Multinationals, Minority Ownership and Tax-Efficient Financing Structures

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Abstract

This paper presents a theory model that simultaneously accounts for the financing decisions and ownership structure in affiliates of multinational firms. We find that affiliates of multinationals have higher internal and overall debt ratios and lower rental rates of physical capital than comparable domestic firms. We also show that affiliates with minority owners have less debt than wholly owned affiliates and a less tax-efficient financing structure. The latter is due to an externality whereby minority ownership dampens the incentive to avoid taxes through the use of internal debt.

JEL-Code: H25, F23.

Keywords: multinationals, tax-efficient financing structures, minority ownership.

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1 Introduction

It is well known that multinationals can use internal debt to save tax payments and thus to increase profits by utilizing differences in national tax rates. Such tax engineering through a strategy of borrowing and lending among corporate affiliates has led multinationals to set up affiliates in low-tax countries that function as financial centers. The mechanism at play under debt shifting is that interest income is deducted in high-tax countries and earned in low-tax countries so that the tax savings arising from the deductions in high-tax countries exceed the corresponding tax payments in low-tax countries.[1]

Previous literature has studied debt shifting when affiliates of multinationals are wholly owned (e.g., Mintz, 2004; Mintz and Smart, 2004). 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, and there is therefore a need for a theory that can explain how different ownership structures affect tax-efficient financing structures in multinationals.[2]

This paper presents a theory model that simultaneously accounts for the financing decisions and ownership structure in affiliates of multinational firms. The theory considers a multinational firm that invests abroad, and that decides on what the tax-efficient financing structure of each affiliate should be, and whether an affiliate should have partial ownership. In its decision making over whether or not to share equity, the multinational enterprise balances costs and gains from sharing equity.

Our model suggests that affiliates of multinationals with minority owners use less internal debt and, thus, have a less tax-efficient financing structure than do affiliates of multinationals that are wholly owned. The reason is

[1] See Mintz and Weichenrieder (2009) for a survey.

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

that there is a classical free riding externality related to minority ownership and 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 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. It is this asymmetric sharing of costs and benefits, which arises endogenously in our model, that leads to the externality.

In a second step of the analysis we show that since affiliates with minority owners have a less tax-efficient financing structure, the rental rate of capital is higher in such affiliates. All else equal, this makes it less attractive to share equity. This insight provides an additional explanation for empirical findings suggesting that there is an increased appetite for control by multinational parents (Desai et al., 2004b). Finally, we show that an optimal financing structure (independently of ownership shares) implies that affiliates of multinationals have higher internal and overall debt ratios as well as lower rental rates of physical capital than comparable domestic firms. Furthermore, they have a more capital-intensive production structure.

Our finding that debt tax planning activities of multinationals are dampened by minority ownership should be contrasted to the findings in the literature on tax evasion and transfer pricing under minority ownership. In this literature it has been shown that minority ownership gives the headquarter of a multinational firm incentives to shift profit income away from minority owners (Kant, 1988, 1990; Bertrand et al., 2002). Thus, minority ownership bolsters tax evasion by transfer pricing.[3] Our result shows that there are qualitative differences between transfer pricing (tax evasion) and debt struc-

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

turing (tax planning). Under transfer pricing, the multinational firm has an incentive to cheat minority owners by shifting profits away from affiliates with minority ownership. In contrast, under debt shifting, tax payments are shifted from high-tax to low-tax affiliates favouring minority owners in high-tax affiliates disproportionately. This is, in essence, the reason why minority ownership leads to more tax evasion under transfer pricing, but less tax planning under debt shifting.

Our model is also related to a small but growing literature on multinationals and their tax-efficient structures. Mintz and Smart (2004) show how multinationals may use direct financial techniques, such as lending among affiliates, to reduce tax payments. 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. Mintz (2004) 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.[4] Finally, Weichenrieder (2009) studies profit shifting using a theoretical model with minority ownership. His model is focused on traditional transfer pricing and FDI rather than on tax-efficient financing structures. 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.

There is also an empirical literature on tax-efficient financing structures and minority ownership that confirms the results derived in our model. A discussion of this literature is deferred to Section 5. Below, Section 2 outlines the basic model, Section 3 analyzes the optimal tax avoidance strategies of a multinational that uses debt to reduce tax payments. In Section 4 we derive optimal ownership shares, whilst Section 5 discusses and relates our results

[4]See also Mintz and Weichenrieder (2009) 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.

to existing empirical studies. In Section 6 we offer some concluding remarks.

2 The Model

Consider a multinational firm (henceforth MNC) with a headquarter (henceforth HQ), which can invest in n countries. When investing the HQ must decide whether or not to let some or all of its affiliates share equity. 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.[5] Endogenous minority ownership depends on the costs and benefits of cooperation between a local firm and the MNC (see, e.g., Gomes-Casseres, 1989; Mugele and Schnitzer, 2008). 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.

We shall assume that the basis for cooperation is cost savings, but we show in Appendix A.2 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 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

[5] See Kant (1995) for a discussion of exogenous ownership requirements.

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 small country assumption).

The firm finances its investments in country i by equity (and retained earnings) E_i or debt D_i. Debt can be classified as external debt $\left(D_i^E\right)$ or internal debt $\left(D_i^I\right)$, 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 $b_i = \alpha_i + \sigma_i = \left(D_i^E + D_i^I\right)/K_i$. 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,

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

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 $C = C(\alpha_i, \sigma_i)$.[6] 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).[7] 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

[6]See for example Mintz and Smart (2004) and Fuest and Hemmelgarn (2005).

[7]Thin capitalization rules are in place in many countries. For 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. CFC rules are in place, e.g., in the US and Germany and they deny tax-exemption of passive income in the home country of the MNC, provided that tax avoidance is suspected (see Ruf and Weichenrieder, 2009).

ratio $\bar{\alpha}_i$ for external debt in the absence of taxes (see, e.g., Fuest and Hemmelgarn, 2005, and Huizinga et al., 2008). 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 the local managers to become too risk-averse.[8] Increasing external debt from a leverage ratio $\alpha_i < \bar{\alpha}_i$ will then decrease leverage costs, whereas any increase for $\alpha_i \geq \bar{\alpha}_i$ will cause positive marginal costs of (external) leverage.

It follows from the discussion above that the costs and benefits of internal and external debt are very different. Internal debt should rather be seen as tax-favored equity, as it neither affects the risk of bankruptcy, nor reduces any informational asymmetry, or ties the hands of managers.[9] In line with this reasoning we assume that the cost function is additively separable, that is $C(\alpha_i, \sigma_i) = C_\alpha(\alpha_i) + C_\sigma(\sigma_i)$, as long as external credit markets are perfect. This assumption implies that internal and external debt are separable across countries and affiliates. This is a reasonable assumption, since managers are not identical and monitoring capabilities may differ across firms and countries. It is also the case that thin capitalization rules and CFC regulation may vary in different countries.

We also 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 in order to conceal the true nature of the transaction from the tax authorities, whilst the convexity for external debt (α) may 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. The cost*

[8]Note 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.

[9]In line with this Chowdhry and Coval (1998) p. 87f, and Stonehill and Stitzel (1969) also argue that internal debt should be seen as tax-favored equity.

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

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

It follows from Assumption 1 that if an affiliate lends money to a related affiliate, there are no costs associated with lending.

3 Optimal Investments

The HQ of the MNC maximizes the net after-tax global profits of the affiliates it controls. For the MNC to structure its production and funding decisions optimally, the HQ must control the affiliates whose profit it maximizes. 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 ($J_i < 50\% \, \forall \, i$), see Kant (1990). The ownership share in each affiliate is still endogenously given by the **costs** and gains from having minority owners, but subject to the condition $J_i < 50\%$. The maximization problem is given by

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

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. A number of 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 assume that the

tax-exemption principle applies in our model as well.[10]

The profit maximization problem above 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.[11] One reason for this may be that it is impossible to write contracts that cover all contingencies that the cooperation need to take into account (see Gomes-Casseres, 1989).

True economic profit is given by revenue from the sale of an output good minus labor costs, 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, r is the world market interest rate, and L_i is labor employed. Without any consequences for our results, we shall assume that the user costs of debt are fully tax deductible in each country. Thus, taxable profit differs from true economic profit in that only labor expenses, borrowing costs and market entry costs are tax deductible,

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

In defining taxable profit we assume 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 violation of the tax code, and it could be argued that such costs should not be tax deductible. However, it is straight-

[10]The 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.

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

forward to show by examination of the equations to follow that the inclusion of these costs 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 line with most countries' tax code we shall assume that the user costs of equity E_i are not tax deductible. 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. We start by considering the profit maximizing financial structure and then proceed by examining optimal supply of the final good.

The HQ maximizes the value of the MNC after corporate taxes, neglecting any effect that personal taxes may have. This is in line with most of the literature on MNCs and is reasonable since MNCs are either owned by several institutional investors or by shareholders located in different countries.[12]

[12]It can be shown that from 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, yield identical results under mild assumptions. For example, if corporate taxes cannot be deducted against personal income tax and if the personal tax rate on dividends and interest income is the same, it is straightforward to show that maximizing the value of the firm to the owner and maximizing corporate profits coincide. These restrictions are fulfilled for a wide range of real world tax codes: the classical corporate taxation system (e.g., in the US), the new German system started in 2009 ("Abgeltungssteuer"), where interest income, dividends and capital gains are taxed at 25% and deductions for corporate taxes are not possible, and the Norwegian shareholder tax, introduced in 2006.

3.1 Profit maximizing financial structure

The maximization procedure of the firm can be seen as a two-tier process whereby the financial structure is first optimized and then the firm determines how much of the final good to produce in each country. Thus, 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

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

It is seen from equation (2) that minority ownership in country i reduces the MNC's profit in country i and thus global after-tax profit as well. 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

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

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

These first order conditions state that the firm will use 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 tax shield offered by external debt, 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 $\alpha^* > \bar{\alpha}$).

The Lagrangian multiplier λ in equation (4) is the shadow price of shifted interest expenses on internal debt. It can be shown to be equal to the effective tax rate, $t^e \equiv (1-J)\cdot t$, facing the MNC in the lowest tax country (see Lemma 1). In the continuation we shall refer to this country as country 1. It now follows that:

Lemma 1 *A tax-efficient financing structure implies*

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

and the affiliate in country 1 will be the financial center.

Proof. See Appendix A.1 ■

The affiliate (financial center) in country 1 has the lowest effective tax rate making it the most attractive place to channel interest income.[13] The MNC will therefore endow it with equity, $E_1^I = -D_1^I = \sum_{i\neq 1} \sigma_i \cdot K_i > 0$, which the financial center uses for its lending operations to the other affiliates. The implication is that the MNC reduces its equity in all affiliates $i > 1$, and concentrates its equity E_1^I in the financial center. The advantage for the MNC in structuring its finances like this is that the global tax burden falls, since the tax savings from interest deductions in the high-tax countries exceed the tax payments in country 1 generated by the lending activities of the financial center.

It should be pointed out that the lending activities in the financial center in country 1 are loss-making. The reason for this is that the user costs of equity are not tax deductible so that lending transactions yield an economic loss due to incomplete tax deductibility.[14] The loss in the affiliate in country

[13]This 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.

[14]If the financial center is only undertaking banking functions, it is running an economic

1 from internal lending equals $-E_1^I \cdot t_1 r$, which is the opportunity cost of equity multiplied by the tax rate.[15] 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 it in our model would not affect the incentives to avoid taxes through the use of debt. Furthermore, the effects of minority ownership on transfer pricing behavior are well know. As shown by Kant (1988), minority ownership of foreign affiliates gives the parent firm an incentive to shift profits away from the affiliate.[16]

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

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

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

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

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 rises

deficit given by $\pi_1 - t\pi_1^t < 0$. Based on accounting values, however, the low-tax affiliate is running a surplus, since the return to equity is not deducted as a cost, i.e., $\pi_1^t > 0$.

[15] Omitting 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 $\pi_1 - t_1\pi_1^t = \left[\mathcal{L}_1 r - r\left(D_1^E + E_1^I\right)\right] - t_1\left[r\mathcal{L}_1 - rD_1^E\right]$, where lending is refinanced by external debt or equity, $\mathcal{L}_1 = D_1^E + E_1^I$. Simplifying this expression yields $\pi_1 - t_1\pi_1^t = -E_1^I \cdot t_1 r$.

[16] Shifting profits by interest rate differentials is inferior to shifting profits by transfer prices on intangibles or overhead costs, since it is easier to establish market parallel prices on interest rates. This argument should be valid even in a complex world with advanced financial derivatives, since there are no market prices available for intangibles.

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 tax haven. Consequently, the use of internal debt decreases in all affiliates as shown in equation (7).[17]

It follows from conditions (5) to (7) that affiliates in high-tax jurisdictions have higher internal debt ratios than affiliates in low-tax jurisdictions. Furthermore, since purely domestic firms cannot engage in cross country tax planning, their internal debt ratio should be zero. Notice that external debt ratios are the same for all firms within the same country as long as Assumption 1 holds. The implication is that MNCs with tax-efficient financial structures should have higher overall debt ratios than domestic firms in the same industry.

A central issue is how minority ownership affects the leverage structure and thus the extent of tax planning. We show that minority ownership dampens the incentive for debt shifting. The reason is that tax savings by affiliate $i > 1$ benefit all owners equally, but minority owners in this affiliate do not take part in paying any of the tax obligations that arise from the funding activities of the financial center.[18] Hence, the MNC bears the full financing costs, but cannot internalize the full gain. This gives rise to a classic externality where minority ownership dampens the incentives to use debt in affiliates with minority owners. This result and its intuition follow

[17]Note that the effective tax rate t_1^e does not affect external debt as long as external and internal debt are separable in the debt cost function (see Assumption 1).

[18]In 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.

from

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

From equation (8) it is seen that the internal debt ratio falls more rapidly the greater the minority ownership share in affiliate i (J_i increases). In contrast, equation (7) shows that if the minority ownership rate rises in the low-tax affiliate, 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 for the MNC to fund tax planning by debt.[19]

The result above should be contrasted to the results in the literature on transfer pricing and profit shifting. As shown by Kant (1988) and documented by among others Bertrand et al. (2002), minority ownership of a foreign affiliate increases tax evasion by transfer pricing, since minority ownership provides an incentive (all else equal) to shift profits away from such affiliates. The reason is that minority ownership acts as an additional tax on profits, which makes it more profitable to shift profit income away from affiliates with minority owners.

Our result is the opposite of that under tax evasion and transfer pricing: Tax avoidance (tax planning) diminishes with the share of minority ownership. As pointed out above, tax avoidance by use of internal debt means that tax payments rather than profits (as under transfer pricing) are shifted, increasing tax obligations in the financial center, but reducing them in affiliates with minority owners. Thus, in contrast to tax evasion by transfer pricing where minority owners are abused, minority owners benefit under tax avoidance and debt shifting.

The optimal internal debt ratio can be deduced by inverting the first

[19]It should be noted that minority ownership does not affect external debt leverage, since the incentive for external debt is independent of the ownership structure.

order condition (4),

$$\sigma_i^* = C_\sigma'^{-1}\left(\left[\frac{t_i}{1-t_i} - \frac{t_1^e}{(1-J_i)\cdot(1-t_i)}\right]\cdot r\right), \tag{9}$$

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

$$\psi_i\left(t_i, t_1^e, J_i\right) = \left(t_i - \frac{t_1^e}{1-J_i}\right)\cdot r\cdot\sigma_i^* - (1-t_i)\cdot C_\sigma(\sigma_i^*). \tag{10}$$

For $t_i > \frac{t_1^e}{1-J_i}$ 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

$$\alpha_i^* = C_\alpha'^{-1}\left(\frac{t_i\cdot r}{1-t_i}\right), \tag{11}$$

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

$$\gamma_i(t_i) = t_i\cdot r\cdot\alpha_i^* - (1-t_i)\cdot C_\alpha(\alpha_i^*) > 0. \tag{12}$$

3.2 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

$$\tilde{r}_i = r - t_i\cdot r\cdot\alpha_i^* + (1-t_i)\cdot C_\alpha(\alpha_i^*) - \left(t_i - \frac{t_1^e}{1-J_i}\right)\cdot r\cdot\sigma_i^* + (1-t_i)\cdot C_\sigma(\sigma_i^*) \tag{13}$$

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

(9) to (13) in the profit function of the MNC, the maximization problem for the choice of capital and labor is

$$\max_{L_i,K_i} \sum_i (1-J_i)\cdot\{(1-t_i)\left[F(K_i,L_i)-w_i\cdot L_i-C_i^M(J_i)\right] - [r-\gamma(t_i)-\psi_i(t_i,t_1^e,J_i),]\cdot K_i\}. \tag{14}$$

The first order conditions are given by

$$F_L^i = w_i, \tag{15}$$

$$F_K^i = \frac{r}{1-t_i}-\frac{\gamma_i(t_i)}{1-t_i}-\frac{\psi_i(t_i,t_1^e,J_i)}{1-t_i}, \tag{16}$$

where the two last terms on the right hand side of equation (16) 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). Furthermore, the higher the corporate tax rate, the larger is the subsidy from debt on the user costs of capital.

Equations (15) and (16) also enable us to derive the marginal rate of technical substitution (MRTS) between capital and labor as follows

$$-\frac{dK_i}{dL_i}=\frac{F_L^i}{F_K^i}=\frac{w_i}{r-\frac{\gamma_i(t_i^*)}{1-t_i}-\frac{\psi_i(t_i,t_1^e,J_i)}{1-t_i}}. \tag{17}$$

Equation (17) 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.[20]

It is worth pointing out that the effects described in equations (16) and (17) 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.

4 Optimal Minority Ownership Share

As shown above, 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 (13) and applying the envelope theorem, we find

$$\frac{\partial \tilde{r}_i}{\partial J_i} = \frac{t_1^e}{(1 - J_i)^2} \cdot r \cdot \sigma_i^* > 0,\ i > 1. \tag{18}$$

Equation (18) shows that the effective user costs of capital $\tilde{r}_i$ 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 become 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

$$\varepsilon_{\tilde{r}_i J_i} = \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} > 0,\ i > 1. \tag{19}$$

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

Furthermore, we have that

$$\frac{\partial \tilde{r}_i}{\partial J_1} = -\frac{t_1}{(1-J_i)} \cdot r \cdot \sigma_i^* < 0,\ i > 1. \tag{20}$$

Equation (20) shows that if the financial center had minority owners and their share of ownership increased, this would lead to higher leverage ratios in affiliates $i > 1$. The reason is that a larger part of the costs arising in the financial center would then be borne by its minority owners making the use of of internal debt cheaper. Consequently, the effective interest costs $\tilde{r}_i$, for affiliates $i > 1$ fall.

The results in (20) do not hold for the financial center. For $i = 1$, the internal leverage ratio cancels in equation (13) and it follows that

$$\frac{\partial \tilde{r}_1}{\partial J_1} = 0. \tag{21}$$

From equation (21) 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 (13). The maximization problem is given by

$$\begin{aligned}\max_{J_i} \Pi = \sum_i (1-J_i) \cdot \{(1-t_i)\left[F(K_i^*, L_i^*) - w_i \cdot L_i^* - C_i^M(J_i)\right] \\ -\tilde{r}_i(J_i, J_1) \cdot K_i^*\}.\end{aligned} \tag{22}$$

Starting with the first order condition for minority ownership share in the

financial center $i = 1$, we find

$$\frac{\partial \Pi}{\partial J_i} = -\left(\pi_1 - t_1 \pi_1^t\right) - \sum_{i>1} (1 - J_i) \underbrace{\frac{\partial \tilde{r}_i}{\partial J_1}}_{(-)} K_i^* - (1 - J_1) \underbrace{\frac{\partial C_1^M}{\partial J_1}}_{(-)} \geq 0. \qquad (23)$$

In equation (23), the second and third terms 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 but the financial center, while the third term is the marginal reduction in market entry costs of 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 (23) is strictly positive meaning that the MNC would like to have a minority ownership share that is 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. In general, the lending activities of the financial center will make it less profitable compared to other firms in country 1 that do not engage in such lending operations, discouraging potential minority owners to take an equity position in the financial center.

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

$$\left\{ x_i - w_i L_i^* - C_i^M(J_i) - \frac{\tilde{r}_i K_i^*}{(1 - t_i)} \right\} + \frac{(1 - J_i)}{(1 - t_i)} \frac{\partial \tilde{r}_i}{\partial J_i} K_i^* = -(1 - J_i) \frac{\partial C_i^M}{\partial J_i}, \quad (24)$$

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

Equation (24) balances the costs and benefits of having minority owners. The right hand side (RHS) of equation (24) 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 left hand side (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 $\varepsilon_{C_i^M J_i} = -\frac{\partial C_i^M}{\partial J_i} \frac{J_i}{C_i^M} > 0$, and let the production elasticities be $\varepsilon_{x_i a_i} = \frac{\partial F_i}{\partial a_i} \frac{a_i}{x_i} > 0$, $a_i = \{L_i, K_i\}$. Applying these definitions as well as the interest rate elasticity (19) in equation (24), after having substituted optimal labor and capital demand from equations (15) and (16), 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

$$\frac{J_i^*}{1 - J_i^*} = \frac{\varepsilon_{C_i^M J_i} \cdot \frac{C_i^M}{x_i} - \varepsilon_{\tilde{r}_i J_i} \cdot \varepsilon_{x_i K_i}}{1 - \varepsilon_{x_i L_i} - \varepsilon_{x_i K_i} - \frac{C_i^M}{x_i}} \tag{25}$$

Note that the lower bound for optimal minority ownership is $J_i = 0$, even if the fraction on the RHS is negative in equation (25). 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 (25) we see that the optimal minority ownership share, J_i, for $i > 1$, is higher the more effective it is in reducing market entry costs, i.e., the larger $\varepsilon_{C_i^M J_i}$is. It is lower, the larger the profit income in affiliate i (i.e., the larger is the denominator) is. 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., $\varepsilon_{x_i K_i} > 0$).

5 Empirical Evidence

One of the main findings of our model is the prediction that both internal and external debt can be used to save tax payments. There are several empirical studies showing that debt, and especially internal debt, is used for tax planning purposes. These studies show that the effect of tax rate differences is (highly) significant, but mostly rather small. Findings consistent with this observation are found in Desai et al. (2004a), relying on US data, Mintz and Smart (2004), using data from Canada, Huizinga et al. (2008), exploiting the European Amadeus data base, and Büttner et al. (2009), who replicate Desai et al. using German data.

Minority ownership and its effect on tax planning is investigated in several papers. 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 purely empirical and suggests that there is an increased appetite for control by multinational parents. They attribute this to three different types of coordination costs. The first relates to conflicts that may arise between minority owners and MNCs since MNCs have an incentive to shift profits away from affiliates with minority owners. The second factor pertains to the fact that MNCs run the risk of having their technology appropriated by local partners. Finally, MNCs have a desire to structure production worldwide and this desire holds the potential for conflict with minority owners. Our analysis shows that there is also a fourth cost element at play. There is a fiscal externality related to minority ownership and debt shifting that makes it more attractive for the MNC to wholly own affiliates, since wholly owned affiliates have more tax-efficient financing structures.

The fiscal externality related to debt shifting and partial ownership that we have derived seems actually to be captured by Desai et al. (2004b). In Table 2 (columns 3 and 4) they compare the effect of taxes on the reported profitability of partially owned and wholly owned affiliates. They state that (see page 341) *"the reported profitability of partially owned affiliates is considerably less sensitive to local tax rates than is the reported profitability of wholly owned affiliates."* Their term "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.[21] Our analysis has shown that MNCs stand to gain less from tax planning in affiliates with minority owners. This should dictate that such affiliates are less tax sensitive than wholly owned affiliates.

The issue of minority ownership and tax avoidance strategies is dealt with in particular by Mintz and Weichenrieder (2005), and Büttner and Wamser (2007). Both these studies use the German MiDi (Bundesbank) data base. They show, in line with the predictions that follow from our model, that minority ownership exerts a negative effect on the use of internal debt. In particular, Büttner and Wamser (2007, p. 22) find that the leverage ratio of internal debt is five (respectively two) percentage points higher in wholly owned (respectively partially-owned) subsidiaries compared to non-majority owned ones.

It should be pointed out that Mintz and Weichenrieder (2005) do not have a model to back their regression results, and Büttner and Wamser (2007) do not model minority ownership. Both studies, however, explain the higher internal debt content in wholly owned affiliates by arguing along the lines of Desai et al. (2004b); the argument being that minority ownership exerts a negative effect on the use of internal debt due to increased coordination

[21] In our analysis we have ruled out the case where the MNC is a minority owner in an affiliate.

costs in shared ownership. Mintz and Weichenrieder (2005, p. 11) also argue that minority owners are not in favor of tax planning and profit shifting. They state: *"Coordinating several owners may be difficult if these owners face different financing and tax conditions – after all, minority shareholders of a subsidiary do not benefit in the same manner from world-wide tax minimization strategies desired by the parent."*

In contrast, we show that minority owners benefit from tax planning, but that they do not pay the full costs associated with facilitating tax avoidance. This creates an externality which reduces the profitability of using internal debt in these affiliates. Put differently, the main reason why there is less internal debt in affiliates of MNCs with minority owners is not due to increased coordination costs, but to a *positive* externality. The use of internal debt implies that economic after-tax profit rises for all shareholders, but since minority owners do not contribute to paying for the subsequent rise in tax payments by the MNC's financial coordination center, the majority owner pays too much of the "investment cost" and does not reap the full benefit of his investment.

Our results and intuition also seem to fit to Japanese data on tax-motivated profit-shifting between affiliates in Japanese keiretsus. Gramlich et al. (2004) study how pre-tax profits in such affiliates are affected, compared to independent firms, and they define a keiretsu as a (diversified) industrial grouping sharing the same financial institutions or being organized around the same main bank. Though not dealing with internal debt in detail, Gramlich et al. (2004) show that a higher leverage significantly decreases taxable income (table 4). Moreover, pre-tax income decreases more sharply the closer the affiliation is to a keiretsu (p. 221). They do not find support for compensatory dividends between keiretsu members (table 6). The results by Gramlich et al. (2004) are not backed by a theoretical model and are sometimes lacking explanations, e.g., they confess on page 223, that *"there may be other vehicles beyond dividends for compensating income shifting among*

the keiretsu member firms."

If their dummy variable $K2$ for president's council members is interpreted as proxy for decreasing minority ownership, the effect of closer affiliation to the keiretsu on pre-tax income might be explained in line with our modeling of higher internal debt due to less minority ownership. Moreover, we have shown that compensating dividends from the lending to the borrowing affiliate **are** not necessary, as the tax-savings, and therefore the return on tax-avoidance, accrue in the *borrowing* affiliate. Thus, the more profit-shifting in the keiretsu that is done by internal debt, the weaker and the more insignificant the results on compensating dividends in Gramlich et al. (2004) should be expected to be.

In our modeling, we have neglected thin capitalization rules which introduce a cap on the amount of tax deductible (internal) debt. Such rules could either be interpreted as increasing the costs of internal debt or as explicit caps on the use of internal debt. Either type of rule would reduce the leverage ratio of internal debt and lead to higher effective capital costs. Other things being equal, this would reduce real investment. Including such rules in our analysis would, however, not change our results qualitatively as long as the MNC has some leeway in terms of manipulating its leverage ratio. This view is backed by empirical results in Büttner et al. (2006) and Weichenrieder and Windischbauer (2008). They find that thin capitalization rules decrease (intercompany) loans, but increase equity. However, they also find that these effects are so small that they probably do not affect real investment. Their explanation for this result is that firms can fairly easily circumvent thin capitalization rules by setting up a holding company structure. Moreover, the relevance of strict thin capitalization rules is theoretically challenged by the fact that weakening these rules is a dominant strategy in corporate tax competition (see Haufler and Runkel, 2008).

Another instrument used as an attempt to prevent profit-shifting via internal debt is CFC rules. If these rules apply, income from subsidiaries is

taxed in the home country of the MNC and the exemption principle does not apply. Taxation under CFC rules mostly requires that there is passive income and low taxation.[22] Relying on German Bundesbank MiDi data, Ruf and Weichenrieder (2009) find in an empirical study that German CFC rules are effective in reducing passive investments (i.e., setting up financial centers) in off-shore tax havens (such as the Cayman Islands and Barbados). However, they do not affect investments in the Benelux countries, since these are not deemed to be low-tax countries. Thus, the CFC rules do not apply in these countries despite the fact that they in many cases have more favorable tax rules than most low-tax countries.[23] Indeed, as a result of this a lot of MNCs have located their financial centers in the Benelux (see Mintz, 2004, section 2, and Weichenrieder and Mintz, 2008, section 2.1).

6 Conclusions

We show that MNCs can save tax payments by setting up tax-efficient financial structures and that both internal and external debt are used as instruments for tax avoidance. A main finding in our analysis is that affiliates of MNCs with minority owners have less internal debt and thus less developed tax-efficient financial structures than MNCs' affiliates that do not have minority ownership. The reason is that a MNC cannot reap the full benefit of tax planning when the value of tax savings must be shared with minority owners that do not contribute to funding tax planning activities. As a consequence, affilates with minority owners have a less efficient financial structure and higher rental costs of capital, and these costs reduce the optimal minority ownership share in affiliates of MNCs.

Our study has not explicitly investigated financial centers and their set up.

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

[23] Luxembourg and the Netherlands have very similar tax rules concerning financial centers as Belgium.

Such centers are often located in countries where the tax base is tailor made to internal banking, and where the tax base is narrow and often excludes financial transactions (as in the case of Belgium). Analyzing these financial centers in detail would require another type of model. This is left for future research.

A Appendix

A.1 Proof of Lemma 1

From $C'_\sigma(\sigma_i) \geq 0$ and FOC (4) we have $(1 - J_i)\ t_i - \lambda \geq 0$. 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 country 1 in order to minimize tax payments on shifted interest payments.

A.2 Productivity-enhancing Partial Ownership

In this Appendix we show that our results can be reproduced if we let the basis for partial ownership be productivity enhancing rather than letting it reduce 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., $K_i = E_i + D_i^E + D_i^I$, and we invoke the same assumptions as in the main text.

Minority ownership increases production and sales by improving access of an affiliate i to the domestic market and to the supply chain (see discussion in section 2 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

$$x_i(L_i, K_i, J_i) = F(L_i, K_i, J_i), \tag{26}$$

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

$$\varepsilon_{x_i a_i} = \frac{\partial F_i}{\partial_{a_i}} \frac{a_i}{x_i} > 0, \quad a_i = \{L_i, K_i, J_i\}. \tag{27}$$

The tax-efficient financial structure is not affected by how the gain from partial ownership is modeled so the results derived in Subsection 3.1 in the paper as well as the effective interest rate $\tilde{r}_i$ in affiliate i are still given by equation (13) as follows

$$\tilde{r}_i = r - t_i \cdot r \cdot \alpha_i^* + (1-t_i) \cdot C_\alpha(\alpha_i^*) - \left(t_i - \frac{t_1^e}{1-J_i}\right) \cdot r \cdot \sigma_i^* + (1-t_i) \cdot C_\sigma(\sigma_i^*). \tag{28}$$

The profit maximization problem with respect to optimal investment and optimal minority ownership share in Subsection 3.2 and Section 4 is now given by

$$\max_{L_i, K_i, J_i} \Pi = \sum_i (1-J_i) \cdot \{(1-t_i)\left[F(K_i, L_i) - w_i \cdot L_i\right] - \tilde{r}_i \cdot K_i\} \text{ s.t. } (28). \tag{29}$$

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

$$(1-J_i)\left\{(1-t_i)F_{L_i} - (1-t_i)w_i\right\} = 0 \tag{30}$$

and, by applying the definition of the production elasticity of labor, equa-

tion (27), the first order condition can be rearranged as follows

$$L_i^* = \frac{x_i \ \varepsilon_{x_i L_i}}{w_i}. \tag{31}$$

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

$$(1 - J_i)\left\{(1 - t_i)F_{K_i} - \tilde{r}\right\} = 0, \tag{32}$$

which we use to derive

$$K_i^* = (1 - t_i)\ \frac{x_i \ \varepsilon_{x_i K_i}}{\tilde{r}_i}. \tag{33}$$

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 (33) and (31) yields the optimal capital intensity as

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

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 17 in the paper and equation (34) above amends and replaces equation (17).

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 (28) and applying the envelope theorem, we find

$$\frac{\partial \tilde{r}_i}{\partial J_i} = \frac{t_1^e}{(1-J_i)^2} \cdot r \cdot \sigma_i^* > 0. \tag{35}$$

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

$$\varepsilon_{\tilde{r}_i J_i} = \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} > 0. \tag{36}$$

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

$$\frac{\partial \tilde{r}_i}{\partial J_1} = -\frac{t_1}{(1-J_i)} \cdot r \cdot \sigma_i^* < 0, \quad i > 1, \tag{37}$$

As before, the internal leverage cancels out in the expression for the effective capital costs of the financial center, $\tilde{r}_1$, and we have

$$\frac{\partial \tilde{r}_1}{\partial J_1} = 0. \tag{38}$$

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

$$\underbrace{(1-t_i)\left[x_i - w_i L_i\right] - \tilde{r}_i K_i}_{=\pi_i - t_i \cdot \pi_i^t} + (1-J_i)\frac{\partial \tilde{r}_i}{\partial J_i} K_i = (1-J_i)(1-t_i)F_{J_i}. \tag{39}$$

Rearranging equation (39) leads to

$$\begin{aligned} -(1-t_i)\left[x_i - \frac{1-J_i}{J_i} F_{J_i} \frac{J_i}{x_i} x_i\right] &+ (1-t_i) w_i L_i \\ &+ \left[\tilde{r}_i - \frac{1-J_i}{J_i} \frac{\partial \tilde{r}_i}{\partial J_i} \frac{J_i}{\tilde{r}_i} \tilde{r}_i\right] K_i = 0. \end{aligned} \tag{40}$$

Applying the definitions of the production elasticities, equation (27), as well as the interest rate elasticity, that is equation (36), and substituting for

optimal labor and capital demand in equations (31) and (33), we have

$$-\left[1-\frac{1-J_i}{J_i}\ \varepsilon_{x_iJ_i}\right]+\varepsilon_{x_iL_i}+\varepsilon_{x_iK_i}\left[1-\frac{1-J_i}{J_i}\ \varepsilon_{\tilde{r}_iJ_i}\right]=0. \tag{41}$$

Collecting terms, the optimal minority ownership share is given by

$$\frac{J_i^*}{1-J_i^*}=\frac{\varepsilon_{x_iJ_i}-\varepsilon_{x_iK_i}\ \varepsilon_{\tilde{r}_iJ_i}}{1-\varepsilon_{x_iL_i}-\varepsilon_{x_iK_i}} \tag{42}$$

in affiliate $i>1$, where $1-\varepsilon_{x_iL_i}-\varepsilon_{x_iK_i}>0$ as long as the production function has non-increasing returns to scale. The discussion and interpretations follow the same lines as in Section 4.

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