payments between affiliates must sum up to zero.

The first order conditions to the maximization problem above lead to

$$C'_\alpha(\alpha_i) = \frac{t_i}{1-t_i} \cdot r > 0, \quad \forall i, \quad (3)$$

$$C'_\sigma(\sigma_i) = \frac{[(1-J_i)t_i - \lambda] \cdot r}{(1-J_i)(1-t_i)} \geq 0, \quad \forall i, \quad (4)$$

where λ is the Lagrangian multiplier to the maximization problem in equation (2).

The first order conditions (3) and (4) state that the firm uses both types of debt until the marginal costs associated with each type of debt are equal to the respective marginal tax savings. The effect of taxation is to reduce the cost of external borrowing as is evident from equation (3). Due to the external debt tax shield, all affiliates have a tax-induced optimal leverage ratio of α^* , which is higher than the optimal external debt ratio in the absence of taxation defined as $\bar{\alpha}$ (so $\alpha^* > \bar{\alpha}$). Equation (3) also makes clear that the financial center and all other affiliates are optimally endowed with external debt.

With respect to internal debt, the Lagrangian multiplier λ gives the shadow price of shifted interest expenses, and therefore, allows us to derive which affiliate should conduct lending operations. In particular, we have:

Lemma 1 *Defining country 1 as the country with the lowest effective tax rate, a tax-efficient financing structure implies*

$$\lambda = \min_i t_i^e \equiv \min_i [(1-J_i) \cdot t_i] = (1-J_1)t_1 \equiv t_1^e.$$

Proof. See Appendix A ■

Lemma 1 states that the MNC maximizes its profit income by using the affiliate located in country 1 as a basis for its lending operations. We shall in the continuation refer to this affiliate interchangeably as the financial center or firm 1. Since firm 1 has the lowest effective tax rate, it is the most attractive place to earn interest income.²⁰ For financing its operations, the financial center borrows external debt (D_1^E) according to equation (3), and is endowed with the optimal amount of equity E_1 from its HQ. In return, the HQ reduces its equity E_i in all affiliates $i > 1$, and concentrates it in the financial center so that all internal lending is conducted from it. By doing so, the HQ maximizes the net tax savings from debt shifting, that is, the difference between the values of the interest tax deductions and the corresponding tax obligation in the lending affiliate. The latter is a cost element that is minimized by conducting lending from the

²⁰This affiliate could be interpreted as a financial center with preferential tax treatment. However, none of our results depend on the existence of a preferential tax regime, or the existence of a pure financial center.

affiliate in the country with the lowest effective rate of tax. It follows from this that it is the borrowing affiliates that benefit from debt shifting, since the interest deductions increase their after-tax income. As a consequence, the gain from debt shifting accrues only in the borrowing affiliates.

It should be pointed out that the lending activities in the financial center are running an economic loss ($\pi_1 - t\pi_1^t < 0$), since the equity cost is not tax deductible whilst interest income is taxed. Based on accounting values, however, the low-tax affiliate is running a book surplus ($\pi_1^t > 0$), since the return to equity is not deducted as a cost. The loss in the affiliate in country 1 from internal lending equals $-E_1^I \cdot t_1 r$, which is the opportunity cost of equity multiplied by the tax rate.²¹ However, borrowing affiliates can deduct the interest cost of internal debt against a higher tax rate than the tax rate in country 1. For the MNC as a whole, then, the loss by the lending affiliate in country 1 is more than offset by tax savings in borrowing affiliates.

The financial center could have had a surplus if we had allowed the MNC to shift profit by interest rate differentials. We have deliberately not embedded transfer pricing into the model in order to focus purely on tax planning and leverage decisions, but it can be shown that including transfer pricing in our model does not affect the incentives to avoid taxes through the use of debt.²²

In order to see how tax policy affects debt structure, we find by implicit differentiation for all $i = 2, \dots, n$ that

$$\frac{d\alpha_i}{dt_i} = \frac{r}{(1-t_i)^2 \cdot C''_\alpha(\alpha_i)} > 0, \quad (5)$$

$$\frac{d\sigma_i}{dt_i} = \frac{(1-J_i) \cdot (1-t_i) + [(1-J_i) \cdot t_i - t_1^e]}{(1-J_i) \cdot (1-t_i)^2 \cdot C''_\sigma(\sigma_i)} \cdot r > 0, \quad (6)$$

$$\frac{d\sigma_i}{dt_1^e} = -\frac{r}{(1-J_i) \cdot (1-t_i) \cdot C''_\sigma(\sigma_i)} < 0, \quad (7)$$

where $(1-J_i) \cdot t_i - t_1^e > 0$ due to Lemma 1.

As seen from (5) and (6), an increase in the domestic tax rate t_i increases marginal tax savings from tax-deductible debt in country i and leads the firm to increase its leverage ratio of both types of debt (i.e., higher α_i and σ_i). In contrast, an increase in the effective tax rate of the low-tax country (t_1^e) makes tax avoidance through internal debt more expensive because the shifted interest payments now bear a higher tax burden in the financial center. Consequently, the use of internal debt decreases in all affiliates as shown in equation (7).²³ It follows from conditions (5) to (7), then, that affiliates in high-tax

²¹Omitting sales and leverage costs (C_α) in the financial center for the purpose of showing this, economic profit from lending \mathcal{L} by the financial center is $\pi_1 - t_1\pi_1^t = [\mathcal{L}_1 r - r(D_1^E + E_1^I)] - t_1[r\mathcal{L}_1 - rD_1^E]$, where lending is refinanced by external debt or equity, $\mathcal{L}_1 = D_1^E + E_1^I$. Simplifying this expression yields $\pi_1 - t_1\pi_1^t = -E_1^I \cdot t_1 r$.

²²See Schindler and Schjelderup (2011).

²³Note that the effective tax rate t_1^e does not affect external debt as long as external and internal debt

jurisdictions have higher internal debt ratios than affiliates in low-tax jurisdictions.

If we compare affiliates of MNCs to purely domestic firms, the latter cannot engage in cross country tax planning. As a consequence, their internal debt ratios are zero. Therefore, affiliates of MNCs with tax-efficient financial structures have higher overall debt ratios than domestic firms in the same industry, since external debt ratios are the same for all firms within the same country as long as Assumption 1 holds.

Turning to the central issue of how minority ownership affects the leverage structure and thus the extent of tax planning, we may state:

$$\frac{d\sigma_i}{dJ_i} = -\frac{t_1^e \cdot r}{C''_\sigma(\sigma_i) \cdot (1 - J_i)^2 \cdot (1 - t_i)} < 0, \quad i > 1. \quad (8)$$

Equation (8) shows that minority ownership dampens the incentive to use internal debt as a tax minimizing strategy. As explained after Lemma 1, the gains from the debt tax shield occur in the borrowing affiliates $i > 1$, and benefit all owners according to their ownership stake. However, minority owners in these affiliates do not take part in paying any of the tax obligations that arise from the funding activities of the financial center.²⁴ Hence, the MNC bears the full financing costs, but cannot internalize the full gain from the debt tax shield in the borrowing affiliates. This gives rise to a classic externality where minority ownership dampens the incentives to use debt in affiliates with minority owners. Our theoretical result is in line with Büttner and Wamser (2007), who find empirical evidence for that the level of internal debt decreases with minority ownership (see section 2). If the effective tax rate in the financial center is zero ($t_1^e = 0$) there are no tax payments on shifted interest income, and, therefore, the externality is eliminated as seen from equation (8), $d\sigma_i/dJ_i = 0$.

Equation (8) should be contrasted with equation (7), which shows that if the minority ownership rate rises in the low-tax affiliate (i.e., the financial center), tax planning by debt goes up in all borrowing affiliates. The reason is that the loss incurred by the financial center is then to a larger extent borne by its minority owners making it less costly to fund tax planning by debt.

The effect of minority ownership on the tax-sensitivity of internal debt can be found by differentiating the comparative-static effect (6) for minority ownership:

$$\frac{\partial \left(\frac{d\sigma_i}{dt_i} \right)}{\partial J_i} = -\frac{t_1^e \cdot r}{C''_\sigma(\sigma_i) \cdot (1 - J_i)^2 \cdot (1 - t_i)^2} < 0, \quad i > 1. \quad (9)$$

are separable in the debt cost function (see Assumption 1).

²⁴In fact, as we show later, the financial center will be wholly owned by the MNC. The reason is that it is running a deficit so there are no gains to minority owners from holding a stake in this affiliate. Note that if the MNC had also engaged in transfer pricing, allowing minority owners to hold a stake in the financial center would not be optimal from the MNCs perspective, since it would reduce the gains from transfer pricing to the MNC.

Equation (9) shows that the larger is the minority ownership rate J_i , the smaller is the tax sensitivity of internal debt to a change in the host country tax rate. The intuition is again the presence of the externality from asymmetric sharing of benefits and costs, as pointed out above. Although this result has not been shown theoretically before, it has been verified empirically by Hebus and Weichenrieder (2010), Büttner and Wamser (2007), Mintz and Weichenrieder (2005), and Desai et al. (2004b) (see also section 2).²⁵

It is worthwhile to point out that the results in equations (8) and (9) show that minority ownership curbs tax planning by debt. This result differs from the main findings in the transfer pricing literature, where a main insight is that minority ownership induces the majority owner to shift income by transfer prices away from the affiliate with minority owners. Therefore, minority ownership aggravates transfer pricing and tax evasion (see Kant, 1988, 1990). Our result, however, is the opposite. Minority ownership leads to less tax planning, since the multinational firm dampens the externality from joint ownership by shifting less debt. The economic reasoning, however, is the same as in the transfer pricing literature. In both cases the multinational firm would like to avoid sharing profit income with minority owners.

The optimal internal debt ratio can be deduced by inverting the first order condition (4),

$$\sigma_i^* = C'_\sigma{}^{-1} \left(\left[\frac{t_i}{1-t_i} - \frac{t_1^e}{(1-J_i) \cdot (1-t_i)} \right] \cdot r \right), \quad (10)$$

and the net gain of tax planning per unit capital invested in country i can be written as

$$\psi_i(t_i, t_1^e, J_i) = \left(t_i - \frac{t_1^e}{1-J_i} \right) \cdot r \cdot \sigma_i^* - (1-t_i) \cdot C_\sigma(\sigma_i^*). \quad (11)$$

For $t_i > t_1^e / (1 - J_i)$ we have $\sigma_i^* > 0$ and $\psi_i(t_i, t_1^e, J_i) > 0$, where the latter stems from C_σ being strictly convex for all $\sigma^* > 0$. Applying analogous arguments, we infer from equation (3) that the optimal external debt ratio in affiliate i is equal to

$$\alpha_i^* = C'_\alpha{}^{-1} \left(\frac{t_i \cdot r}{1-t_i} \right), \quad (12)$$

and the maximum net gain from external debt per unit capital invested becomes

$$\gamma_i(t_i) = t_i \cdot r \cdot \alpha_i^* - (1-t_i) \cdot C_\alpha(\alpha_i^*) > 0. \quad (13)$$

²⁵Note that Desai et al. (2004b) in their Table 2 (columns 3 and 4) compare the effect of taxes on the reported profitability of partially owned and wholly owned affiliates. They find that “the reported profitability of partially owned affiliates is considerably less sensitive to local tax rates than is the reported profitability of wholly owned affiliates.” In their analysis ‘partially owned’ includes affiliates that are both majority- and minority-owned by the MNC. When they distinguish between the two groups they find that the reduced tax sensitivity is most robust for majority-owned affiliates, i.e., affiliates with minority owners in our setting. In our analysis we have ruled out the case where the MNC is a minority owner in an affiliate.

4.2 Optimal real investment and production

Given optimal values α_i^* and σ_i^* , and therefore optimal net gain functions for external and internal debt (γ_i and ψ_i), the effective capital cost (\tilde{r}) after taxation in affiliate i is given by

$$\tilde{r}_i = r - t_i \cdot r \cdot \alpha_i^* + (1 - t_i) \cdot C_\alpha(\alpha_i^*) - \left(t_i - \frac{t_1^e}{1 - J_i} \right) \cdot r \cdot \sigma_i^* + (1 - t_i) \cdot C_\sigma(\sigma_i^*). \quad (14)$$

It is straightforward to simplify this expression to

$$\tilde{r}_i = r - \gamma_i(t_i) - \psi_i(t_i, t_1^e, J_i).$$

Using the optimal financial strategies and effective capital costs, equations (10) to (14), in the profit function of the MNC, the maximization problem for the choice of capital and labor is

$$\begin{aligned} \max_{L_i, K_i} \sum_i (1 - J_i) \cdot \{ & (1 - t_i) [F(K_i, L_i) - w_i \cdot L_i - C_i^M(J_i)] \\ & - [r - \gamma(t_i) - \psi_i(t_i, t_1^e, J_i)] \cdot K_i \}. \end{aligned} \quad (15)$$

The first order conditions are given by

$$F_L^i = w_i, \quad (16)$$

$$F_K^i = \frac{r}{1 - t_i} - \frac{\gamma_i(t_i)}{1 - t_i} - \frac{\psi_i(t_i, t_1^e, J_i)}{1 - t_i}, \quad (17)$$

where the two last terms on the right hand side of equation (17) are the tax savings due to the use of external and internal debt. It is seen that these tax savings reduce the user costs of capital. Therefore, we can conclude that affiliates of MNCs with tax-efficient financial structures have lower costs of capital and thus invest more in capital than comparable domestic firms (within the same industry), since domestic firms cannot utilize internal debt. Furthermore, the higher the corporate tax rate, the larger is the subsidy from debt on the user costs of capital.

Equations (16) and (17) also enable us to derive the marginal rate of technical substitution (MRTS) between capital and labor as follows

$$-\frac{dK_i}{dL_i} = \frac{F_L^i}{F_K^i} = \frac{w_i}{r - \frac{\gamma_i(t_i^*)}{1 - t_i} - \frac{\psi_i(t_i, t_1^e, J_i)}{1 - t_i}}. \quad (18)$$

Equation (18) suggests that if the wage rate is the same across all firms, MNCs have a higher MRTS than domestic firms because the financing costs (denominator) are lower. As argued by Lipsey (2004), there is an extensive literature showing that MNCs on

average pay higher wages than domestic firms. If this is the case and since the financing costs in MNCs are lower than in domestic firms, the MRTS will be larger in MNCs. Empirical evidence from a number of countries suggests that this is the case and that accordingly MNCs have a higher capital to employee ratio than national firms.²⁶

It is worth pointing out that the effects described in equations (17) and (18) should be weaker in case of shared ownership, since internal debt is less attractive and capital costs are higher compared to wholly owned subsidiaries ($J_i = 0$) within the same industry.

5 Optimal Minority Ownership Share

The sharing of ownership creates both costs and benefits, and in this section we analyze how these determine the optimal minority ownership share. As an intermediate step, using equation (14) and applying the envelope theorem, we find

$$\frac{\partial \tilde{r}_i}{\partial J_i} = \frac{t_1^e}{(1 - J_i)^2} \cdot r \cdot \sigma_i^* > 0, \quad i > 1. \quad (19)$$

Equation (19) shows that the effective user costs of capital \tilde{r} rise in affiliate $i > 1$ when the minority ownership rate goes up. The reason is that a higher minority ownership share J_i in affiliate $i > 1$ makes internal debt less attractive. Consequently, internal leverage σ_i falls. This in turn increases the user costs of capital. As will be clear later, this has implications for the ownership structure.

We can define the elasticity of the effective interest rate with respect to the minority ownership share as

$$\varepsilon_{\tilde{r}J_i} = \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} > 0, \quad i > 1. \quad (20)$$

Furthermore, we have that

$$\frac{\partial \tilde{r}_i}{\partial J_1} = -\frac{t_1}{(1 - J_i)} \cdot r \cdot \sigma_i^* < 0, \quad i > 1. \quad (21)$$

Equation (21) shows that the effective interest costs \tilde{r}_i for affiliates $i > 1$ would fall if the financial center had minority owners and their share of ownership increased. The reason is that a larger part of the costs arising in the financial center would be borne by its minority owners making the use of internal debt cheaper. This would lead to higher leverage ratios in affiliates $i > 1$ and would cause the user costs of capital for affiliates $i > 1$ to fall.

The results in (21) do not hold for the financial center. For $i = 1$, the internal leverage

²⁶For a survey of empirical evidence related to capital to labor ratios and factor markets see Navaretti and Venables (2004, ch. 7).

ratio cancels in equation (14) and it follows that

$$\frac{\partial \tilde{r}_1}{\partial J_1} = 0. \quad (22)$$

From equation (22) we see that the costs of capital in the financial center are independent of internal leverage, since the financial center's lending activities give rise to tax payments instead of tax reductions.

The optimal minority ownership shares now follow from maximizing after-tax profits, given optimal labor and capital demand, L_i^* and K_i^* , and a tax-efficient financing structure as summarized by \tilde{r}_i in equation (14). The maximization problem is given by

$$\max_{J_i} \Pi = \sum_i (1 - J_i) \cdot \{(1 - t_i) [F(K_i^*, L_i^*) - w_i \cdot L_i^* - C_i^M(J_i)] - \tilde{r}_i(J_i, J_1) \cdot K_i^*\}. \quad (23)$$

Starting with the first order condition for minority ownership share in the financial center $i = 1$, we find

$$\frac{\partial \Pi}{\partial J_1} = -(\pi_1 - t_1 \pi_1^t) - \sum_{i>1} (1 - J_i) \underbrace{\frac{\partial \tilde{r}_i}{\partial J_1}}_{(-)} K_i^* - (1 - J_1) \underbrace{\frac{\partial C_1^M}{\partial J_1}}_{(-)} \geq 0. \quad (24)$$

In equation (24), the second and third term are positive and display the marginal benefits of having a higher minority ownership share. The second term is the marginal benefit from a reduction in the effective costs of capital in all affiliates except for the financial center, while the third term is the marginal reduction in market entry costs by the financial center. The first term is the cost of sharing after tax profit with minority owners. If the financial center is running a deficit, equation (24) is strictly positive meaning that the MNC would like to have a minority ownership share as high as possible. However, since the financial center is running an economic deficit (see the discussion after Lemma 1), taking a positive equity stake in the financial center is not profitable for minority owners. Hence, it is wholly owned.

For all affiliates except for the financial center (i.e., affiliates $i > 1$), each affiliate's optimal minority ownership share can be found from the corresponding first order conditions as follows

$$\left\{ x_i - w_i L_i^* - C_i^M(J_i) - \frac{\tilde{r}_i K_i^*}{(1 - t_i)} \right\} + \frac{(1 - J_i)}{(1 - t_i)} \frac{\partial \tilde{r}_i}{\partial J_i} K_i^* = -(1 - J_i) \frac{\partial C_i^M}{\partial J_i}, \quad (25)$$

where $x_i = F(K_i^*, L_i^*)$ denotes optimal production.

Equation (25) balances the costs and benefits of having minority owners. The RHS of equation (25) is the benefit from having minority owners. The benefit arises since minority owners cause a reduction in marginal entry costs ($\partial C_i^M / \partial J_i < 0$). The LHS is

the marginal cost from minority ownership. Minority ownership is costly since minority shareholders receive part of the affiliate's profit. This effect is captured by the first term on the LHS. The second cost term on the LHS is new to the literature and is due to the fact that minority ownership increases the effective costs of capital.

In order to derive the optimal ownership share we shall define the entry cost elasticity with respect to minority ownership as $\varepsilon_{C_i^M J_i} = -(\partial C_i^M / \partial J_i) \cdot (J_i / C_i^M) > 0$, and let the production elasticities be $\varepsilon_{x_i a_i} = (\partial F_i / \partial a_i) \cdot (a_i / x_i) > 0$, $a_i = \{L_i, K_i\}$. Applying these definitions as well as the interest rate elasticity (20) in equation (25), after having substituted optimal labor and capital demand from equations (16) and (17), it follows that

$$x_i - \varepsilon_{x_i L_i} x_i - C_i^M(J_i) - \varepsilon_{x_i K_i} x_i = \frac{1 - J_i}{J_i} \left[\varepsilon_{C_i^M J_i} C_i^M - \varepsilon_{x_i K_i} x_i \varepsilon_{\tilde{r}_i J_i} \right].$$

Collecting terms, we end up with a formula for the optimal minority ownership share as follows

$$\frac{J_i^*}{1 - J_i^*} = \frac{\varepsilon_{C_i^M J_i} \cdot \frac{C_i^M}{x_i} - \varepsilon_{\tilde{r}_i J_i} \cdot \varepsilon_{x_i K_i}}{1 - \varepsilon_{x_i L_i} - \varepsilon_{x_i K_i} - \frac{C_i^M}{x_i}}. \quad (26)$$

Before discussing the implications of equation (26), it is useful to note that the lower bound for optimal minority ownership is $J_i = 0$, even if the fraction on the RHS is negative in equation (26). As discussed in Section 3, in order for the HQ to set up a tax-efficient financial structure for the MNC, it must have control of its affiliates. Consequently, minority owners must own less than 50 percent of any affiliate (i.e., $J_i < 50\%$). Thus, there is also an upper bound on the optimal minority ownership share. From equation (26), we see that the optimal minority ownership share J_i , $i > 1$, is higher the more effective it is in reducing market entry costs, i.e., the larger is $\varepsilon_{C_i^M J_i}$. It is lower, the larger is profit income in affiliate i (i.e., the larger is the denominator). Optimal minority ownership also falls (all else equal), the more it increases the effective user costs of capital, $\varepsilon_{\tilde{r}_i J_i} > 0$, and the more the resulting decrease in capital employed causes production to fall (i.e., $\varepsilon_{x_i K_i} > 0$).

6 Discussion

Our analysis has demonstrated that when it is profitable to form a joint venture, debt shifting entails a transfer from the MNC to its minority owners, since the subsidiary's capital costs are subsidized by the financial center, which is wholly owned by the parent.

Our study has not taken into account the potential effect of thin capitalization rules (TC rules). Such rules imply a cap on the amount of tax deductible (internal) debt, and could either be interpreted as increasing the costs of internal debt or as explicit caps on the use of internal debt.²⁷ Either type of rule would reduce the leverage ratio of internal debt

²⁷In the U.S., corporations whose debt-to-equity ratio is in excess of 1.5:1, and which pay interest on

and lead to higher effective capital costs and reduce the use of debt. Other things being equal, this would also reduce real investment. Including such rules in our analysis would, however, not change our results qualitatively as long as the MNC has some discretion in terms of manipulating its leverage ratio. Formally, more binding TC rules imply more convex cost functions $C_\sigma(\sigma_i)$ and, thus, higher marginal tax-engineering costs. From the first-order condition (4), it then follows that the internal leverage will decrease. It is straightforward, however, to see that this does not affect any of our comparative static results. An interesting insight that follows from our analysis is that in countries with more restrictive TC rules, minority ownership shares, all else equal, should on average be higher. The reason is that the fall in internal debt following from effective TC rules decreases the sensitivity of the effective capital costs related to minority ownership, see equation (19). This reduces the financing externality from minority ownership.

The effects of TC rules have recently been examined by Büttner et al. (2008) and Weichenrieder and Windischbauer (2008). Both studies find that TC rules decrease (inter-company) loans and increase equity. They disagree, however, on the real effects. Büttner et al. (2008) find that TC rules have a negative impact on real investments. In contrast, Weichenrieder and Windischbauer (2008) find no effect on real investment, and argue that the reason is that MNCs have various strategies to circumvent TC rules. One strategy they describe in detail is the use of holding company structures (see Weichenrieder and Windischbauer, 2008, section 5 for the details). One reason for the divergence in findings related to real effects may be that Büttner et al. (2008) use data for German outbound investments, whilst Weichenrieder and Windischbauer (2008) use German inbound investment data. From a theoretical point of view, the relevance of strict TC rules has been challenged by Hauffer and Runkel (2008), who show that weakening TC rules is a dominant strategy in corporate tax competition among countries.

Nor have we investigated the use of so called CFC rules and the impact they may have on our analysis. Under such rules, income from subsidiaries is taxed in the home country of the MNC and, as a consequence, the exemption principle does not apply. Taxation under CFC rules mostly requires that the income earned is deemed to be passive and that the taxation level is below a certain level (i.e., earned in a low-tax jurisdiction).²⁸ In our model, tighter CFC rules can be interpreted as more convex cost functions for tax-engineering. If CFC rules are so effective that they cannot be circumvented, they reproduce the home country tax system. Then, the MNC would serve as financial center and incentives for debt shifting to lower taxed affiliates would vanish. This would in our model imply that the marginal costs of using internal debt would become infinitely

debt owed to, or guaranteed by, certain non-US affiliates are subject to the earnings stripping limitations of interest deduction (see SEC. 163 (j), IRC). In Germany, the tax deductibility of interest expenses are limited to 3% of an affiliate's pre-tax earnings.

²⁸See Ruf and Weichenrieder (2009), section 2, on how the German tax code defines passive and active income.

high in such affiliates. However, debt shifting to affiliates being taxed at higher rates than the parent firm would still be possible and profitable. If CFC rules are not strictly binding, marginal costs of internal debt are increased, but still finite. Then, the use of internal debt will be reduced in all affiliates, but this would not change our result in any qualitative way.

Ruf and Weichenrieder (2009) argue that German CFC rules are effective in reducing passive investments (i.e., setting up financial centers), particularly in low-tax jurisdictions outside the EU. Benelux Countries such as Belgium have set up special tax systems for financial centers that make them escape CFC taxation. This may explain why Ruf and Weichenrieder (2009) find that a substantial number of MNCs have their financial centers located in the Benelux countries (see also Weichenrieder and Mintz, 2008). Countries that offer tailor-made tax systems for financial centers would imply that adding CFC rules to our model would not affect our results qualitatively. In a world where such loopholes did not exist, however, tax incentives for debt shifting would be less pronounced.

7 Conclusions

We develop a model that allows a MNC to determine its leverage and ownership structure endogenously. Our main result is that affiliates with partial ownership have less debt than wholly owned affiliates and, therefore, have a higher rental rate of capital and a less tax-efficient financing structure. The reason is that a MNC cannot reap the full benefit of its debt shifting strategy when the value of tax savings must be shared with minority owners who do not in an equal manner contribute to the funding of such tax planning activities. We also show that affiliates of MNCs have higher internal and overall debt ratios and lower rental rates of physical capital than comparable domestic firms. Our findings are in line with some recent empirical results showing that changes in corporate tax rates have less of an effect on debt-to-asset ratios in joint ventures than in wholly owned affiliates of MNCs.

We have also shown in this paper that there are qualitative differences between debt shifting and profit shifting in joint ventures. Debt shifting activities by MNCs in joint ventures are dampened by minority ownership due to the externality related to the financing of internal debt. In contrast, under transfer pricing minority ownership gives the headquarters of a MNC incentives to shift income away from minority owners by mispricing intra-firm transactions. This leads us to conclude that joint ventures can be used to curb debt shifting activities. At the same time joint ventures encourage mispricing of intra-firm transactions. On balance, therefore, more research is needed on the joint effects of debt shifting and transfer pricing before policy recommendations can be passed.

A Proof of Lemma 1

Note that it must be $(1 - J_i) t_i - \lambda \geq 0$ from $C'_\sigma(\sigma_i) \geq 0$ and FOC (4). Assume now that the condition holds with equality for an arbitrary affiliate j , i.e., $\lambda = (1 - J_j) t_j = t_j^e$. However, this will violate FOC (4) as long as there are affiliates having a lower effective tax rate $t_i^e < t_j^e = \lambda$. Thus, the optimality condition can only be fulfilled if $\lambda = \min_i t_i^e = \min_i [(1 - J_i) \cdot t_i] = (1 - J_1) t_1$.

Country 1 is then a low-tax country in the sense that the effective tax payments for the MNC are lower in this country than in others. Thus, $t_1^e = (1 - J_1) t_1 < (1 - J_i) t_i = t_i^e \forall i \neq 1$. Accordingly, the financial center should be located in this country in order to minimize tax payments on shifted interest payments and to maximize tax savings.

B Appendix B

In this Appendix, we show that our results can be reproduced if we let the basis for partial ownership be productivity enhancing rather than reducing market entry costs (as in the main section of our paper). We start with the same model as in section 2 of the paper, i.e., a MNC runs i affiliates, producing a homogenous good x by employing capital K_i and labor L_i . Capital is financed by equity E_i , external debt D_i^E and internal debt D_i^I , i.e., $K_i = E_i + D_i^E + D_i^I$. Expenses for costs of equity cannot be deducted in the corporate tax base.

Minority ownership increases production and sales by improving access of an affiliate i to the domestic market and to the supply chain, say (see discussion in section 3 of the paper). Hence, minority ownership J_i can be interpreted as an additional production factor and the production function of good x in affiliate i can be written as

$$x_i(L_i, K_i, J_i) = F(L_i, K_i, J_i), \quad (27)$$

where the marginal productivity of minority ownership is $F_{J_i} > 0$. Then, define the production elasticities as

$$\varepsilon_{x_i a_i} = \frac{\partial F_i}{\partial a_i} \frac{a_i}{x_i} > 0, \quad a_i = \{L_i, K_i, J_i\}. \quad (28)$$

The tax-efficient financial structure is not affected by how the gain from partial ownership is modeled, so the results derived in subsection 4.1 in the paper as well as the effective interest rate \tilde{r}_i in affiliate i is still given by equation (13) as follows

$$\tilde{r}_i = r - t_i \cdot r \cdot \alpha_i^* + (1 - t_i) \cdot C_\alpha(\alpha_i^*) - \left(t_i - \frac{t_1^e}{1 - J_i} \right) \cdot r \cdot \sigma_i^* + (1 - t_i) \cdot C_\sigma(\sigma_i^*). \quad (29)$$

The profit maximization problem with respect to optimal investment and optimal minority ownership share in subsection 4.2 and section 5 is now given by

$$\max_{L_i, K_i, J_i} \Pi = \sum_i (1 - J_i) \cdot \{(1 - t_i) [F(K_i, L_i) - w_i \cdot L_i] - \tilde{r}_i \cdot K_i\} \text{ s.t. (29)}. \quad (30)$$

The first-order-condition for optimal labor demand in affiliate i is

$$(1 - J_i) \{(1 - t_i) F_{L_i} - (1 - t_i) w_i\} = 0 \quad (31)$$

and, by applying the definition of the production elasticity of labor, equation (28), the first order condition can be rearranged as follows

$$L_i^* = \frac{x_i \varepsilon_{x_i L_i}}{w_i}. \quad (32)$$

Accordingly, optimal labor demand is increasing in optimal production x_i , in the productivity of labor ($\varepsilon_{x_i L_i}$) and it is decreasing in the wage rate w_i . Optimal real capital demand is derived from

$$(1 - J_i) \{(1 - t_i) F_{K_i} - \tilde{r}\} = 0, \quad (33)$$

which can be used to derive

$$K_i^* = (1 - t_i) \frac{x_i \varepsilon_{x_i K_i}}{\tilde{r}_i}. \quad (34)$$

Optimal capital demand is increasing in optimal production and the productivity of capital. It decreases in the effective costs of capital \tilde{r}_i , and ceteris paribus, in the tax rate t_i , because not all capital costs are tax deductible.

Dividing equations (34) and (32) yields the optimal capital intensity as

$$k_i^* = \frac{K_i^*}{L_i^*} = (1 - t_i) \frac{\varepsilon_{x_i K_i}}{\varepsilon_{x_i L_i}} \frac{w_i}{\tilde{r}_i}. \quad (35)$$

Indeed, an affiliate of a MNC will have a higher capital intensity than a comparable purely domestic firm, if the production elasticities are the same in both firms (e.g., if the production function is Cobb-Douglas) and given that the wage rate in a MNC does not decrease more than effective costs of capital. This is in line with our discussion on page 14 in the paper and equation (35) above amends and replaces equation (18).

Turning to optimal minority ownership, we derive as an intermediate step the effect of minority ownership on effective capital costs $\tilde{r}_i = \tilde{r}_i(J_i, J_1)$. Relying on equation (14) and applying the envelope theorem, we find

$$\frac{\partial \tilde{r}_i}{\partial J_i} = \frac{t_1^e}{(1 - J_i)^2} \cdot r \cdot \sigma_i^* > 0. \quad (36)$$

This effect is identical to the entry-cost case in the paper and we define the elasticity of

the effective interest rate with respect to minority ownership share as

$$\varepsilon_{\tilde{r}J_i} = \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} > 0. \quad (37)$$

Furthermore, the effect of minority ownership in the financial center is given by

$$\frac{\partial \tilde{r}_i}{\partial J_1} = -\frac{t_1}{(1 - J_i)} \cdot r \cdot \sigma_i^* < 0, \quad i > 1, \quad (38)$$

whereas internal leverage cancels in the effective capital costs of the financial center, \tilde{r}_1 , again. Hence,

$$\frac{\partial \tilde{r}_1}{\partial J_1} = 0. \quad (39)$$

Finally, the interesting first-order-condition is the one for optimal minority ownership share in affiliates $i > 1$, which implies after reordering

$$\underbrace{(1 - t_i) [x_i - w_i L_i] - \tilde{r}_i K_i}_{=\pi_i - t_i \cdot \pi_i^t} + (1 - J_i) \frac{\partial \tilde{r}_i}{\partial J_i} K_i = (1 - J_i)(1 - t_i) F_{J_i}. \quad (40)$$

Rearranging equation (40) leads to

$$\begin{aligned} -(1 - t_i) \left[x_i - \frac{1 - J_i}{J_i} F_{J_i} \frac{J_i}{x_i} x_i \right] + (1 - t_i) w_i L_i & \quad (41) \\ + \left[\tilde{r}_i - \frac{1 - J_i}{J_i} \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} \tilde{r}_i \right] K_i = 0. & \end{aligned}$$

Applying the definitions of the production elasticities, equation (28), as well as the interest rate elasticity, that is equation (37), and substituting for optimal labor and capital demand in equations (32) and (34), we have

$$-\left[1 - \frac{1 - J_i}{J_i} \varepsilon_{x_i J_i} \right] + \varepsilon_{x_i L_i} + \varepsilon_{x_i K_i} \left[1 - \frac{1 - J_i}{J_i} \varepsilon_{\tilde{r}_i J_i} \right] = 0. \quad (42)$$

Collecting terms, the optimal minority ownership share is given by

$$\frac{J_i^*}{1 - J_i^*} = \frac{\varepsilon_{x_i J_i} - \varepsilon_{x_i K_i} \varepsilon_{\tilde{r}_i J_i}}{1 - \varepsilon_{x_i L_i} - \varepsilon_{x_i K_i}} \quad (43)$$

in affiliate $i > 1$, where $1 - \varepsilon_{x_i L_i} - \varepsilon_{x_i K_i} > 0$ as long as the production function has non-increasing returns to scale. The discussion and interpretations follows the same lines as in section 5.

References

- Altshuler, R., and H. Grubert, 2003. Repatriation Taxes, Repatriation Strategies, and Multinational Financial Policy. *Journal of Public Economics* 87, 73–107.
- Barion, F., R. Miniaci, P.M. Panteghini, and M.L., Parisi, 2010. Profit-Shifting via Debt Financing in Europe. CESifo Working Paper No. 2985, Munich.
- Bertrand, M., P. Mehta, and M. Sendhil, 2002. Ferreting out Tunneling: An Application to Indian Business Groups. *Quarterly Journal of Economics* 117, 121–148.
- Büttner, T., and G. Wamser, 2007. Intercompany Loans and Profit Shifting – Evidence from Company-Level Data. CESifo Working Paper Nr. 1959, Munich.
- Büttner, T., M. Overesch, U. Schreiber, and G. Wamser, 2008. The Impact of Thin-Capitalization Rules on Multinationals’ Financing and Investment Decisions. Bundesbank Discussion Paper 03/2008, Frankfurt.
- Büttner, T., M. Overesch, U. Schreiber, and G. Wamser, 2009. Taxation and Capital Structure Choice – Evidence from a Panel of German Multinationals. *Economics Letters* 105, 309–311
- Chowdhry, B., and J.D. Coval, 1998. Internal Financing of Multinational Subsidiaries: Debt vs. Equity. *Journal of Corporate Finance* 4, 87–106.
- Desai, M.A., C.F. Foley, and J.R. Hines, 2004a. A Multinational Perspective on Capital Structure Choice and Internal Capital Markets. *Journal of Finance* 59, 2451–2487.
- Desai, M.A., C.F. Foley, and J.R. Hines, 2004b. The Cost of Shared Ownership: Evidence from International Joint Ventures. *Journal of Financial Economics* 73, 323–374.
- Dourado, A., and R. de la Feria, 2008. Thin Capitalization Rules in the Context of the CCCTB. Oxford University Centre for Business Taxation Working Paper 08/04.
- Egger, P., W. Eggert, C. Keuschnigg, and H. Winner, 2010. Corporate Taxation, Debt Financing and Foreign-Plant Ownership. *European Economic Review* 54, 96–107.
- Fuest, C., and T. Hemmelgarn, 2005. Corporate Tax Policy, Foreign Firm Ownership, and Thin Capitalization. *Regional Science and Urban Economics* 35, 508–526.
- Gertner, R.H., D.S. Scharfstein, and J.C. Stein, 1994. Internal versus External Capital Markets. *Quarterly Journal of Economics* 109, 1211–1230.
- Gomes-Casseres, B., 1989. Ownership Structures of Foreign Subsidiaries – Theory and Evidence. *Journal of Economic Behavior and Organization* 11, 1–25.

- Gouthière, B., 2005. A Comparative Study of the Thin Capitalization Rules in the Member States of the European Union and Certain Other Countries. *European Taxation* 45, 367–451.
- Grossman, S.J., and O.D. Hart, 1986. The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. *Journal of Political Economy* 55, 279–306.
- Hauffer, A., and M. Runkel, 2008. Firms' Financial Choices and Thin Capitalization Rules under Corporate Tax Competition. CESifo Working Paper Nr. 2429, Munich.
- Hebous, S., and A. Weichenrieder, 2010. Debt Financing and Sharp Currency Depreciations: Wholly versus Partially-owned Multinationals. *Review of World Economics* 146, 281–302.
- Holmstrom, B., 1990. Moral Hazards in Teams. *Bell Journal of Economics* 13, 324–340.
- Hovakimian, A., G. Hovakimian, and H. Theranian, 2004. Determinants of Target Capital Structure: The Case of Dual Debt and Equity Issues. *Journal of Financial Economics* 71, 517–540.
- Kant, C., 1988. Foreign Subsidiary, Transfer-pricing and Tariffs. *Southern Economic Journal* 55, 162–170.
- Kant, C., 1990. Multinational Firms and Government Revenues. *Journal of Public Economics* 42, 135–147.
- Kant, C., 1995. Minority Ownership, Deferral, Perverse Intrafirm Trade and Tariffs. *International Economic Journal* 9, 19–37.
- Konrad, K., and K.E. Lommerud, 2001. Foreign Direct Investment, Intra-Firm Trade, and Ownership Structure. *European Economic Review* 45, 475–494.
- Lax, D.A., and J.K. Sibenius, 1986. *The Manager as a Negotiator: Bargaining for Cooperation and Competitive Gain*. Free Press, New York.
- Lipsey, R.E, 2004. Home and Host Country Effects of Foreign Direct Investment. in: *Challenges to Globalization: Analyzing the Economics*. NBER Economic Research Conference Report Series. University of Chicago Press, 333–379.
- Miller, M., H., 1997. Debt and Taxes. *Journal of Finance* vol. XXXII (No. 2).
- Mintz, J., 2004. Conduit Entities: Implications of Indirect Tax-Efficient Financing Structures for Real Investment. *International Tax and Public Finance* 11, 419–434.

- Mintz, J., and M. Smart, 2004. Income Shifting, Investment, and Tax Competition: Theory and Evidence from Provincial Taxation in Canada. *Journal of Public Economics* 88, 1149–1168.
- Mintz, J., and A.J. Weichenrieder, 2005. Taxation and the Financial Structure of German Outbound FDI. CESifo Working Paper Nr. 1612, Munich.
- Mintz, J., and A.J. Weichenrieder, 2010. *The Indirect Side of Direct Investment – Multinational Company Finance and Taxation*. MIT Press.
- Navaretti, G.B., and A.J. Venables (editors), 2004. *Multinational Firms in the World Economy*. Princeton University Press.
- Ramachandran, V., 1993. Technology Transfer, Firm Ownership, and Investment in Human Capital. *Review of Economics and Statistics* 75, 664–70.
- Ruf, M. and A.J. Weichenrieder, 2009. *The Taxation of Passive Foreign Investments: Lessons from German Experience*. CESifo Working Paper Nr. 2624, Munich.
- Schindler, D., and G. Schjelderup, 2011. *Multinationals and Their Financial Tax-Avoidance Strategies: Internal Debt vs. Profit Shifting*. Norwegian School of Economics and Business Administration, Bergen, mimeo.
- Stonehill, A., and Stitzel, T., 1969. Financial Structure and Multinational Corporations. *California Management Review* 12, 91–96.
- Svejnar, J., and S.C. Smith, 1984. The Economics of Joint Ventures in Less Developed Countries. *Quarterly Journal of Economics* 99, 149–167.
- Weichenrieder, A.J., 2009. Profit Shifting in the EU: Evidence from Germany. *International Tax and Public Finance* 16, 281–297.
- Weichenrieder, A.J., and J. Mintz, 2008. What Determines the Use of Holding Companies and Ownership Chains? Oxford University Center for Business Taxation WP 08/03, Oxford.
- Weichenrieder, A.J., and H. Windischbauer, 2008. Thin-Capitalization Rules and Company Responses: Experience from German Legislation. CESifo Working Paper Nr. 2456, Munich.
- Williamson, O, 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York.