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Capital Structure and International Debt Shifting

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Abstract: This paper presents a model of a multinational firm's optimal debt policy that incorporates international taxation factors. The model yields the prediction that a multinational firm's indebtedness in a country depends on a weighted average of national tax rates and differences between national and foreign tax rates. These differences matter as multinationals have an incentive to shift debt to high-tax countries. The predictions of the model are tested using a novel firm-level dataset for European multinationals and their subsidiaries, combined with newly collected data on the international tax treatment of dividend and interest streams. Our empirical results show that a foreign subsidiary's capital structure reflects local corporate tax rates as well as tax rate differences vis-à-vis the parent firm and other foreign subsidiaries, although the overall economic effect of taxes on leverage appears to be small. Ignoring the international debt shifting arising from differences in national tax rates would understate the impact of national taxes on debt policies by about 25%.

Key words: corporate taxation, financial structure, debt shifting
JEL classifications: F23, G32, H25

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1. Introduction

Despite the seminal work by Modigliani and Miller (1958) and Miller (1977) highlighting the importance of differences in marginal tax rates for optimal debt policy of firms, the empirical literature on capital structure choice has so far not been very successful in identifying the importance of the relative tax advantage of debt with respect to retained earnings for firm leverage (Rajan and Zingales, 1995). This paper shows that national tax policies do matter for corporate debt structures, using a unique dataset on internal debt positions of multinational firms and their foreign subsidiaries.

In most countries, interest expenses are deductible for corporate tax purposes while dividends have to be paid out of net-of-tax corporate income. Most tax systems thus favor debt finance over equity finance, but to different degrees given the dispersion in top statutory corporate tax rates. In determining their financial structure, purely domestic firms only have to deal with the domestic tax system. Multinational firms, however, face the more complicated choice of determining their overall indebtedness and the allocation of their debts to the parent firm and the subsidiaries across all countries in which the multinational operates. As a consequence, the financial structure of a multinational firm is expected to reflect the tax systems of all the countries where it operates.

In an international setting, the tax costs of debt and equity finance depend on the combined tax systems of the subsidiary and parent countries of the multinational firm. Dividends, as indicated, have to be paid out of the subsidiary's income after subsidiary-country corporate tax and in addition may be subject to a non-resident dividend withholding tax in the subsidiary country. In the parent country, the dividend income may again be subject to corporate income tax. If so, double tax relief may or may not be provided for the previously paid corporate income and non-resident withholding tax. The tax costs of equity finance thus reflect tax rates as well as the double-tax relief convention used by the parent

country. This paper collects detailed information on all of these aspects of the international tax system for European multinationals.

A firm's financial policies are affected by tax as well as non-tax considerations. A non-tax consideration is that indebtedness of the overall multinational firm should not be too high to keep the probability of costly bankruptcy low. In contrast, an advantage of debt finance is that it reduces the free cash flow within the firm and hence can act as a disciplining device for otherwise overspending managers. The disciplining properties of debt finance can explain generally positive debt levels at each of a multinational's individual establishments (i.e., its parent company and its foreign subsidiaries). These various considerations give rise to an optimal overall capital structure for the overall multinational firm for non-tax reasons.

This paper first presents a model of the optimal overall capital structure of the multinational firm reflecting tax and non-tax factors. Generally, the tax advantages of debt finance lead the firm to choose a higher leverage than would be desirable for purely non-tax reasons. At the same time, a change in tax policy optimally causes the firm to rebalance its capital structure in all the countries where it operates. Specifically, stronger incentives for debt finance in one country encourage debt finance in that country but at the same time discourage debt finance in other countries to keep the overall indebtedness of the multinational in check. The model yields the result that the optimal debt to assets ratio at any establishment of the multinational is positively related to the national tax rate and to differences between the national and foreign tax rates. The relevant tax rates in this regard are the effective tax rates that take into account any double taxation and double taxation relief. International tax rate differences matter, as they determine the incentives to shift debt internationally within a multinational firm.

Next, the paper presents evidence on the impact of taxation on firm indebtedness for a sample of 32 European countries over the period 1994 through 2003 using a unique firm-

level database on the financial structure of domestic and multinational firms, including their parent companies and their subsidiaries. For stand-alone domestic firms, our estimation implies that a 10 percentage points increase in the overall tax rate (reflecting corporate income taxes and non-resident dividend withholding taxes) increases the ratio of liabilities to assets by 1.8 percentage points, a rather small effect compared to the sample standard deviation of this leverage ratio of 21 percentage points. For multinational firms, the leverage ratio is found to be more sensitive to taxation on account of international debt shifting. As an example, we can consider a multinational with two equal-sized establishments in two separate countries. A 10 percentage points overall tax increase in one country is found to increase the leverage ratio in that country by 2.4 percentage points, while the leverage ratio in the other country decreases by 0.6 percentage points.

We also find that corporate debt policy appears to reflect local, source-level taxes rather than residence-level taxes levied on a multinational's worldwide income, perhaps because these latter taxes can often be deferred. Similarly, debt policy appears to reflect corporate income taxation rather than bilateral non-resident dividend withholding. In practice, multinationals may be able to avoid bilateral withholding taxes through triangular arbitrage involving a conduit company in a third country.

Several authors consider the relationship between firm leverage and taxation with U.S. data. Among these, MacKie-Mason (1990) and Gordon and Lee (2001) identify a tax effect by exploiting the different effective taxation faced by previously loss-making firms and firms of different sizes, respectively. Graham (2000) calculates the value of the tax benefits of debt finance for the U.S. case. Using Italian data, Alworth and Arachi (2001) find a positive effect of both corporate and personal income tax rates on financial leverage. Studies that use cross-country data have the advantage that they allow for international variation in tax rates. Examples are Rajan and Zingales (1995) and Booth, Aivazian, Demirgüc-Kunt and

Maksimovic (2001). The latter set of authors finds a weak effect on leverage for a tax variable that measures the tax shield of debt finance. Next, there is a set of papers that consider the debt finance of multinationals with either parent companies or subsidiaries in the United States. Specifically, Hines and Hubbard (1990), Collins and Shackelford (1992), Froot and Hines (1992), Grubert (1998) and Altshuler and Grubert (2003) provide evidence that U.S. multinational financial structure and the pattern of intra-firm interest and other income flows are consistent with tax minimization objectives. Using German data, Ramb and Weichenrieder (2004) and Mintz and Weichenrieder (2005) find a positive effect of taxation on the leverage of German inbound and outbound FDI, respectively. Newberry and Dhaliwal (2001) find that the debt issuance location of U.S. multinationals is affected by these firms' jurisdiction-specific tax-loss carry-forwards and binding foreign tax credit limitations on the value of debt tax shields. Desai, Foley and Hines (2004) find that both the internal and external financing of outward U.S. FDI is sensitive to foreign tax rates. Mills and Newberry (2004) analogously find that non-U.S. multinationals from countries with relatively low tax rates use relatively intensive debt finance of their foreign controlled corporations in the United States.

Jog and Tang (2001) consider the leverage of firms in Canada that may or may not be part of U.S.-based or Canadian-based multinationals. The debt-to-assets ratios of Canadian corporations without foreign affiliates are found to be more sensitive to Canadian tax rates than the debt-to-assets ratios of U.S. controlled corporations located in Canada. Using data for member countries of the European Union, Moore and Ruane (2005) examine the leverage of 8,500 foreign subsidiaries. They find that leverage ratios of these subsidiaries are sensitive to the local corporate tax rate, unless the parent country operates a foreign tax credit system. Our paper nests the approaches of the latter two papers by considering how both multinational firm structure and the international tax system affect leverage in Europe.

Hence, we take into account whether a firm is a parent or a subsidiary of a multinational or a domestic firm. At the same time, we account for the tax systems of all the countries where the multinational operates. By including parent fixed effects (and in some robustness tests subsidiary fixed effects) we can abstract from common factors across subsidiaries of the same parent company that affect corporate debt policy, unlike much of the empirical capital structure literature that tends to use data on aggregate debt of corporate groups as a whole.

Our paper is closely related to Collins and Shackelford (1998) who study the impact of taxes on cross-country payments between foreign affiliates of U.S. multinationals. They consider a broad range of payment transfers, including dividend, interest, royalty, and management fee payments. They find that dividend, interest, and royalty payments are structured to mitigate non-U.S. taxes. There are a number of important differences between their study and ours. First, they focus on the use of deductible payments to shift income from high-tax to low-tax environments, while we focus on the implications of bilateral tax differences on the capital structure of firms. Second, they consider transfers of expenses (such as interest payments) while we consider transfers of liabilities (debt). In other words, they examine shifting on a flow basis while we use stock variables. Third, we consider only shifting associated with taxes on interest and dividend payments, while they also consider royalties and compensation fees. Unfortunately, we do not have information on royalty and management fee payments for the firms in our sample. Fourth, they analyze aggregated payment transfers between country-pairs at the country level, while we study debt shifting at the subsidiary level. Fifth, and importantly, they study the impact of bilateral tax differences on payment transfers between subsidiaries in two countries (country pairs), while we take a multilateral approach to investigate how shifting between subsidiaries is affected not only by bilateral tax differences between the location of the two subsidiaries (as they do) but also

(indirectly) by tax differences vis-à-vis the parent firm and subsidiaries in all other countries. Nevertheless, we see our work as complementary to theirs.

The main contribution of our paper is to explore in an international context the possibility that multinationals set the capital structure of individual subsidiaries by taking into account the tax rate faced by all other subsidiaries of the firm. Unlike previous research, our modeling and our empirical work take a fully multilateral approach studying the effect of taxation on firm leverage in a matrix setting of Nx Ncountries. Our finding that subsidiary leverage within a multinational firm responds to bilateral tax rate differences vis-à-vis both the parent firm and other foreign subsidiaries provides direct support for this multilateral approach.

In the remainder of this paper, Section 2 describes the international tax treatment of the debt and equity finance of multinational firms. Section 3 presents the model. Section 4 discusses the company-level data. Section 5 presents the empirical results. Section 6 presents robustness tests and extensions of our main results. Section 7 concludes.

2. The international tax system

This section describes the main features of the corporate income tax system applicable to a multinational firm with subsidiaries in one or more foreign countries.[1] To fix ideas, let us consider a multinational firm that operates a foreign subsidiary in country i and has the parent firm in country p. The deductibility of interest expense from corporate income implies that the corporate income tax bill of the multinational firm is reduced with external debt finance.[2]

[1] Although numerous papers provide evidence consistent with firm policy being affected by stockholder taxes (e.g., Elton and Gruber, 1970; Poterba and Summers, 1984; Barclay, 1987; Michaely, 1991; Allen and Michaely, 2003; Chetty and Saez, 2005), we assume that multinationals do not take into account the taxation of dividend, interest and capital gains at the investor level. We also abstract from clientele effects, as described in Elton and Gruber (1970) and Allen et al. (2000).

[2] Of course, debt holders still pay income taxes on interest income received.

Dividends paid by the subsidiary to the parent firm in contrast are generally subject to corporate taxation in at least one country.

The subsidiary's income in county i is first subject to the corporate income tax t_i in this country. The second column of Table 1 indicates the statutory corporate tax rate on corporate profit for a sample of 32 European countries in 2003. Data on corporate tax rates for each of the years in the 1994-2003 sample period are provided in Appendix A. For illustrative purposes, in Tables 1 to 5 in the text we report the figures for the taxation variables only for the year 2003, although we have collected tax data for the entire 1994-2003 period.[3] The corporate tax rates in Table 1 include regional and local taxes as well as specific surcharges. Germany has the highest tax rate at 39.6%, while Ireland is at the bottom with a tax rate of 12.5%. These corporate tax rates and all other tax system information in this paper has been collected from the International Bureau of Fiscal Documentation and various websites of national ministries of finance.

The subsidiary pays out its after-tax corporate income as a dividend to the parent company. The subsidiary country may levy non-residents a withholding tax w_i^e on this outgoing dividend income. Bilateral dividend withholding taxes in Europe for 2003 are presented in Table 2. These rates are zero in most – but not in all – cases. Specifically, they are zero among long-standing EU member states on account of the EU Parent-Subsidiary Directive. New EU member states such as the Czech Republic, Hungary, Poland and Slovenia still maintain non-zero dividend withholding taxes vis-à-vis considerable numbers of European countries in the year prior to their accession. Non-EU member states such as Bulgaria, Romania, and Russia similarly maintain non-zero dividend withholding taxes in a considerable number of cases. For example, the withholding tax in Romania on dividend payment from a Romanian subsidiary to an Austrian parent company is 10%, while the

[3] The complete dataset on the international tax data collected is available upon request from the authors.

withholding tax in Austria on dividends paid by an Austrian subsidiary to its Romanian parent is 15%. The combined corporate and withholding tax rate in the subsidiary country is seen to be $1-(1-t_i)(1-w_i^e)$ or $t_i + w_i^e - t_i w_i^e$.

The parent country subsequently may or may not use its right to tax the income generated abroad. In case the parent country operates a territorial or source-based tax system, it effectively exempts foreign-source income from taxation. The effective marginal tax on income reported in country *i*, denoted τ_i, in this instance equals combined corporate and withholding tax $t_i + w_i^e - t_i w_i^e$ in country *i*.[4] Alternatively, the parent country operates a worldwide or residence-based tax system. In this instance, the parent country subjects income reported in country *i* to taxation, but it generally provides a foreign tax credit for taxes already paid in country *i* to reduce the potential for double taxation. The OECD model treaty, which summarizes recommended practice, in fact gives countries the choice between an exemption and a foreign tax credit as the only two ways to relieve double taxation (OECD, 1997). The foreign tax credit reduces domestic taxes on foreign source income one-for-one with the taxes already paid abroad. The foreign tax credit can be indirect in the sense that it applies to both the dividend withholding tax and the underlying subsidiary country corporate income tax. Alternatively, the foreign tax credit is direct and applies only to the withholding tax. In either case, foreign tax credits in practice are limited to prevent the domestic tax liability on foreign source income from becoming negative.

In the indirect credit regime, the multinational will effectively pay no additional tax in the parent country, if the parent tax rate t_p is less than $t_i + w_i^e - t_i w_i^e$. The multinational then has unused foreign tax credits and is said to be in an excess credit position. Alternatively, t_p exceeds $t_i + w_i^e - t_i w_i^e$. In that instance, the firm pays tax in the parent country at a rate equal

[4] Note that for the parent firm we have that the effective tax rate on corporate income equals the statutory rate, or $\tau_p = t_p$.

to the difference between t_p and $t_i + w_i^e - t_i w_i^e$. The effective, combined tax rate on the dividend income, τ_i, then equals the parent country tax rate, t_p. To summarize, with the indirect credit system the effective rate on income generated in country i, τ_i, is given by max $[t_p, t_i + w_i^e - t_i w_i^e]$. In case of a direct foreign tax credit, the multinational analogously pays no additional tax in the parent country, if the parent tax rate t_p is less than w_i^e. In the more common case where t_p exceeds w_i^e, the firm instead pays tax in the parent country at a rate equal to $(1-t_i)(t_p - w_i^e)$. The effective, two-country tax rate, τ_i, with the direct credit system is now given by $t_i + (1-t_i)\max[t_p, w_i^e]$. A few countries with worldwide taxation do not provide foreign tax credits, but instead allow foreign taxes to be deducted from the multinational's taxable income. Under this deduction method, foreign taxes are essentially seen as a tax-deductible cost of doing business at par with other business costs. In the scenario, the effective rate of taxation on dividends, τ_i, is given by $1-(1-t_i)(1-w_i^e)(1-t_p)$.

The third and fourth columns of Table 1 provide information on the double taxation rules applied to incoming dividend. As reflected in the table, several countries are seen to discriminate between international tax treaty partners and non-treaty countries. Finland and Spain, for instance, exempt dividend income from treaty partners, while they provide a direct and indirect foreign tax credit in case of non-treaty counties, respectively. Note that signing a tax treaty makes the granted double tax relief more generous in these instances.

Across the categories of treaty and non-treaty countries, the exemption system is seen to be the most common method of double tax relief, followed by foreign tax credits. At the same time, indirect foreign tax credits regimes are somewhat more common than direct foreign tax credits. As an exceptional case, the Czech Republic is seen to apply the deduction method to foreign dividends from non-treaty countries, while Russia and the Slovak Republic provide no double tax relief at all to such income.

The tendency to discriminate double tax relief on the basis of the existence of a tax treaty makes it necessary to know whether a bilateral tax treaty is indeed effective. Table 3 indicates with a binary variable whether any two countries had a tax-treaty in force by 2003.[5] Specifically, the table denotes whether a tax treaty was in force on income received by countries listed in the rows and originating from countries listed in the columns of the table. For example, the table shows that a bilateral tax treaty was in place in 2003 between Finland and all other countries in the sample except Cyprus. As a consequence, dividends coming into Finland from these treaty countries are exempt from taxes in Finland, while dividends coming into Finland from Cypriot subsidiaries benefit only from a direct tax credit.

Combining the data displayed in Tables 1 to 3, we compute the effective corporate tax rates on cross-border dividends, τ_i, for all countries in our sample for the period 1994-2003. For example, the effective tax rate on dividends from a Czech subsidiary of an Austrian parent company for the year 2003 is calculated as follows. Table 3 shows that a bilateral tax treaty was in place between Austria and the Czech Republic. The third column of Table 1 shows that foreign dividends are exempt from taxes in Austria for treaty countries like the Czech Republic. From the discussion above we know that the effective marginal tax rate (τ_i) in case of exemption of foreign-source income amounts to $t_i + w_i^e - t_i w_i^e$. The first column of Table 1 shows that the statutory tax rate t_i in the Czech Republic is 31%. From Table 2 we know that the relevant withholding tax w_i^e for the Czech subsidiary is 10%. The effective marginal tax rate for this subsidiary is therefore 37.9% (=0.31+0.10-0.31*0.10).

[5] Most of the 32 countries in our sample had such treaties with each other. For instance, France, Germany, Norway, Poland, Sweden and the United Kingdom have a double-tax treaty in force with all other countries. However, the treaty network of some countries – in particular some of the new EU member states and some non-EU countries – are far from complete. Note that the table is not exactly symmetric because the date of entry into force of a treaty may slightly differ between two treaty partners. For example, while Bulgaria and Croatia had both signed a bilateral tax treaty by 2003, the treaty had only entered into force in Bulgaria (on income from Croatia).

As a second example, we take the opposite case: the effective tax rate on dividends from an Austrian subsidiary of a Czech parent company for the year 2003. From Table 3 we know that a bilateral tax treaty was in place between Austria and the Czech Republic. The third column of Table 1 shows that the Czech Republic applies an indirect credit system to foreign dividends from treaty countries like Austria. From the discussion above we know that with the indirect credit system the effective marginal tax rate (τ_i) is given by max $[t_p, t_i + w_i^e - t_i w_i^e]$. The first column of Table 1 shows that the statutory tax rate t_i in Austria is 34% and the statutory tax rate t_p in the Czech Republic – the parent country – is 31%. From Table 2 we know that the relevant withholding tax w_i^e for the Austrian subsidiary is 10%. The effective marginal tax rate for this subsidiary is therefore 40.6% (=max [0.31, 0.34+0.10-0.34*0.10]).[6]

In practice, multinationals use equity as well as internal debt to provide own resources to their foreign subsidiaries. Thus, leverage is likely to be affected by the taxation of dividends, as considered so far, and by the taxation of interest on internal debt. To reflect this in our empirical work, we use a variable φ_i to denote the effective tax rate on cross-border dividends (τ_i) minus an analogous effective rate of tax on interest. Hence, φ_i captures the relative taxation of equity relative to internal debt (or the relative tax advantage of internal debt versus equity). Higher φ_i discourages equity finance and should lead to a higher debt to assets ratio. Interest expense on internal debt is generally deductible from taxable corporate income in the subsidiary country. The interest income from such internal debt flowing to the

[6] To check the quality of our data, we were provided with a free sample of bilateral tax rates on dividends for the EU-15 in 2003 by COMTAX (http://www.comtaxit.com), a Swedish company specializing in international tax planning services. Only two small differences appeared between our database and theirs. First, in cases involving Portugal we take into account the 10% municipal surcharge. Second, in the cases of Italian parent firms and French or British subsidiaries, taxpayers had the choice between applying the EU parent-subsidiary directive (as assumed in our case) or applying for an imputation credit in Italy (as assumed by COMTAX). Otherwise, rates are identical (or very similar reflecting differences in rounding). None of these differences affect our results.

parent company thus reduces the corporate income tax bill in the subsidiary country but of course still faces corporate income tax in the parent country. As in the case of dividends, cross-border interest flows within the multinational firm may generally be subject to a non-resident withholding tax in the subsidiary country. Let w_i^d denote the bilateral non-resident interest withholding tax. As seen in Table 4, these tax rates are mostly zero on a bilateral basis for the countries in our sample, even if Belgium, Estonia, Latvia, Portugal and Romania continue to impose positive interest withholding taxes vis-à-vis almost all countries in our sample. As applied to internal interest flows, the parent country has three main options regarding double tax relief: (i) an exemption, (ii) a foreign tax credit, or (iii) a deduction. Table 5 provides information on the double taxation rules applicable to incoming interest from treaty and non-treaty signatory countries, respectively. The signing of a tax treaty, if anything, makes the double tax relief in case of interest flows more generous. Foreign-source interest flows are seen to benefit from a foreign tax credit in most countries, particularly in the case of interest payments originating from treaty partners. Clearly, the taxation of dividend income relative to interest income, φ_i, depends on the possibly different tax relief granted for dividends and for interest. Expressions for φ_i in the various possible combinations of double tax relief granted for dividend and interest income are provided in Table 6. Combining the data displayed in Tables 3 to 5 and the statutory corporate tax rates in Table 1, we compute the effective corporate tax rates on cross-border interest payments for all countries in our sample for the period 1994 through 2003 (in much the same way as we compute the tax rates on cross-border dividends). By subtracting these tax rates on cross-border interest from the relevant tax rates on cross-border dividends (see Table 6), we arrive at the relative taxation of equity and internal debt, φ_i.

To illustrate, let us again consider a Czech subsidiary of an Austrian parent company and compute φ_i for the year 2003. From our earlier calculations we know that the effective marginal tax rate (τ_i) on dividends is 37.9%. The effective marginal tax rate on interest payments is calculated as follows. Table 3 shows that a bilateral tax treaty was in place between Austria and the Czech Republic. The second column of Table 5 shows that Austria applies the credit system to cross-border interest payments from treaty countries like the Czech Republic. Table 6 shows that the effective marginal tax rate on interest payments in case of a foreign tax credit amounts to max[w_i^d , t_p], where w_i^d is the interest withholding tax and t_p is the statutory corporate tax rate in the parent country. The first column of Table 1 shows that the statutory tax rate t_p in Austria is 34%. From Table 4 we know that the relevant withholding tax w_i^d for the Czech subsidiary is 0%. The effective marginal tax rate on interest for this subsidiary is therefore 34% (=max[0, 0.34]). This implies a relative taxation of equity and internal debt, φ_i, of 3.9% (=37.9%-34%).

3. The model

The model considers a multinational that generally operates in n countries. The multinational is domiciled in country p, while it has foreign subsidiaries in one or more countries i with assets A_i. The subsidiary is financed with debt L_i, which for now we take to be external debt, and the parent firm's equity investment I_i. Hence, the balance sheet identity of a subsidiary implies $A_i = L_i + I_i$. The parent firm fully owns each subsidiary's equity I_i. In addition, the parent firm owns 'outside' assets A_p. The parent firm in turn can be financed through either debt L_p or equity E_p. Thus, the balance sheet identity for the parent can be stated as $A_p + \sum_{i \neq p}^{n} I_i = L_p + E_p$.

Let λ_i be the ratio of debt to assets for each establishment of the multinational, i.e., $\lambda_i = \frac{L_i}{A_i}$. Analogously, let λ_f be ratio of debt to assets for the entire firm, i.e., $\lambda_f = \frac{\sum_{i=1}^{n} L_i}{\sum_{i=1}^{n} A_i}$.

Alternatively, we can write λ_f as the asset-weighted average of the establishment-specific debt ratios λ_i, or $\sum_{i=1}^{n} \lambda_i \rho_i$, where $\rho_i = \frac{A_i}{\sum_{i=1}^{n} A_i}$ are the assets of establishment i as a share of the firm's total assets. Throughout, we will assume that the assets A_i of subsidiary i and the parent firm's 'outside' assets A_p are given.[7]

In deciding its financial structure, the multinational firm takes taxation as well as non-tax factors into account.[8] To start with the latter, the multinational recognizes that higher leverage increases the chance of bankruptcy. We will assume that the parent firm provides explicit or implicit credit guarantees for the debts of all its subsidiaries.[9] This implies that the chance of bankruptcy of the overall multinational firm depends on the firm-wide leverage ratio λ_f. Specifically, we will assume that expected bankruptcy costs, C_f, of the firm are quadratic in the overall leverage ratio λ_f and proportional to the firm's overall outside assets as follows[10]

$$C_f = \frac{\gamma}{2}(\lambda_f)^2 (\sum_{i=1}^{n} A_i) \qquad (1)$$

[7] In response to a change in I_i, the parent firm thus will change either L_p or E_p rather than A_p.
[8] See Hovakimian, Hovakimian and Tehranian (2004) for a recent discussion of the theoretical and empirical literature on target capital structures reflecting various costs and benefits of debt and equity.
[9] The guarantee need not be explicit but could be implicit. Reputation concerns or the subsidiary's importance to the firm's other operations may give the firm sufficient incentives to bail it out in the event of distress (e.g, Shapiro, 1978, and Stumpp et al., 2003). Stobaugh (1970) presents results of a survey showing that most CEOs of parent companies would bail out their distressed subsidiaries, even if they do not have an explicit guarantee. Kolasinski (2006) reports some statistics on explicitly guaranteed subsidiary debt for a sample of 1427 US firms over the 1990-2003 period and finds that about 31% of parent firms with subsidiary debt provide an explicit parent guarantee (see his Table 3).
[10] Bankruptcy costs are incurred by loss-making firms and hence are assumed not to be deductible from taxable corporate income.

Next, it is recognized that leverage may bring benefits in that it disciplines local managers and aligns their incentives more closely to those of the firm. High leverage at a subsidiary may, for instance, serve to prevent local managers from overspending on perks for themselves to prevent de jure bankruptcy of the subsidiary. On the other hand, high leverage may have the disadvantage of making local managers too risk-averse to the point where they do not make appropriate local investment decisions. In either case, the incentive effects of leverage are assumed to stem from the local leverage ratio λ_i for establishment i.[11] On the basis of these incentive considerations alone, let λ^* be the optimal leverage ratio at each of the multinational's establishments. Deviations of the leverage ratio at any establishment from the level λ^* are assumed to imply incentive-related costs to the firm. These costs are assumed to be quadratic in λ_i and proportional to the outside assets A_i at establishment i as follows:

$$C_i = \frac{\mu}{2}(\lambda_i - \lambda^*)^2 A_i - \frac{\mu}{2}\lambda^{*2} A_i \qquad i=1,\ldots, n \qquad (2)$$

Note that these cost functions are scaled to equal zero if the debt ratios λ_i are zero, which implies that C_i can be of either sign. Next, let V_L and V_u be the values of the levered and completely unlevered multinational firm, respectively. The two are different on account of the tax benefits of debt finance and of the (net) non-tax costs associated with debt finance. Specifically, V_L and V_u are related as follows

$$V_L = V_u + \sum_{i=1}^{n} \tau_i L_i - C_f - \sum_{i=1}^{n} C_i, \qquad (3)$$

where τ_i again is the rate of taxation of dividend income relative to interest income in locale i taking into account the overall international tax system.

[11] Higher local leverage may be disadvantageous if it increases the probability of losses that cannot be credited against profits made elsewhere in the firm. Losses that are not creditable per definition reduce the after-corporate-tax income of the firm one-for-one. For this reason, we assume that the costs associated with higher leverage at the establishment level are not deductible from taxable corporate income.

The multinational firm's objective is to maximize its overall firm value V_L in the leveraged state. Its instruments are the debt levels L_i at each establishment.[12] The first order conditions with respect to L_i – written in terms of leverage ratios – are given by

$$\tau_i - \gamma\lambda_f - \mu(\lambda_i - \lambda^*) = 0 \qquad i=1,\ldots, n \qquad (4)$$

The first order conditions jointly allow us to solve for the optimal value of λ_i as follows:

$$\lambda_i = \beta_0\lambda^* + \beta_1\tau_i + \beta_2\sum_{j\neq i}^{n}(\tau_i - \tau_j)\rho_j \qquad i=1,\ldots, n \qquad (5)$$

where $\beta_0 = (\frac{\mu}{\gamma+\mu})$, $\beta_1 = \frac{1}{\gamma+\mu}$, and $\beta_2 = (\frac{\gamma}{\mu(\gamma+\mu)})$.

In expression (5), the term $\beta_0\lambda^*$ is the optimal leverage ratio at all establishments on the basis of all non-tax considerations, or equivalently if all the τ_i's and τ_j's are equal to zero. The term $\beta_0\lambda^*$ can be seen to balance the expected costs of bankruptcy (with a value of λ above zero) against the costs of deviating from the optimal value of the leverage ratio λ^* on the basis of incentive considerations. Expression (5) further contains two tax-related terms. First, the term $\beta_1\tau_i$ reflects the impact of taxation on the optimal leverage ratio that would obtain for a purely domestic firm located in country *i*. For this reason, this term is dubbed the 'domestic' effect of taxation on leverage. Second, the term $\beta_2\sum_{j\neq i}^{n}(\tau_i - \tau_j)\rho_j$ reflects the impact of international tax rate differences on the optimal leverage in country *i* on account of international debt shifting. Interestingly, this term weights the international tax differences $\tau_i - \tau_j$ by the asset shares ρ_j. This reflects that the cost function C_i implies that it is relatively painless to shift (absolute) debt into or out of country *j,* if the assets in this country

[12] The firm recognizes all subsidiary and parent firm balance sheet identities, which means that the I_i are codetermined.

are relatively large. This second effect of taxation on leverage in country *i* is named the 'international' or 'debt-shifting' effect. Note that leverage λ_i in country *i* is negatively related to τ_j on account of the 'debt-shifting' effect.

The theoretical expression in (5) gives rise to the following regression equation

$$\lambda_i = \alpha_i + \beta_1 \tau_i + \beta_2 \sum_{j \neq i}^{n} (\tau_i - \tau_j) \rho_j + \varepsilon_i \qquad i=1,\ldots,n \qquad (6)$$

where α_i is a country-specific fixed effect and ε_i is an error term. In the benchmark case, the sample will consist of observations for all subsidiaries to the exclusion of parent firms, and we will include a range of firm-level and country-level control variables in the estimation.

4. The data

The data on multinational firms are taken from the Amadeus database compiled by Bureau Van Dijk.[13] This database provides accounting data on private and publicly owned European firms as well as on their ownership relationships. These ownership data allow us to match European firms with their domestic subsidiaries and subsidiaries located in other European countries. A firm is defined to be a subsidiary, if at least 50% of the shares are owned by another single firm. A multinational firm has at least one foreign subsidiary. Multinational firms tend to provide consolidated and unconsolidated accounting statements. Consolidated statements reflect the activities within the parent companies themselves and in all domestic and foreign subsidiaries. Non-consolidated statements in contrast reflect the activities directly within the parent firm and in each of its subsidiaries. The data we use on parent firms and subsidiaries are based on non-consolidated statements.

Information on the number of parent companies and subsidiaries – domestic and foreign – in our data set is provided in Panel A of Table 7. The total number of parent

companies is 5,791, while the total number of subsidiaries is 13,307. We have up to 10 years of data for each parent company and subsidiary for a total of 38,736 parent-year observations and 90,599 subsidiary-year observations. Note that Amadeus only provides information on subsidiaries located in one of the European countries listed in the table.[14] France, Spain and the United Kingdom each are home to at least 4,000 parent companies in the data set. Each subsidiary has a home country (i.e. the country of its parent company) and a host country where the subsidiary is located (therefore, for domestic subsidiaries, home and host countries are the same). For each country, the table lists the number of subsidiaries by home country (where the parent company is located) and by host country (where the subsidiary is located). The table reveals that, for instance, Germany and the Netherlands are the home country to relatively many subsidiaries. Hence, there are relatively many subsidiaries with a parent firm in one of these countries. Croatia, the Czech Republic and Romania instead are the host country to relatively many subsidiaries.

Panel B of Table 7 provides information on financial leverage and applicable tax rates. First, financial leverage is defined as the ratio of total nonequity liabilities to total assets (see Appendix B for variable definitions and data sources). Adjusted financial leverage, instead, is the ratio of total nonequity liabilities minus accounts payable minus cash to total assets minus accounts payable minus cash. These adjustments reflect that accounts payable are liabilities that reflect current operations rather than efforts to optimize the firm's capital structure. Similarly, the subtraction of cash reflects that cash may be on hand to pay off existing debts (e.g., Rajan and Zingales, 1995, who make similar adjustments to

[13] The database is created by collecting standardized data received from 50 vendors across Europe. The local source for this data is generally the office of the Registrar of Companies.

[14] The Amadeus database only contains information on European firms and we therefore only cover the European operations of the multinationals in our sample. We can therefore not consider how tax differences between European countries and other parts of the world affect the capital structure of subsidiaries in Europe. While this is an important caveat to be mentioned, we do not see this as a major limitation of our analysis because European multinationals typically derive much of their revenues from operations in Europe rather than other parts of the world.

leverage). In Panel B of Table 7, we see that the average parent company financial leverage of 0.62 indeed exceeds the average adjusted financial leverage of 0.49. Average financial leverage ranges from 0.36 for Russia and Slovenia to 0.80 for Romania. Interestingly, subsidiaries by host country have average financial leverage and adjusted financial leverage of 0.62 and 0.49, respectively – exactly equal to the averages for parent firms. Hence, there is no tendency for subsidiaries to be either more or less leveraged than parent firms. Next, the effective tax rate for subsidiaries by host country is seen to be highest for Germany at 0.49, and lowest for Estonia at 0.14. As discussed before, the effective tax reflects the taxation of dividends in the host country itself as well as the tax treatment of this income in any foreign parent country. The tax incentive to shift debt variable varies by subsidiary and host country and is the asset-weighted difference of the effective tax rate in the host country and the effective tax rates applicable to other establishments of the same multinational firm. A positive value of this variable indicates that multinationals on average have an incentive to shift debt into a particular host country, while a negative value indicates that multinationals on average have an incentive to shift debt out of the country. By this measure, subsidiaries hosted in Iceland and Germany have the largest incentive to attract debt, while subsidiaries located in Estonia and Hungary have the largest incentive to shift debt away.

Let us illustrate the calculation of the tax incentive to shift debt variable with an example. Let there be a corporate group that consists of two subsidiaries A and B and one parent company C, with all three entities having assets of equal size. The tax incentive to shift debt for subsidiary A, S_A, is then calculated as the asset-weighted difference of the effective tax rate applicable to A, τ_A, and the effective tax rates applicable to B and C, τ_B and τ_C, respectively. Specifically, $S_A = \sum_{j \neq i}^{n} (\tau_A - \tau_j)\rho_j = (\tau_A - \tau_B)\,1/3 + (\tau_A - \tau_C)\,1/3$. If τ_A is 0.5 and both τ_B and τ_C are 0.2, so that subsidiary A is located in a country with a relatively high tax

regime, then S_A equals 0.2, which being a positive number indicates that there exists an incentive to shift debt away from B and C to subsidiary A.

While financial leverage and adjusted financial leverage have remained remarkably constant over our sample period, averaging about 62% and 49%, respectively, our tax variables show quite some variability over our sample period (see Appendix C for year-by-year summary statistics). On average, we observe a gradual decline in effective marginal tax rates from about 38% in 1994 to 33% in 2003, largely due to a gradual reduction of statutory corporate tax rates across most of the European countries over this period. While the minimum effective tax rate observed across Europe stood at 25% in 1994, by the year 2003 there are firms that pay an effective tax rate of 0%. At the same time, the maximum observed tax rate has come down from 67% to 49%. The variation in marginal tax rates has also come down substantially from a standard deviation of more than 6% in 1994 to a standard deviation of about 4% in 2003. The tax incentive to shift debt variable, on the other hand, has somewhat increased on average over this period, from -0.1% in 1994 to 0.2% in 2003. At the same time, its variation has decreased somewhat, reflecting the overall decrease in effective marginal tax rates.

Panel C of Table 7 provides summary statistics of our leverage and tax variables as well as of control variables included in the subsequent estimation. The control variables are several firm-level variables derived from the firm's balance sheet or income statement as well as some country variables. Among the firm-level variables, tangibility is defined as the ratio of fixed assets to total assets. This variable captures that it may be relatively easy to borrow against fixed assets that could serve as collateral. As in previous work (e.g., Rajan and Zingales, 1995), we would therefore expect a positive relationship between tangibility of assets and firm leverage. On the other hand, depreciable assets such as fixed assets may act as a non-debt tax shield and are therefore a substitute for debt in taxable profit minimization

strategies (DeAngelo and Masulis, 1980). Firms may therefore select a level of debt which is negatively correlated to the level of fixed assets (and corresponding depreciation deductions). The relationship between tangibility and leverage is therefore theoretically ambiguous. Next, log of sales is the logarithm of sales, which we use as a proxy for firm size. This is a scaling variable to reflect that larger firms may have easier access to credit because they tend to be more diversified and less prone to bankruptcy (Rajan and Zingales, 1995). We therefore expect a positive relationship between firm size and firm leverage. Since leverage itself is a scaling variable, we expect a non-linear relationship between firm size and debt. In a robustness test, we use the log of total assets as proxy for firm size. We prefer to use sales as our main proxy for firm size because using assets would make firms that operate in industries that are asset intensive look disproportionately large. Next, profitability is the ratio of earnings before interest, taxes, depreciation and amortization to total assets. The theoretical predictions on the effects of profitability on leverage are conflicting. Profitable firms may be perceived to be relatively riskless, which would facilitate their access to credit. This would suggest a positive relationship between profitability and leverage. On the other hand, profitable firms may use their profits to pay down their debts or alternatively to finance investments through retained earnings (Myers and Majluf, 1984). This would suggest a negative relationship between profitability and leverage. Among the country variables, creditor rights is the annual index of creditor rights in a country from Djankov et al. (2005). Well-protected creditor rights are expected to encourage leverage. Next, political risk is the annual (December) index of political risk from the International Country Risk Guide. We inverted the scale from 0-100 with higher scores indicating greater risk. Firms in countries with high political risk may be more likely to be credit constrained because banks are less willing to lend in uncertain environments. On the other hand, high political risks may encourage borrowing from local creditors, as this is a way to reduce a multinational's value at

risk in a country. The relationship between political risk and leverage is therefore ambiguous. Inflation is the annual percentage change in the consumer price index from the World Development Indicators database of the World Bank. An inflationary environment may lead to higher risk premiums and nominal interest rates, discouraging debt finance. We therefore expect a negative relationship between inflation and leverage. Inflation may also decrease debt by reducing the real value of deductible interest payments, especially if those are based on debt valued at historical cost and if interest rates are fixed, thereby reducing the tax advantage of debt. Finally, the growth opportunities variable measures the median annual growth rate of sales in an industry in a particular country. Growth opportunities signal future profitability and possibly an ability to borrow (Harris and Raviv, 1991). We therefore expect a positive relationship between growth opportunities and firm leverage.

5. Empirical results

Table 8 presents our basic regressions. The sample consists of all European subsidiaries in Amadeus. For each observation, an effective tax rate and a debt shifting incentive variable has been constructed. All regressions in the table provide for parent, industry and year fixed effects. For each regression variable, we indicate between brackets the predicted sign of the regression coefficient. Regression (1) includes the effective tax rate to the exclusion of the international debt shifting incentive variable. The pertinent coefficient is estimated to be 0.259 and statistically significant.[15] Given the large sample size, estimated coefficients are likely to be statistically significant. In what follows, we therefore focus on the economic significance of results, which is the more relevant metric. The tangibility variable has a negative coefficient, unlike prior evidence to the contrary (e.g., Rajan and Zingales, 1995). While tangible assets can serve as collateral and are therefore generally expected to

have a positive effect on financial leverage, tangible, depreciable assets may create non-tax shields so that debt and tangible assets act as substitutes, as described in DeAngelo and Masulis (1980). Apparently for our sample this substitute effect appears to be important. This result is not driven by collinearity between tangibility and our tax variables. The correlation between tangibility and the effective marginal tax rate is only -0.004, and the correlation between tangibility and the tax incentive to shift debt variable is only -0.009 (see Appendix D). Log of sales enters positively, consistent with theoretical predictions and prior evidence in Rajan and Zingales (1995) who also find a non-linear relationship between firm size and debt. Profitability, in turn, obtains a negative coefficient, which suggests that the overall effect of higher profitability is to reduce leverage, consistent with the theoretical prediction by Myers and Majluf (1984). Note that the 71,355 observations in the sample are associated with a total of 5,566 parent companies. Yearly observations of the same subsidiary are counted separately.

Regression (2) includes the debt shifting incentive variable. The estimated coefficient for this variable is positive, which confirms that leverage at any subsidiary of a multinational reflects the overall international tax system faced by the corporate group. The estimated coefficients of regression (2) can serve to evaluate the size of the effect of taxation on leverage. First, the estimated size of β_1, 0.16, indicates the full effect of domestic taxation on the leverage of firms. Specifically, the 'domestic' effect of an increase in the effective tax rate by 0.06 (or one standard deviation) on leverage is 1.0 percentage points (=0.16*0.06). This is a small, though not negligible effect, compared to the sample standard deviation of leverage of 21%. Next, the estimated size of β_2, 0.13, captures the 'international debt-shifting' effect of taxation on leverage. As an example, we can take a hypothetical multinational firm that has a single foreign subsidiary with assets of equal size to those of the

[15] Desai, Foley and Hines (2004) similarly find a coefficient of 0.262 in their regression (1) in Table II where

parent firm. In this instance, an increase of the effective tax rate by 0.06 in the subsidiary country has a positive 'international' effect on leverage in the subsidiary country of 0.4 percentage points (=0.13*0.06*0.5).[16] [17] The total effect of an increase of the effective tax rate by 0.06 on subsidiary leverage is now calculated to be 1.4 percentage points (=1.0+0.4 percentage points). Hence, ignoring the international debt shifting arising from differences in national tax rates would understate the impact of national taxes on debt policies by about 29% (=0.4/1.4).

Next, regression (3) includes a set of additional, country-level controls. The creditor rights variable enters the regression positively, as expected. The political risk variable is also positively related to leverage. As indicated, this may reflect that political risks lead a multinational to increase local borrowing in order to reduce its own capital at risk. Next, inflation has a negative impact on leverage. This could reflect that in an inflationary environment there is more uncertainty about the ex post real interest rate to be paid on nominal debt denominated in the local currency. Finally, the growth opportunities variable enters the regression positively. High growth at the industry and country level may facilitate debt finance of the affected subsidiaries.

The estimated coefficients of regression (3) confirm that the effect of taxation on leverage is economically important (and similar to that obtained in regression (2)). First, the estimated effect of domestic taxation on the leverage of firms is now estimated with a coefficient β_1 of 0.18, slightly larger than the coefficient obtained in regression (2), so that the

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they regress leverage ratios of U.S. outward FDI on the source country tax rate.

[16] Specifically, the international debt shifting effect S_i is equal to $\beta_2 \sum_{j \neq i}^{n} (\tau_i - \tau_j)\rho_j$. With one subsidiary and one parent company, let s denote the subsidiary and p the parent, then n=1 and $S_s = \beta_2(\tau_s - \tau_p)\rho_p$. Because s and p have assets of equal size, ρ_p=0.5. It follows that with an estimated coefficient of $\hat{\beta}_2 = 0.13$ and an increase in τ_s of $\Delta\tau_s = 0.06$, that $\Delta S_s = \beta_2(\Delta\tau_s - \Delta\tau_p)\rho_p$ = 0.13*(0.06-0)*0.05=0.4%.

[17] In contrast, an increase in the effective tax rate in the parent country ($\Delta\tau_p$) of 0.06 has a negative 'international' effect on leverage in the subsidiary of –0.4 percentage points (=0.13*(0-0.06)*0.05).

'domestic' effect of an increase in the effective tax rate by 0.06 (or one standard deviation) on leverage is 1.1 percentage points (=0.18*0.06). Second, the 'international debt-shifting' effect of taxation on leverage is now estimated with a coefficient β_2 of 0.12, similar to that obtained in regression (2). Taking the same hypothetical multinational firm as before that has a single foreign subsidiary with assets of equal size to those of the parent firm, it follows that an increase of the effective tax rate by 0.06 in the subsidiary country has a positive 'international' effect on leverage in the subsidiary country of 0.4 percentage points (=0.12*0.06*0.5). The total effect of an increase of the effective tax rate by 0.06 on subsidiary leverage is now calculated to be 1.5 percentage points, marginally larger than that obtained in the previous regression.

Finally, in regression (4) adjusted financial leverage is taken to be the dependent variable. As indicated, adjusted financial leverage abstracts from account payables and cash positions. In other respects, regression (4) mimics regression (3). The effective tax rate and debt shifting incentive variables continue to obtain positive coefficients, albeit somewhat larger than before, suggesting somewhat larger economic effects. Hence, the adjustment of financial leverage for accounts payable and cash has little impact on the estimated impact of taxation on leverage. However, contrary to the previous regressions in Table 8, we now find that the tangibility variable enters with a positive coefficient, consistent with prior literature and the notion that debt and tangible assets are complements (as firms can relatively easily borrow against tangible assets). In other words, the negative relationship between tangibility and leverage found earlier depends on how we measure leverage. Once we adjust leverage for accounts payables and cash positions, we do obtain a positive relationship between tangibility and leverage, consistent with existing literature. Also, contrary to the regression (3), the political risk and growth opportunities variables cease to obtain significant coefficients.

Importantly though, our main results on the effect of taxes on leverage do not depend on which of the two measures of leverage we use.

6. Robustness tests and extensions

Table 9 presents some robustness checks, taking regression (3) in Table 8 as a starting point. In regression (1), we correct standard errors for clustering across country-industry observations. The estimated coefficients for the two tax variables are virtually unchanged from those of the benchmark regression. Regression (2) in turn limits the sample to subsidiaries in the manufacturing sector. In this regression, the estimated sizes of β_1 and β_2 are somewhat smaller, and much larger, respectively. The relatively large size of β_2 in regression (2) may reflect that manufacturing firms are relatively transparent. Hence, for these firms it may be relatively easy to borrow in one country against the assets located in other countries to explain that leverage in one country is relatively sensitive to international tax rate differences. For the hypothetical multinational firm used before to illustrate the economic significance of the results, the estimated coefficient of β_2 of 0.26 implies that an increase of the effective tax rate by 0.06 in the subsidiary country has a positive 'international' effect on leverage in the subsidiary country of 0.7 percentage points (=0.26*0.06*0.5). This is a small, though not negligible, effect, compared to the sample standard deviation of leverage of 21%.

Next, regression (3) limits the sample to foreign subsidiaries, where we expect the incentive to shift debt to be most pronounced. This reduces the sample size to 23,296 subsidiaries rather than 49,248 in regression (3) of Table 8. Relative to the benchmark regression, the value of β_2 is very similar in magnitude at 0.138. In regression (4), we restrict the sample to subsidiaries of multinationals, i.e. of firms that have at least one foreign

subsidiary. Hence, compared to regression (3) we now include domestic subsidiaries of multinational firms. The estimated size of β_1 and β_2 are very similar to the benchmark results.

In regression (5), we exclude loss-making subsidiaries by dropping firms that have negative earnings before interest, taxes, depreciation and amortization. The reason for excluding loss-making firms is that these firms may be close to financial distress, which could alter their debt policy. The results are not qualitatively affected. In regression (6), we exclude Eastern European countries from the sample, as the coverage of subsidiaries in Eastern Europe is quite poor. This reduces the sample size to 48,444 subsidiaries, but does not alter our main results.

Financial leverage can also be affected by firm-specific risk. In particular, riskier firms tend to be higher levered. Thus far, we have not controlled for this potential effect. In regression (1) of Table 10, we use the standard deviation of the firm's ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets over the period 1994-2003 as a proxy for the riskiness of the firm. Consistent with capital structure theory, we find that financial leverage is positively correlated with risk (Harris and Raviv, 1991). Controlling for risk, however, does not much alter the effect of our tax variables on leverage. We continue to find positive coefficients for β_1 and β_2 of about the same size as before. In regression (2), we control for financial development using the ratio of private credit to GDP rather than the index of creditor rights. While private credit to GDP does not enter significantly, unlike creditor rights did in previous regressions, our main results are not affected.

Next, we use alternative proxies for several of our control variables. In regression (3), we use an alternative measure of tangibility that is computed as the ratio of tangible fixed assets to total assets. Tangible fixed assets include land, buildings, and equipment, but exclude intangible fixed assets and other fixed assets included in total fixed assets. We are

concerned that the negative relationship found earlier between tangibility and firm leverage may depend on the tangibility measure used (we already know it depends on the way leverage is computed). However, when using this alternative measure of tangibility, we continue to find a negative relationship between tangibility and leverage.

It could be that the profitability of firms affects their tax incentives to shift income to other subsidiaries, reflected in a negative correlation between profitability and the effective marginal tax rate. If this is true, then including Profitability as an explanatory variable may affect the estimated effect on our tax variables. In regression (4), we therefore drop the Profitability measure. Our results are not affected. It turns out that the correlation between Profitability and the Effective Marginal Tax Rate is not negative but slightly positive, with a coefficient of 0.03. In regression (5), we include a measure of profitability that is aggregated at the country-level, to mitigate concerns about within-country transfers of profits affecting the results. Specifically, aggregate profitability is the sum of profits in a given year of all subsidiaries in the country divided by the sum of assets in a given year of all subsidiaries in the country. Again, our main results on the tax implications for firm leverage are not affected. We obtain qualitatively similar results when using the average of profitability across subsidiaries by country and year instead of aggregated profitability (not reported).

Thus far, we have included Log of sales in the regression specification to reflect that larger firms may have easier access to credit because they tend to be more diversified and less prone to bankruptcy. Such a specification is quite common in the literature when explaining firm leverage (e.g., Rajan and Zingales, 1995, use a similar specification). Because all other variables are scaled by total assets, we want to make sure that the non-linear structure imposed on the model by including the Log of sales variable does not distort the main results (although theory suggests that we should find a positive relationship between firm size and leverage). In regression (6) we therefore drop the Log of sales variable from the regression.

Our main result is not affected. Our results are also robust to using the logarithm of total assets as proxy for firm size rather than the log of sales (regression (7)). We prefer to use sales as our main proxy for firm size because using assets would make firms that operate in industries that are not asset intensive (such as trade or services) look disproportionately small.

6.1. Additional tax considerations

Table 11 reports several robustness checks where we alter the taxation variables. In regression (1) of Table 11, we control for the relative taxation of equity and internal debt of subsidiaries, or φ_i. Because a higher φ_i discourages equity finance, we expect a positive relationship between φ_i and firm leverage. We construct φ_i using information on corporate tax rates in the parent and subsidiary countries, withholding taxes on dividend and interest payments in the subsidiary country, and double tax relief conventions applied by the parent country to incoming dividend and interest payments. We find that the coefficient on φ_i, although positive as expected, is neither statistically nor economically significant, and that our main results are not affected after controlling for the relative taxation of equity and internal debt of subsidiaries.

In regression (2), we include "intermediate" companies, i.e., subsidiaries that are also parent companies of other subsidiaries, in the sample. This increases the sample from 49,248 to 57,409 observations. Our main results on the effect of taxation on financial leverage are unaffected, but we no longer find an effect of political risk on financial leverage.

In regression (3), we assess whether there is a differential effect of our tax variables on leverage for intermediate companies and pure subsidiaries (i.e., subsidiaries that are not themselves parent companies). We find a negative coefficient for an included intermediate firm dummy variable, while the leverage of intermediate firms tends to respond relatively strongly to changes in the effective marginal tax rate. A heightened role for taxation to affect the leverage of intermediate firms is to be expected, if these firms are important in the overall

tax planning of the firm. Empirically, however, the tax incentive to shift debt abroad is found to affect the leverage of intermediate and pure subsidiaries similarly.

In regression (4), we split the tax incentive to shift debt variable in one component that captures the incentive to shift debt to the parent country and another component that captures the incentive to shift debt to subsidiaries in other countries than the host and parent countries. Specifically, the component that captures the tax incentive to shift debt to the parent country equals $\beta_{2,p}(\tau_i - \tau_p)\rho_p$, where p denotes the parent country, and the component that captures the incentive to shift debt to other countries than the host and parent countries equals $\beta_{2,-p}\sum_{j\neq i,p}^{n}(\tau_i - \tau_j)\rho_j$. Interestingly, we find that on average the incentives to shift debt to the parent country and to other countries both matter, although leverage appears to be more sensitive to the tax incentive to shift debt to other countries. These results imply that multinational firms not only consider tax-motivated debt shifting opportunities between a foreign subsidiary and the parent country, but also among the various foreign subsidiaries. This finding supports our thesis that multilateral - rather than bilateral - differences in tax rates determine the financial structure of multinational firms.

In regression (5), we split the effective tax rate variable in one part that captures the taxation in the source country (to be found by setting the tax rate of the parent country to zero) and the complement that captures the taxation in the resident country. Parent country taxes should matter relatively little to the extent that multinationals are able to defer parent country taxes on foreign-source income unless this income is repatriated to the parent country. We find that the source-country part of the effective tax rate has a positive and statistically significant impact on leverage, while the parent-country part obtains a negative and insignificant coefficient perhaps reflecting the option of deferral.

In regression (6), we split the two tax variables into parts that exclude and are specifically due to non-resident dividend withholding taxes. The first part is obtained by setting all withholding taxes to zero. The second part is obtained as the difference between our regular tax rate variables and the tax variables excluding withholding taxes. Interestingly, only the tax variables exclusive of withholding taxes are estimated with positive and significant coefficients. This suggests that withholding taxes are not seen as part of the effective tax burden, possibly because they can be avoided by triangular arbitrage involving a conduit company in a tax haven.[18]

6.2. Endogeneity concerns and omitted variables

We are concerned about potential endogeneity that arises if countries respond to pervasive debt shifting by changing their tax regimes (although tax regimes reflect a host of other factors as well). As larger countries tend to have higher tax rates, we use the populations of the subsidiary and parent countries as instruments in the construction of the effective tax rate variable. Specifically, we re-compute the effective tax rate using the populations of the subsidiary and the parent countries instead of these countries' tax rates, taking into account possible double tax relief and assuming withholding taxes are zero. Because we do not have separate instruments for the tax incentive to shift debt variable, we only include the effective tax rate in this robustness check. The results for this instrumental variables regression are very similar (regression (7) in Table 11). The coefficient on the effective tax rate variable is positive and of similar magnitude as in previous regressions. An F-test of the excluded instruments supports the choice of our instruments. The first-stage results (not reported) indicate that effective tax rates tend to be higher in more populous countries.

[18] Note that withholding taxes tend to be low compared to corporate income taxes, and that most double tax relief systems provide full relief for withholding taxes.

Next, we investigate whether the effect of taxes on leverage is more pronounced in corporate groups with multiple subsidiaries. It could be easier to shift debt across subsidiaries for groups that consist of a large number of subsidiaries compared to groups that have only a small number of subsidiaries. Regression (1) of Table 12 includes an interaction term between the tax incentive to shift debt variable and a variable that denotes the number of subsidiaries in the group that the subsidiary belongs to. We find that the tax incentive to shift debt does not depend on the number of subsidiaries in the group. Next, in regression (2), we limit the sample to subsidiaries of groups that consist of at least two subsidiaries and again our results are not qualitatively altered. Corporate groups place a disproportionate amount of debt in subsidiaries located in countries with high tax rates.

While we control for a host of factors (including parent fixed-effects) that could drive firm leverage in addition to taxes, we are still concerned that omitted variables may be driving the results. To further mitigate concerns about omitted variables, we repeat tests at the corporate group level for corporate groups with multiple subsidiaries. Specifically, we test whether tax rates are correlated with each subsidiary's share in the total debt held by the group. We run these tests for all corporate groups that have at least two subsidiaries. The results are presented in regression (3) of Table 12. These tests confirm our main findings. Corporate groups place a disproportionate amount of debt in subsidiaries located in countries where the tax incentive to shift debt is high. Interestingly, we find that the subsidiary's share in group debt is not affected by the effective marginal tax rate in the host country. The coefficient on the effective marginal tax rate could be imprecisely estimated because we use the share in total debt as dependent variable, while theory predicts a linear relationship between the effective marginal tax rate and level of debt (as measured in our earlier regressions by firm leverage). The regression specification in column (3) of Table 12 is thus likely more effective in identifying the effect of taxes on debt shifting between different

subsidiaries of a group than it is in identifying the effect of taxes on the level of subsidiary debt.

In regression (4), we repeat the regression in column (3) of Table 12 but split the tax incentive to shift debt variable in one component that captures the incentive to shift debt to the parent country and another component that captures the incentive to shift debt to subsidiaries in other countries than the host and parent country. We find that both components have a significant effect on the subsidiary's share in total corporate group debt.

Thus far, we have included parent fixed-effects in our regressions, so that our tests control for systematic differences between corporate groups. However, our results may still be subject to omitted variables at the subsidiary level due to subsidiary heterogeneity. In Table 13, we include subsidiary fixed effects.[19] We still find that leverage is affected by tax rates, although now we find that the tax incentive to shift debt operates mostly through other countries than the parent country. The economic effect of the result is also somewhat reduced compared to the basic specification in Table 8. For many subsidiaries in our sample we have only a few years of data, about 6 years of data on average. For this subset of firms with a short time-series dimension, it is hard to accurately estimate the subsidiary fixed effects. We therefore re-estimate panel regressions with subsidiary fixed effects for the subset of firms for which we have at least nine years of data, the median value of the time-series dimension in our dataset (regressions (5) to (8) of Table 13). When we do this, the estimated coefficients on the tax variables increase to levels that are comparable to those obtained without subsidiary fixed effects (see Tables 8 and 11), although we continue to find that the tax incentive to shift debt operates mostly through other countries than the parent country.

Finally, we consider shifting of intangibles as an alternative form of shifting income across establishments of multinational firms. Collins and Shackelford (1997) consider

shifting of royalties. We do not have information about royalties for the firms in our sample but we do have information on the amount of intangible assets (that include royalties) of each establishment. While debt shifting consists of transfers of liabilities (and associated expenses) within the multinational firm, shifting of intangibles entails a transfer of assets (and associated income), and in this sense the two are complementary.

Table 14 presents empirical tests of the impact of taxes on intangibles. The dependent variable is the ratio of intangible assets to total assets. Because we do not have information on the tax treatment of intangibles in the various countries included in our study (such as withholding taxes on income from intangibles), we simply use the statutory corporate income tax rates to construct the tax variables in these tests. Specifically, the marginal tax rate is the statutory corporate income tax rate, and the tax incentive to shift intangibles is computed as the asset-weighted average of the differences in statutory corporate income tax rates between the subsidiaries, or $\sum_{j \neq i}^{n} (t_i - t_j)\rho_j$, where t_j is the statutory corporate income tax rate of the establishment in country *j*. We expect the tax variables to be negatively associated with intangibles, as firms will move intangibles (and associated income) to relatively low-tax environments. As control variables, we include the logarithm of sales and the logarithm of per capita GDP. We expect that bigger firms and firms in more developed countries are more willing to incur the fixed costs of investing in research and development that may lead to intangible assets. Our regression results are consistent with our priors. The ratio subsidiary intangible assets to subsidiary total assets is significantly lower in countries with high marginal tax rates. We also find that multinational firms have an incentive to shift intangibles to low-tax environments, although the effect operates mostly through shifting to countries

[19] Because we include the subsidiary fixed effects we need to drop the parent fixed effects and the industry fixed effects. We do keep the year fixed effects.

other than the parent country. Finally, larger firms and firms located in more developed economies have more intangibles, consistent with our predictions.

The estimated coefficients of regression (2) of Table 14 can serve to evaluate the size of the effect of taxation on the share of intangible assets. First, the estimated effect of domestic taxation on the intangibility of firms is estimated with a coefficient of -0.06, so that the 'domestic' effect of an increase in the marginal tax rate by 0.06 (or one standard deviation) on intangibility is -0.4 percentage points (= -0.06*0.06). Second, the tax incentive effect to shift intangibles to countries other than the parent country is estimated with a coefficient of -0.05. Taking a hypothetical multinational firm that has two foreign subsidiaries in two different countries with assets of equal size to those of the parent firm, it follows that an increase of the marginal tax rate by 0.06 in one of the subsidiary countries has a negative 'international' effect on intangibility in this subsidiary country of -0.1 percentage points (=-0.05*(0.06-0)*1/3). The total effect of an increase in the marginal tax rate by 0.06 on the subsidiary's intangibility ratio is now calculated to be -0.5 percentage points, which is small compared to the sample standard deviation of the intangibility ratio of 9.7%. Overall, these results on the shifting of intangibles are consistent with our main results on the shifting of debt.

7. Conclusions

This paper has considered the sensitivity of the capital structure of multinational firms to taxation. Generally this capital structure depends on the national or international structure of the firm and on the tax systems of all the countries where a firm operates. On the basis of a large sample of European firms over the 1994-2003 period, we find that a firm's leverage depends on national tax rates as well as international tax rate differences. The relationship

between leverage and international tax rates differences thus reflects the presence of international debt shifting.

Moreover, international debt shifting is shown to reflect a subsidiary's tax rates differences vis-à-vis the parent firm as well as vis-à-vis other foreign subsidiaries. This finding confirms our premise that international debt shifting reflects the tax regimes of all the countries where the multinational operates rather then just bilateral tax rate differences vis-à-vis the parent firm. In practice, source-level taxation appears to be more important in affecting leverage than the residence-level taxation levied by a multinational's parent country. This finding may reflect that parent-country taxes on a multinational's foreign source income in practice can be deferred, in some cases indefinitely. At the same time, corporate tax rates rather than non-resident dividend withholding tax rates appear to matter for leverage. This could reflect that multinationals are able to avoid bilateral nonresident dividend withholding taxes by using conduit companies in third countries.

While statistically highly significant, both the 'domestic' and 'international' effects of taxation on leverage are rather small. To explain this, note that our basic sample includes firms that are not paying corporate income taxes for a lack of reported profits. A firm can fail to report profits on account of true economic losses or as a result of international profit shifting. In addition, dividend taxation should have a small impact on leverage if a main part of the return to equity comes in the form of capital gains taxed at a different rate. Finally, dividend taxation is expected to affect the leverage at foreign subsidiaries little, if the deductibility of interest payments at these foreign subsidiaries is restricted by thin capitalization rules. For all these reasons it is not surprising that we find only a small impact of dividend taxation on leverage.

International debt shifting serves to lower average levels of corporate income taxation in high-tax countries. Countries with relatively low rates of taxation may benefit from

international debt shifting, as local establishments of multinational firms will be less highly leveraged than they would otherwise be – resulting in higher corporate income tax revenues. Overall, international debt shifting may introduce some dead-weight losses in the form of implementation costs for the multinational firms and also costs inherent in deviations from the firm's optimal financial structure on the basis of non-tax considerations. An obvious way to eliminate international debt shifting is to harmonize top corporate income tax rates internationally. Alternatively, international debt shifting is moot in case countries introduce a common, consolidated tax base for multinational firms. As long as none of these solutions is implemented, international debt shifting will remain an important policy for multinationals worldwide.

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Table 1. Corporate taxation and double-tax relief systems for dividend received in selected European countries in 2003

	Statutory corporate tax rate	Treatment of foreign dividends from treaty countries	Treatment of foreign dividends from non-treaty countries
Austria	34	Exemption	Exemption
Belgium	33.99	Exemption (up to 95%)	Exemption (up to 95%)
Bulgaria	23.5	Indirect credit	Direct credit
Croatia	20	Exemption	Exemption
Cyprus	15	Exemption	Exemption
Czech Republic	31	Indirect credit	Deduction
Denmark	30	Exemption	Exemption
Estonia	26	Indirect credit	Indirect credit
Finland	29	Exemption	Direct credit
France	35.43	Exemption (up to 95%)	Exemption (up to 95%)
Germany	39.59	Exemption (up to 95%)	Exemption (up to 95%)
Greece	35	Indirect credit	Indirect credit
Hungary	19.64	Exemption	Exemption
Iceland	18	Exemption	Exemption
Ireland	12.5	Indirect credit	Indirect credit
Italy	38.25	Exemption (up to 60%)	Exemption (up to 60%)
Latvia	19	Exemption	Exemption
Lithuania	15	Exemption	Exemption
Luxembourg	30.38	Exemption	Exemption
Malta	35	Indirect credit	Indirect credit
Netherlands	34.5	Exemption	Exemption
Norway	28	Indirect credit	Indirect credit
Poland	27	Indirect credit	Direct Credit
Portugal	33	Direct credit	Direct credit
Romania	25	Indirect credit	Indirect credit
Russia	24	Direct credit	No relief
Slovak Republic	25	Indirect credit	No relief
Slovenia	25	Exemption	Exemption
Spain	35	Exemption	Indirect credit
Sweden	28	Exemption	Exemption
Switzerland	21.74	Exemption	Exemption
United Kingdom	30	Indirect credit	Indirect credit

Note: Table shows treatment of foreign dividends by parent country. Dividends are assumed to be paid by fully owned subsidiaries. We only show the data for the year 2003 but have collected data on tax rates for each year in our sample period. Statutory corporate tax rate in Estonia is 0% on retained earnings but a distribution tax of 26% is applied on distributed profit. Corporate tax rate of France includes a 3% social surcharge and a special 3.3% surcharge for large companies. Corporate tax rate of Germany includes a solidarity surcharge of 5.5%, an average deductible trade tax of 16.14%, and an exceptional surcharge of 1.5%. Corporate tax rate of Hungary includes a deductible local business tax. Corporate tax rate of Ireland applies to trading activities. For non-trading activities, the rate is 25%. Corporate tax rate of Luxembourg includes employment surcharges and local taxes. Corporate tax rate of Switzerland applies to the canton of Zurich and includes cantonal and local taxes in Zurich. The indirect credit system applies to foreign dividends from treaty countries in Poland as long as the holding stake is at least 75% for the past two years and there exists a bilateral treaty or the EU parent-subsidiary directive applies. In Portugal, foreign dividends from treaty countries are exempt from corporate taxes if the EU parent-subsidiary directive applies (but the foreign withholding tax is not creditable). In some countries, dividend income is exempt from taxes up to a certain percentage, indicated between brackets. Source : International Bureau of Fiscal Documentation.

Table 2. Bilateral withholding tax levied by the source country on dividend payments from fully owned foreign subsidiary to parent in 2003

Subsidiary \ Parent	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Rep.	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovak Rep.	Slovenia	Spain	Sweden	Switzerland	United Kingdom
Austria	X	0	0	0	10	10	0	5	0	0	0	0	10	25	0	0	25	25	0	15	0	5	10	0	15	5	10	5	0	0	0	0
Belgium	0	X	10	10	10	5	0	25	0	0	0	0	10	25	0	0	25	25	0	15	0	5	10	0	5	10	5	5	0	0	10	0
Bulgaria	0	10	X	5	5	10	5	15	10	5	15	10	10	15	5	10	15	15	5	0	5	15	10	10	10	15	10	15	5	10	5	10
Croatia	0	10	5	X	10	5	5	15	5	5	0	5	5	15	15	10	5	15	15	5	5	15	5	15	5	5	5	15	5	15	5	5
Cyprus	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Rep.	10	5	10	5	10	X	15	5	5	10	5	15	5	5	5	15	5	5	5	5	0	5	5	10	10	10	5	5	5	0	5	5
Denmark	0	0	5	5	10	15	X	5	0	0	0	0	5	0	0	0	5	5	0	0	0	0	0	0	10	10	15	5	0	0	0	0
Estonia	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0	0	10	5	29	0	0	0	X	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
France	0	0	5	5	10	10	0	5	0	X	0	0	5	5	0	0	5	5	0	5	0	0	5	0	10	10	10	5	0	0	5	0
Germany	0	0	15	15	10	5	0	5	0	0	X	0	5	5	0	0	5	5	0	5	0	0	5	0	10	5	5	15	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	10	10	10	10	5	5	5	20	5	5	5	10	X	20	5	10	20	20	5	5	5	10	10	10	5	10	5	10	5	5	10	5
Iceland	15	15	15	15	15	5	0	5	0	5	5	15	15	X	15	15	5	5	5	15	0	0	5	10	15	15	15	15	5	0	5	5
Ireland	0	0	0	20	0	0	0	0	0	0	0	20	0	20	X	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
Italy	0	0	10	10	15	15	0	5	0	0	0	0	10	27	0	0	27	5	0	15	0	15	10	0	10	5	15	10	0	0	15	0
Latvia	10	10	10	5	10	5	5	5	5	5	5	10	10	5	5	10	X	0	10	5	5	5	5	10	10	10	10	5	10	5	5	5
Lithuania	15	15	15	5	15	5	5	0	5	5	5	15	15	5	5	5	0	X	15	15	5	5	5	15	10	15	10	5	5	5	5	5
Luxembourg	0	0	0	20	20	0	0	20	0	0	0	0	0	0	0	0	20	20	X	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	5	0	25	0	0	5	0	0	0	0	5	0	0	0	5	5	0	5	X	0	0	0	0	5	0	5	0	0	0	0
Norway	5	15	15	15	0	5	0	5	0	0	0	20	10	0	0	15	5	5	5	15	0	X	5	10	10	10	5	15	10	0	5	5
Poland	10	10	10	5	10	5	5	5	5	5	5	15	10	5	0	10	5	5	5	5	0	5	X	10	5	10	5	5	5	5	5	5
Portugal	0	0	15	30	30	15	0	30	0	0	0	0	15	15	0	0	30	30	0	15	0	15	15	X	15	15	30	30	0	0	15	0
Romania	10	5	10	5	10	10	10	10	5	10	10	10	5	10	3	10	10	10	5	5	5	10	5	10	X	10	10	5	10	10	10	10
Russia	5	15	15	5	0	10	10	15	5	5	5	15	10	15	10	5	15	15	10	15	5	10	10	10	15	X	10	10	5	5	5	10
Slovak Rep.	10	5	10	5	10	5	15	15	5	10	5	15	5	15	0	15	10	10	5	5	0	5	5	15	10	10	X	5	5	0	5	5
Slovenia	5	5	15	15	10	5	5	15	5	5	15	15	10	15	5	10	5	5	5	15	5	15	5	15	15	10	5	X	5	5	5	5
Spain	0	0	5	15	15	5	0	15	0	0	0	0	5	5	0	0	15	15	0	15	0	10	5	0	5	5	5	5	X	0	10	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0
Switzerland	5	10	5	35	35	5	0	35	5	5	5	5	10	5	10	15	5	5	0	35	0	5	5	10	10	5	5	15	10	0	X	5
United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X

Notes: This table reports withholding taxes on dividends in the source country, taking the existence of bilateral tax treaties into account. The recipients are corporations. We only show the data for the year 2003 but have collected data on tax rates for each year in our sample period. The Parent-Subsidiary directive is binding between EU Member States and provides exemption from withholding tax when equity holding is at least 25%. The reported figures assume an equity holding in the subsidiary of at least 25%. In Ireland, companies located in EU or treaty countries are exempt from withholding tax provided that they are not under the control of persons not resident in such countries. In Italy, authorities can provide a refund equal to the tax claimed limited to 4/9 of the Italian withholding tax if the recipient can prove a tax is paid in its country on the dividend. In Luxembourg there is an exemption from withholding tax for EU and treaty partners if holding in foreign company is at least 10%. Source: International Bureau of Fiscal Documentation.

Table 3. Existence of a bilateral tax treaty for country pairs in 2003

Income	From:	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Rep.	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovak Rep.	Slovenia	Spain	Sweden	Switzerland	United Kingdom
To:																																	
Austria		X	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium		1	X	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bulgaria		1	1	X	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1
Croatia		1	1	0	X	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	0	1
Cyprus		1	1	1	1	X	1	1	0	0	1	1	1	1	0	1	1	0	0	0	1	0	1	1	0	1	1	1	1	0	1	0	1
Czech Rep.		1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Denmark		1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
Estonia		0	0	0	0	0	1	1	X	1	1	1	0	0	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1
Finland		1	1	1	1	0	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
France		1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Germany		1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Greece		1	1	1	1	1	1	1	0	1	1	1	X	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1
Hungary		1	1	1	1	1	1	1	0	1	1	1	1	X	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland		0	0	0	0	0	1	1	1	1	1	1	0	0	X	0	0	1	1	1	0	1	1	1	1	0	0	0	0	1	1	1	1	1
Ireland		1	1	1	0	1	1	1	1	1	1	1	0	1	0	X	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Italy		1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	X	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Latvia		0	0	0	1	0	1	1	1	1	1	1	0	0	1	1	0	X	1	0	0	1	1	1	0	1	0	1	1	0	1	1	1	1
Lithuania		0	0	0	1	0	1	1	1	1	1	1	0	0	1	1	1	1	X	0	0	1	1	1	0	1	0	1	1	0	1	1	1	1
Luxembourg		1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Malta		1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	X	1	1	1	1	1	0	1	0	0	1	1	1	1
Netherlands		1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1	1
Norway		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Poland		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1
Portugal		1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	X	1	1	1	0	1	0	1	1	1
Romania		1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	X	1	1	1	1	1	1	1	1
Russia		1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	1	0	0	1	0	1	1	1	1	1	X	1	0	1	1	1	1	1
Slovak Rep.		1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1
Slovenia		1	1	0	0	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	X	1	1	1	1	1
Spain		1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	X	1	1	1	1
Sweden		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1
Switzerland		1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1
United Kingdom		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1

Notes: This table denotes whether a bilateral tax treat was in force to deal with income received by countries listed in the rows and originating from countries listed in the columns. Specifically, 1 denotes that a bilateral tax treaty was in place, and o denotes that a tax treaty was not in place. The table is not exactly symmetric because the date of entry into force of a treaty may slightly differ between two treaty partners. We only show the data for the year 2003 but have collected data on tax rates for each year in our sample period. Source: International Bureau of Fiscal Documentation and various ministries' websites.

Table 4. Bilateral withholding tax levied by the source country on interest payments from fully owned foreign subsidiary to parent in 2003

Subsidiary \ Parent	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Rep.	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovak Rep.	Slovenia	Spain	Sweden	Switzerland	United Kingdom
Austria	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	15	X	10	15	10	10	15	15	10	15	15	10	15	15	15	15	15	15	15	10	10	15	10	15	10	10	10	10	15	10	10	15
Bulgaria	0	10	X	5	7	10	0	15	0	0	0	15	10	15	5	0	15	15	10	0	0	0	10	10	15	15	10	15	0	0	10	0
Croatia	5	15	5	X	10	0	0	15	0	0	0	10	0	15	15	10	10	10	15	0	0	0	10	15	10	10	10	15	15	0	5	10
Cyprus	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Rep.	0	10	10	0	10	X	0	10	0	0	0	10	0	0	0	0	10	10	0	0	0	0	10	10	7	0	0	5	0	0	0	0
Denmark	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	10	26	26	26	26	10	10	X	10	10	10	26	26	10	10	10	10	0	26	10	10	10	10	26	26	26	26	26	26	10	26	10
Finland	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Germany	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	0	15	10	0	10	0	0	18	0	0	0	10	X	18	0	0	18	18	0	10	0	0	10	10	15	0	0	0	0	0	10	0
Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	20	0	0	0	0	0	0	0	0	0	20	X	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	12.5	0	X	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Latvia	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	X	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Lithuania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	X	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0
Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0
Poland	0	10	10	10	10	10	5	10	0	0	0	10	10	10	10	10	10	10	10	10	0	0	X	10	10	10	10	10	0	0	10	0
Portugal	10	15	10	20	20	10	10	20	15	12	15	15	10	10	15	15	20	20	15	10	10	15	10	X	10	10	20	20	15	20	10	10
Romania	10	10	10	7.5	10	7	10	10	5	10	10	10	10	10	3	10	10	10	10	5	0	10	10	10	X	10	10	7.5	10	10	10	10
Russia	0	15	20	10	0	0	0	20	0	0	0	20	0	20	0	10	20	20	0	20	0	10	10	10	20	X	0	10	5	0	10	0
Slovak Rep.	0	10	10	10	10	0	0	25	0	0	0	10	0	25	0	0	10	10	0	0	0	0	10	25	10	0	X	0	0	0	10	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0
Spain	0	0	0	15	15	0	0	15	0	0	0	0	0	5	0	0	15	15	0	15	0	10	0	0	10	5	0	5	X	0	10	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0
Switzerland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0
United Kingdom	0	15	0	10	10	0	0	10	0	0	0	30	0	0	0	10	10	10	0	10	0	0	0	10	10	0	0	10	12	0	0	X

Notes: This table reports withholding taxes on interest income in the source country, taking the existence of bilateral tax treaties into account. The recipients are corporations. We only show the data for the year 2003 but have collected data on tax rates for each year in our sample period. In Ireland, interest paid to a 75% non-resident parent is deemed to be a dividend. In Spain, interest is generally exempt from tax in Spain provided the direct beneficiary is a resident in another EU Member State. In Estonia, there is no withholding tax if the tax rate in recipient country exceeds 2/3 of the tax rate in Estonia. In Switzerland, there is no withholding tax on ordinary loans, and a rate of 35% on bonds and deposits. In Italy, there is zero withholding tax with treaty countries for public bonds, private bonds, and deposits; 27% with non-treaty countries for deposits and private bonds of maturity of less than 18 months; and 12.5% otherwise. N.a. denotes that information is not available. Source: International Bureau of Fiscal Documentation.

Table 5. Double-tax relief systems for interest payments received in selected European countries in 2003

	Interest payments from treaty countries	Interest payments from non-treaty countries
Austria	Credit	Credit
Belgium	Credit	Credit
Bulgaria	Credit	Credit
Croatia	Credit	Credit
Cyprus	Exemption (up to 50%)	Exemption (up to 50%)
Czech Republic	Credit	Deduction
Denmark	Credit	Credit
Estonia	Credit	Deduction
Finland	Credit	Credit
France	Credit	Deduction
Germany	Credit	Credit
Greece	Credit	Credit
Hungary	Credit	Credit
Iceland	Credit	Credit
Ireland	Credit	Credit
Italy	Credit	Credit
Latvia	Credit	Credit
Lithuania	Credit	Credit
Luxembourg	Credit	Credit
Malta	Credit	Credit
Netherlands	Credit	Credit
Norway	Credit	Credit
Poland	Credit	Credit
Portugal	Credit	Credit
Romania	Credit	Credit
Russia	Credit	Credit
Slovak Republic	Credit	No relief
Slovenia	Credit	Credit
Spain	Credit	Credit
Sweden	Credit	Credit
Switzerland	Credit	Deduction
United Kingdom	Credit	Credit

Notes: We only show the data for the year 2003 but have collected data on tax rates for each year in our sample period. In Cyprus, 50% of interest income is exempt from taxes. The tax credit in Belgium is equal to the actual foreign tax paid with a maximum of 15/85th of the net interest received. Source: International Bureau of Fiscal Documentation.

Table 6. Expressions for the relative taxation of equity and internal debt of subsidiaries

Treatment of - Debt - - Equity -	Exemption	Credit	Deduction
Exemption	$t_i + w_i^e - t_i w_i^e - w_i^d$	$t_i + w_i^e - t_i w_i^e - \max[w_i^d, t_p]$	$t_i + w_i^e - t_i w_i^e - [t_p + w_i^d - t_p w_i^d]$
Indirect credit	$\max\left[t_i + w_i - t_i w_i^e, t_p\right] - w_i^d$	$\max\left[t_i + w_i - t_i w_i^e, t_p\right] - \max\left[w_i^d, t_p\right]$	$\max\left[t_i + w_i - t_i w_i^e, t_p\right] - [t_p + w_i^d - w_i^d t_p]$
Direct credit	$t_i + (1 - t_i)\max[t_p, w_i^e] - w_i^d$	$t_i + (1 - t_i)\max[t_p, w_i^e] - \max\left[w_i^d, t_p\right]$	$t_i + (1 - t_i)\max[t_p, w_i^e] - [t_p + w_i^d - w_i^d t_p]$
Deduction	$1 - (1 - t_i)(1 - w_i^e)(1 - t_p) - w_i^d$	$1 - (1 - t_i)(1 - w_i^e)(1 - t_p) - \max[w_i^d, t_p]$	$1 - (1 - t_i)(1 - w_i^e)(1 - t_p) - [t_p + w_i^d - t_p w_i^d]$

Notes: This table gives expressions for the relative taxation of equity and internal debt of subsidiaries (φ_i in our model). t_i is the corporate income tax on subsidiary income in the subsidiary country. w_i^e is the withholding tax on outgoing dividend income levied by the subsidiary country. t_p is the corporate income tax in the parent country. w_i^d is the bilateral non-resident withholding tax on interest payments. Source: International Bureau of Fiscal Documentation.

Table 7. Descriptive statistics for subsidiaries of European multinationals

Panel A lists the number of parent companies and subsidiaries (by home and host country) in the sample. Intermediary companies, that are both parent firms and subsidiaries, are counted as subsidiaries only. Domestic subsidiaries are counted as subsidiaries by home country only. Panel B presents the sample averages of financial leverage and tax variables. Panel C presents the summary statistics for the financial leverage, tax, and other variables for subsidiaries only. Financial leverage is the ratio of total liabilities to total assets. Adjusted financial leverage is the ratio of total liabilities minus accounts payables minus cash to total assets minus accounts payables minus cash. Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking withholding taxes and the international tax system into account. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the country index of creditor rights from Djankov et al. (2005). Political risk is the index of political risk from the International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in the CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. Sample consists of parent companies and subsidiaries of European firms in Amadeus. We have up to 10 years of data for each parent company and subsidiary. The total number of parent-year observations is 38,736, and the total number of subsidiary-year observations is 90,599.

Panel A: Number of parent companies and subsidiaries

	Number of parent companies:	Number of subsidiaries:	
Country	by home country	by home country	by host country
Austria	32	75	67
Belgium	538	1,168	1,322
Bulgaria	38	92	13
Croatia	0	0	25
Cyprus	0	0	1
Czech Republic	2	2	58
Denmark	282	595	493
Estonia	10	22	33
Finland	132	307	352
France	582	1,586	1,313
Germany	321	974	657
Greece	163	369	250
Hungary	11	17	67
Iceland	22	45	56
Ireland	56	118	94
Italy	567	928	954
Latvia	2	7	11
Lithuania	5	7	9
Luxembourg	5	9	21
Netherlands	429	884	563
Norway	159	384	623
Poland	32	50	135
Portugal	70	127	255

Country	Number of parent companies: by home country	Number of subsidiaries: by home country	by host country
Romania	2	3	54
Russia	8	12	5
Slovak Republic	3	8	4
Slovenia	17	27	6
Spain	933	2,071	2,573
Sweden	595	1,194	1,030
Switzerland	48	76	59
United Kingdom	727	2,150	2,204
Total	5,791	13,307	13,307

Panel B: Financial leverage and marginal tax rates

	Financial leverage		Adjusted financial leverage		Effective marginal tax rate	Tax incentive to shift debt
	Parent companies:	Subsidiaries:	Parent companies:	Subsidiaries:	Subsidiaries:	Subsidiaries:
Country	by home country	by host country	by home country	by host country	by host country	by host country
Austria	0.58	0.61	0.52	0.56	0.34	-0.033
Belgium	0.66	0.66	0.50	0.51	0.40	0.016
Bulgaria	0.56	0.42	0.43	0.33	0.30	-0.004
Croatia		0.48			0.32	-0.006
Cyprus		0.15		0.06	0.35	0.002
Czech Republic	0.47	0.45	0.27	0.22	0.42	0.004
Denmark	0.62	0.65	0.54	0.57	0.31	-0.003
Estonia	0.49	0.50	0.26	0.27	0.14	-0.153
Finland	0.56	0.55	0.45	0.46	0.29	-0.021
France	0.60	0.63	0.43	0.46	0.37	0.001
Germany	0.65	0.66	0.58	0.60	0.49	0.043
Greece	0.54	0.55	0.38	0.38	0.42	0.036
Hungary	0.50	0.49	0.40	0.43	0.26	-0.114
Iceland	0.57	0.63	0.47	0.57	0.43	0.080
Ireland	0.59	0.58	0.41	0.43	0.26	-0.029
Italy	0.73	0.70	0.61	0.58	0.45	0.027
Latvia	0.71	0.62	0.47	0.38	0.33	0.018
Lithuania	0.60	0.56	0.46	0.32	0.28	-0.003
Luxembourg	0.68	0.58	0.59	0.48	0.37	-0.007
Netherlands	0.63	0.63	0.52	0.52	0.35	-0.001
Norway	0.63	0.63	0.52	0.51	0.33	-0.004
Poland	0.56	0.54	0.37	0.40	0.35	-0.009
Portugal	0.63	0.63	0.54	0.50	0.37	0.005

	Financial leverage		Adjusted financial leverage		Effective marginal tax rate	Tax incentive to shift debt
Country	Parent companies: by home country	Subsidiaries: by host country	Parent companies: by home country	Subsidiaries: by host country	Subsidiaries: by host country	Subsidiaries: by host country
Romania	0.80	0.52	0.59	0.37	0.37	-0.002
Russia	0.36	0.48	0.18	0.17	0.35	0.015
Slovak Republic	0.48	0.48	0.33	0.34	0.42	0.012
Slovenia	0.36	0.40			0.37	-0.025
Spain	0.61	0.60	0.45	0.45	0.35	0.000
Sweden	0.61	0.62	0.51	0.53	0.29	-0.011
Switzerland	0.52	0.58	0.37	0.49	0.31	-0.027
United Kingdom	0.57	0.62	0.44	0.50	0.31	-0.017
Total	0.62	0.62	0.49	0.49	0.36	0.001

Panel C: Summary statistics of leverage, tax, and control variables

Variable	Number of observations	Average	Standard Deviation	Minimum	Maximum
Financial leverage	90,599	0.62	0.21	0.00	1.00
Adjusted financial leverage	86,516	0.49	0.27	0.00	1.00
Effective marginal tax rate	90,599	0.36	0.06	0.00	0.67
Tax incentive to shift debt	66,462	0.00	0.05	-0.49	0.42
Tangibility	90,233	0.38	0.26	0.00	1.00
Intangibility	87,977	0.04	0.10	0.00	0.99
Log of sales	81,747	10.40	1.93	0.00	18.56
Profitability	74,812	0.11	0.19	-10.13	28.03
Creditor rights	89,945	2.07	1.18	0.00	4.00
Political risk	90,517	16.56	5.86	3.00	57.00
Inflation	90,599	2.64	3.78	-1.18	154.76
Growth opportunities	78,310	0.00	0.42	-7.26	14.00

Table 8. The impact of taxes on the financial leverage of subsidiaries of multinational firms

The dependent variable in columns (1) to (3) is the ratio of subsidiary total liabilities to subsidiary total assets (Financial leverage). The dependent variable in column (4) is the ratio of total liabilities minus accounts payables minus cash to total assets minus accounts payables minus cash (Adjusted financial leverage). Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking withholding taxes and the international tax system into account. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. Sample consists of subsidiaries of European companies in Amadeus. All regressions are estimated using OLS and include parent, industry, and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

	(1)	(2)	(3)	(4)
Variables (predicted sign of coefficient)	Financial leverage	Financial leverage	Financial leverage	Adjusted financial leverage
Effective marginal tax rate (+)	0.259***	0.162***	0.184***	0.195***
	(0.017)	(0.031)	(0.033)	(0.044)
Tax incentive to shift debt (+)		0.132***	0.120***	0.178***
		(0.031)	(0.033)	(0.045)
Tangibility (+ / −)	-0.130***	-0.123***	-0.120***	0.105***
	(0.005)	(0.006)	(0.006)	(0.008)
Log of sales (+)	0.022***	0.023***	0.023***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)
Profitability (+ / −)	-0.062**	-0.055**	-0.060*	-0.081*
	(0.025)	(0.027)	(0.032)	(0.042)
Creditor rights (+)			0.006***	0.019***
			(0.001)	(0.002)
Political risk (+ / −)			0.001***	-0.000
			(0.000)	(0.000)
Inflation (−)			-0.001***	-0.002***
			(0.000)	(0.000)
Growth opportunities (+)			0.021***	0.010
			(0.008)	(0.009)
Parent, industry, and year fixed effects	Y	Y	Y	Y
Number of observations	71,355	52,310	49,248	47,511
Number of parent companies	5,566	5,118	5,064	5,016
R-squared	0.08	0.08	0.08	0.05

Table 9. The impact of taxes on the financial leverage of subsidiaries of multinational firms: robustness checks

The dependent variable is the ratio of subsidiary total liabilities to subsidiary total assets. Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking the international tax system into account. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in the CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. In column (1), we correct standard errors for clustering across country-industry observations. In column (2), we only include subsidiaries operating in the manufacturing sector. In column (3), we only include the subset of foreign subsidiaries. In column (4), we only include subsidiaries of multinational companies. In column (5), we exclude subsidiaries with negative Profitability. In column (6), we exclude Eastern European countries from the sample. Sample consists of subsidiaries of European companies in Amadeus. Regressions are estimated using OLS and include parent, industry, and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

Variables (predicted sign of coefficient)	(1) Clustering	(2) Manufacturing	(3) Foreign	(4) Multinationals	(5) No negative profits	(6) No Eastern Europe
Effective marginal tax rate (+)	0.184***	0.139***	0.241***	0.193***	0.212***	0.180***
	(0.053)	(0.046)	(0.045)	(0.041)	(0.034)	(0.033)
Tax incentive to shift debt (+)	0.120***	0.264***	0.138***	0.122***	0.108***	0.090***
	(0.045)	(0.048)	(0.040)	(0.037)	(0.034)	(0.033)
Tangibility (+ / −)	-0.120***	-0.080***	-0.116***	-0.115***	-0.115***	-0.113***
	(0.014)	(0.010)	(0.009)	(0.007)	(0.006)	(0.006)
Log of sales (+)	0.023***	0.019***	0.018***	0.020***	0.021***	0.023***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Profitability (+ / −)	-0.060**	-0.131***	-0.144***	-0.052	-0.054	-0.058*
	(0.030)	(0.023)	(0.015)	(0.036)	(0.035)	(0.031)
Creditor rights (+)	0.006**	0.010***	0.017***	0.007***	0.007***	0.006***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Political risk (+ / −)	0.001*	0.001**	0.001**	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation (−)	-0.001**	-0.002***	-0.001***	-0.001***	-0.001***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Growth opportunities (+)	0.021***	0.014	0.039***	0.029***	0.030***	0.025***
	(0.006)	(0.010)	(0.009)	(0.008)	(0.007)	(0.009)
Parent, industry, and year fixed effects	Y	Y	Y	Y	Y	Y
Number of observations	49,248	19,397	23,296	30,187	44,410	48,444
Number of parent companies	5,064	2,416	2,844	2,883	4,882	4,967
R-squared	0.08	0.06	0.09	0.08	0.08	0.08

Table 10. The impact of taxes on the financial leverage of subsidiaries of multinational firms: alternative control variables

The dependent variable is the ratio of subsidiary total liabilities to subsidiary total assets. Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking withholding taxes and the international tax system into account. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from the International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in the CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. In column (1), we include the volatility of profits, measured as the standard deviation of the firm's ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets over the period 1994-2003, as a proxy for firm-specific risk. In column (2), we control for financial development using the ratio of private credit to GDP rather than the index of creditor rights. In column (3), we use an alternative measure of tangibility that is computed as the ratio of tangible fixed assets to total assets. Tangible fixed assets include land, buildings, and equipment, but exclude intangible fixed assets and other fixed assets included in total fixed assets. In column (4), we drop the Profitability measure. In column (5), we include a measure of profitability that is aggregated at the country-level. Specifically, aggregate profitability is the sum of profits in a given year of all subsidiaries in the country divided by the sum of assets in a given year of all subsidiaries in the country. In column (6), we drop the Log of sales variable. In column (7), we include the logarithm of total assets as proxy for firm size. Sample consists of subsidiaries of European companies in Amadeus. All regressions are estimated using OLS and include parent, industry, and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

Variables (predicted sign of coefficient)	(1) Firm-specific risk	(2) Financial development	(3) Alternative tangibility	(4) Excluding profitability	(5) Aggregate profitability	(6) Excluding log of sales	(7) Log of assets
Effective marginal tax rate (+)	0.186***	0.184***	0.193***	0.188***	0.192***	0.205***	0.194***
	(0.033)	(0.033)	(0.033)	(0.031)	(0.032)	(0.033)	(0.033)
Tax incentive to shift debt (+)	0.116***	0.130***	0.124***	0.107***	0.108***	0.139***	0.125***
	(0.033)	(0.033)	(0.033)	(0.032)	(0.032)	(0.033)	(0.033)
Tangibility (+ / −)	-0.119***	-0.119***		-0.121***	-0.121***	-0.122***	-0.146***
	(0.006)	(0.006)		(0.005)	(0.005)	(0.006)	(0.006)
Alternative tangibility (+ / −)			-0.035***				
			(0.007)				
Log of sales (+)	0.023***	0.023***	0.023***	0.023***	0.023***		
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		
Log of assets (+)							0.014***
							(0.001)
Profitability (+ / −)	-0.069**	-0.060*	-0.053*			-0.044*	-0.044*
	(0.028)	(0.032)	(0.029)			(0.024)	(0.024)
Profitability (country-year aggregate) (+ / −)				-0.024			
				(0.042)			
Creditor rights (+)	0.006***		0.008***	0.006***	0.006***	0.009***	0.008***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Variables (predicted sign of coefficient)	(1) Firm-specific risk	(2) Financial development	(3) Alternative tangibility	(4) Excluding profitability	(5) Aggregate profitability	(6) Excluding log of sales	(7) Log of assets
Political risk (+ / −)	0.001***	0.000	0.001***	0.001**	0.001**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation (−)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Growth opportunities (+)	0.021***	0.022***	0.022***	-0.002	-0.002	0.027***	0.027***
	(0.008)	(0.008)	(0.007)	(0.005)	(0.005)	(0.008)	(0.008)
Volatility of profits (+)	0.035***						
	(0.013)						
Private credit to GDP (+)		-0.000					
		(0.000)					
Parent, industry, and year fixed effects	Y	Y	Y	Y	Y	Y	Y
Number of observations	48,512	47,997	49,110	54,461	54,461	49,711	49,711
Number of parent companies	4,847	5,105	5,058	5,271	5,271	5,077	5,077
R-squared	0.09	0.08	0.07	0.08	0.08	0.05	0.06

Table 11. The impact of taxes on the financial leverage of subsidiaries of multinational firms: additional tax considerations

The dependent variable is the ratio of subsidiary total liabilities to subsidiary total assets. Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking the international tax system into account. In column (1), we control for the relative taxation of equity and internal debt of subsidiaries. In column (2), we include "intermediate" companies, i.e., subsidiaries that are also parent companies of other subsidiaries, in the sample. In column (3), we assess whether there is a differential effect of our tax variables on leverage for intermediate companies. In column (4), we split the tax incentive to shift debt variable in one component that captures the incentive to shift debt to the parent country and another component that captures the incentive to shift debt to subsidiaries in other countries than the host and parent country. In column (5), we split the effective marginal tax rate variable in one component that captures the taxation in the source country (by setting the tax rate of the parent to zero) and one component that captures the taxation in the resident country. In column (6), we split both tax variables in one component that does not depend on withholding taxes and another component that depends on withholding taxes. In column (7), we use the population of the subsidiary country and the population of the parent country as instruments for the effective marginal tax rate, taking the tax system into account and assuming that withholding taxes are zero. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from the International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in the CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. Sample consists of subsidiaries of European companies in Amadeus. Regressions are estimated using OLS (except regression 7) and include parent, industry, and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

Variables (predicted sign of coefficient)	(1) Relative tax of equity and debt	(2) Include intermediate companies	(3) Differential effect for intermediate	(4) Shifting to parent versus other countries	(5) Source versus resident tax	(6) Withholding taxes	(7) Instrumental variables
Effective marginal tax rate (+)	0.184***	0.164***	0.149***	0.178***			0.200***
	(0.034)	(0.030)	(0.031)	(0.033)			(0.064)
Tax incentive to shift debt (+)	0.120***	0.149***	0.154***		0.112***		
	(0.044)	(0.030)	(0.031)		(0.033)		
Relative tax of equity and debt (+)	0.001						
	(0.043)						
Intermediate (+ / −)			-0.045**				
			(0.017)				
Intermediate * Effective marginal tax rate (+)			0.090*				
			(0.047)				
Intermediate * Tax incentive to shift debt (+)			-0.065				
			(0.087)				
Tax incentive to shift debt to parent country (+)				0.086**			
				(0.037)			
Tax incentive to shift debt to other countries (+)				0.215***			
				(0.065)			

Variables (predicted sign of coefficient)	(1) Relative tax of equity and debt	(2) Include intermediate companies	(3) Differential effect for intermediate	(4) Shifting to parent versus other countries	(5) Source versus resident tax	(6) Withholding taxes	(7) Instrumental variables
Source effective marginal tax rate (+)					0.188***		
					(0.033)		
Resident effective marginal tax rate (+ / −)					-0.186		
					(0.116)		
Effective marginal tax rate excl. withholding taxes (+)						0.184***	
						(0.033)	
Tax incentive to shift debt excl. withholding taxes (+)						0.133***	
						(0.033)	
Effective marginal tax rate due to withholding taxes (+)						0.162	
						(0.173)	
Tax incentive to shift debt due to withholding taxes (+)						-0.115	
						(0.167)	
Tangibility (+ / −)	-0.120***	-0.134***	-0.133***	-0.120***	-0.120***	-0.119***	-0.127***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.004)
Log of sales (+)	0.023***	0.022***	0.022***	0.023***	0.023***	0.023***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Profitability (+ / −)	-0.060*	-0.065**	-0.065**	-0.060*	-0.060*	-0.060*	-0.066***
	(0.032)	(0.029)	(0.030)	(0.032)	(0.032)	(0.032)	(0.004)
Creditor rights (+)	0.006***	0.005***	0.005***	0.006***	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Political risk (+ / −)	0.001***	0.000	0.000	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation (−)	-0.001***	-0.001**	-0.001**	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Growth opportunities (+)	0.021***	0.011*	0.012*	0.022***	0.022***	0.022***	0.012***
	(0.008)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.005)
F-test of excluded instruments (p-value)							0.000***
Parent, industry, and year fixed effects	Y	Y	Y	Y	Y	Y	Y
Number of observations	49,248	57,409	57,409	49,248	49,248	49,248	65,120
Number of parent companies	5,064	5,236	5,236	5,064	5,064	5,064	5,502
R-squared	0.08	0.09	0.09	0.08	0.08	0.08	0.10

Table 12. The impact of taxes on the financial leverage of subsidiaries of multinational firms: tests for groups with multiple subsidiaries

The dependent variable in columns (1) and (2) is the ratio of subsidiary total liabilities to subsidiary total assets. The dependent variable in regressions (3) and (4) is the subsidiary share in total corporate group debt. The sample in columns (2) to (4) is restricted to subsidiaries of corporate groups that have at least two subsidiaries. Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking the international tax system into account. In column (1), we include an interaction term between the tax incentive to shift debt variable and a variable that denotes to number of subsidiaries of the corporate group the subsidiary belongs to. In column (2), we restrict the sample to corporate groups with at least 2 subsidiaries. In column (3), we use the subsidiary share in total corporate group debt variable instead of financial leverage as dependent variable. In column (4), we repeat the regression in column (3) but split the tax incentive to shift debt variable in one component that captures the incentive to shift debt to the parent country and another component that captures the incentive to shift debt to subsidiaries in other countries than the host and parent country. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from the International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in the CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. Sample consists of subsidiaries of European companies in Amadeus. Regressions are estimated using OLS and include parent, industry, and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

	(1)	(2)	(3)	(4)
	Financial leverage		Share in corporate group debt	
Variables (predicted sign of coefficient)	Number of subsidiaries	Groups with at least two subsidiaries	Groups with at least two subsidiaries	Shifting to parent versus other countries
Effective marginal tax rate (+)	0.182***	0.212***	-0.005	-0.005
	(0.033)	(0.039)	(0.042)	(0.042)
Tax incentive to shift debt (+)	0.102**	0.109***	0.103***	
	(0.040)	(0.038)	(0.036)	
Tax incentive to shift debt * Number of subsidiaries (+)	0.002			
	(0.003)			
Tax incentive to shift debt to parent country (+)				0.102**
				(0.041)
Tax incentive to shift debt to other countries (+)				0.107*
				(0.058)
Tangibility (+ / −)	-0.120***	-0.129***	0.163***	0.163***
	(0.006)	(0.006)	(0.005)	(0.005)
Log of sales (+)	0.023***	0.022***	0.089***	0.089***
	(0.001)	(0.001)	(0.001)	(0.001)
Profitability (+ / −)	-0.060*	-0.052*	-0.065**	-0.065**
	(0.032)	(0.029)	(0.030)	(0.030)
Creditor rights (+)	0.006***	0.007***	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)

Variables (predicted sign of coefficient)	(1)	(2)	(3)	(4)
	Financial leverage		Share in corporate group debt	
	Number of subsidiaries	Groups with at least two subsidiaries	Groups with at least two subsidiaries	Shifting to parent versus other countries
Political risk (+ / −)	0.001***	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation (−)	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Growth opportunities (+)	0.021***	0.026**	-0.020**	-0.020**
	(0.008)	(0.010)	(0.009)	(0.009)
Parent, industry, and year fixed effects	Y	Y	Y	Y
Number of observations	49,248	36,267	36,267	36,267
Number of parent companies	5,064	2,162	2,162	2,162
R-squared	0.08	0.09	0.40	0.40

Table 13. The impact of taxes on the financial leverage of subsidiaries of multinational firms: subsidiary fixed-effects

The dependent variable in columns (1) and (2) is the ratio of subsidiary total liabilities to subsidiary total assets (Financial leverage). The dependent variable in columns (3) and (4) is the ratio of total liabilities minus accounts payables minus cash to total assets minus accounts payables minus cash (Adjusted financial leverage). Effective marginal tax rate (τ) is the statutory tax rate on dividend income generated in the subsidiary country, taking withholding taxes and the tax system for foreign source income into account. Tax incentive to shift debt is the sum of international tax differences between subsidiary countries weighted by subsidiary asset shares, taking the international tax system into account. In columns (2) and (4), we repeat the regressions in columns (1) and (3) but split the tax incentive to shift debt variable in one component that captures the incentive to shift debt to the parent country and another component that captures the incentive to shift debt to subsidiaries in other countries than the host and parent country. The regressions presented in columns (5) to (8) repeat those in columns (1) to (4) for the subset of subsidiaries for which we have at least nine years of data. Tangibility is the ratio of subsidiary fixed assets to subsidiary total assets. Log of sales is the logarithm of subsidiary sales. Profitability is the ratio of subsidiary earnings before interest, taxes, depreciation and amortization to subsidiary total assets. Creditor rights is the index of country creditor rights from Djankov et al. (2005). Political risk is the index of political risk from International Country Risk Guide. We inverted the scale with higher scores indicating greater risk. Inflation is the annual percentage change in CPI of the subsidiary's host country. Growth opportunities is the median of the annual growth rate of subsidiary sales in a subsidiary's country and industry. Sample consists of subsidiaries of European companies in Amadeus. Regressions are estimated using OLS and include subsidiary and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

Variables (predicted sign of coefficient)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				At least nine years of data			
	Financial leverage		Adjusted financial leverage		Financial leverage		Adjusted financial leverage	
Effective marginal tax rate (+)	0.109***	0.109***	0.131***	0.130***	0.185***	0.185***	0.202***	0.202***
	(0.024)	(0.024)	(0.034)	(0.034)	(0.028)	(0.028)	(0.039)	(0.039)
Tax incentive to shift debt (+)	0.029		0.061		0.009		0.082*	
	(0.028)		(0.039)		(0.033)		(0.048)	
Tax incentive to shift debt to parent country (+)		0.006		0.025		-0.032		0.041
		(0.032)		(0.045)		(0.039)		(0.055)
Tax incentive to shift debt to other countries (+)		0.105*		0.179**		0.134*		0.203**
		(0.059)		(0.087)		(0.068)		(0.102)
Tangibility (+ / −)	-0.005	-0.005	0.230***	0.230***	-0.010	-0.010	0.240***	0.240***
	(0.009)	(0.009)	(0.012)	(0.012)	(0.010)	(0.010)	(0.014)	(0.014)
Log of sales (+)	0.038***	0.038***	0.034***	0.035***	0.048***	0.048***	0.046***	0.046***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Profitability (+ / −)	-0.064**	-0.064**	-0.078**	-0.078**	-0.225***	-0.225***	-0.291***	-0.291***
	(0.032)	(0.032)	(0.039)	(0.039)	(0.018)	(0.018)	(0.025)	(0.025)
Creditor rights (+)	0.072**	0.071**	0.093**	0.093**	0.149***	0.149***	0.142**	0.142**
	(0.033)	(0.033)	(0.040)	(0.040)	(0.052)	(0.051)	(0.060)	(0.060)
Political risk (+ / −)	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation (−)	0.001*	0.001*	0.000	0.000	0.001*	0.001*	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Growth opportunities (+)	0.013**	0.013**	0.012*	0.012*	0.026***	0.026***	0.026**	0.026**
	(0.006)	(0.006)	(0.007)	(0.007)	(0.009)	(0.009)	(0.012)	(0.012)
Subsidiary and year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	50,982	50,982	49,213	49,213	28,380	28,380	27,541	27,541
Number of subsidiaries	11,289	11,289	11,113	11,113	4,740	4,740	4,703	4,703
R-squared	0.05	0.05	0.04	0.04	0.07	0.08	0.07	0.07

Table 14. The impact of taxes on the intangibility of subsidiaries of multinational firms

The dependent variable is the ratio of subsidiary intangible assets to subsidiary total assets (Intangibility). Marginal tax rate is the statutory tax rate on corporate income generated in the subsidiary country. Tax incentive to shift intangibles is the sum of international tax differences in corporate income taxes between subsidiary countries weighted by subsidiary asset shares. In column (2), we repeat the regression in column (1) but split the tax incentive to shift debt variable in one component that captures the incentive to shift intangibles to the parent country and another component that captures the incentive to shift intangibles to subsidiaries in other countries than the host and parent country. Unlike the tax incentive to shift debt variables in the previous tables, these variables are computed solely on the basis of corporate income taxes. Log of sales is the logarithm of subsidiary sales. Log of per capita GDP is the logarithm of per capita GDP of the subsidiary's host country. Sample consists of subsidiaries of European companies in Amadeus. Regressions are estimated using OLS and include subsidiary and year fixed effects. We report White (1980)'s heteroskedasticity-consistent standard errors between brackets. * denotes significance at 10%; ** significance at 5%; and *** significance at 1%.

Variables (predicted sign of coefficient)	(1)	(2)
Marginal tax rate (−)	-0.072***	-0.061***
	(0.011)	(0.012)
Tax incentive to shift intangibles (−)	-0.003	
	(0.007)	
Tax incentive to shift intangibles to parent country (−)		0.001
		(0.007)
Tax incentive to shift intangibles to other countries (−)		-0.053**
		(0.024)
Log of sales (+)	0.003***	0.003***
	(0.000)	(0.000)
Log of per capita GDP (+)	0.012***	0.012***
	(0.002)	(0.002)
Parent, industry, and year fixed effects	Y	Y
Number of observations	56,672	56,672
Number of parent companies	5,307	5,307
R-squared	0.04	0.04

Appendix A. Statutory corporate tax rates

This table reports statutory corporate tax rates (including local taxes and surcharges) by country for the period 1994 to 2003. Tax rates are reported in percentages.

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Austria	34	34	34	34	34	34	34	34	34	34
Belgium	40	40	40	40	40	40	40	40	40	34
Bulgaria					37	34	33	28	24	24
Croatia		25	25	25	35	35	35	20	20	20
Cyprus	25	25	25	25	25	25	29	28	28	15
Czech Republic	42	41	39	39	35	35	31	31	31	31
Denmark	34	34	34	34	34	32	32	30	30	30
Estonia	26	26	26	26	26	26	26	26	26	26
Finland	25	25	28	28	28	28	29	29	29	29
France	33	37	37	37	42	40	37	36	35	35
Germany	54	57	57	57	57	57	52	39	38	40
Greece	40	40	40	40	40	40	40	38	35	35
Hungary	36	20	20	20	20	20	20	20	20	20
Iceland	33	33	33	33	30	30	30	30	18	18
Ireland	40	40	38	36	32	28	24	20	16	13
Italy	52	52	53	53	41	41	41	40	40	38
Latvia		25	25	25	25	25	25	25	22	19
Lithuania	29	29	29	29	29	29	24	24	15	15
Luxembourg	39	41	41	39	37	37	37	37	30	30
Malta	35	35	35	35	35	35	35	35	35	35
Netherlands	35	35	35	35	35	35	35	35	35	35
Norway	28	28	28	28	28	28	28	28	28	28
Poland	40	40	40	38	36	34	30	28	28	27
Portugal	40	40	40	40	37	37	35	35	33	33
Romania	45	38	38	38	38	38	25	25	25	25
Russia	38	38	38	38	35	30	30	35	24	24
Slovak Republic	45	40	40	40	40	40	29	29	25	25
Slovenia	40	25	25	25	25	25	25	25	25	25
Spain	35	35	35	35	35	35	35	35	35	35
Sweden	28	28	28	28	28	28	28	28	28	28
Switzerland	34	36	36	36	23	25	25	22	22	22
United Kingdom	33	33	33	31	31	30	30	30	30	30

Appendix B. Variable definitions and data sources

Variable	Definition	Source
Financial leverage	Ratio of total nonequity liabilities to total assets	Amadeus
Adjusted financial leverage	Ratio of total nonequity liabilities minus accounts payable minus cash to assets minus accounts payable minus cash	Amadeus
Effective marginal tax rate	Statutory tax rate on dividend income taking into account withholding taxes and international tax system	International Bureau of Fiscal Documentation and various ministries
Tax incentive to shift debt	Sum of international tax differences weighed by local asset shares taking into account withholding taxes and international tax system	International Bureau of Fiscal Documentation and various ministries
Relative tax of equity and debt	Statutory tax rate on dividend income minus statutory tax rate on interest income taking into account withholding taxes and international tax system	International Bureau of Fiscal Documentation and various ministries
Tangibility	Ratio of fixed assets to total assets	Amadeus
Adjusted tangibility	Ratio of tangible fixed assets to total assets	Amadeus
Intangibility	Ratio of intangible assets to total assets	Amadeus
Log of sales	Logarithm of sales	Amadeus
Log of assets	Logarithm of total assets	Amadeus
Profitability	Ratio of earnings before interest, taxes, depreciation and amortization to total assets	Amadeus
Intermediate	Dummy variable flagging subsidiary firm that is also parent firm	Amadeus
Creditor rights	Annual index of credit rights in the country	Djankov et al. (2005)
Political risk	Annual (December) index of political risk. On a scale from 0-100 with higher scores indicating greater risk	International Country Risk Guide
Inflation	Annual percentage change in the CPI	World Development Indicators
Growth opportunities	Median of the annual growth rate of sales per country and industry.	Amadeus
Volatility of profits	Standard deviation of the firm's ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to total assets over the period 1994-2003	Amadeus
Private credit to GDP	Ratio of credit to the private sector to GDP	World Development Indicators

Appendix C. Year-by-year summary statistics of main regression variables

Variable	Year	Observations	Mean	Standard deviation	Minimum	Maximum
Financial leverage	1994	5317	0.6327	0.2118	0.0000	1.0000
Financial leverage	1995	6652	0.6269	0.2149	0.0000	0.9808
Financial leverage	1996	7347	0.6178	0.2186	0.0000	0.9775
Financial leverage	1997	8615	0.6211	0.2166	0.0000	0.9744
Financial leverage	1998	9210	0.6207	0.2139	0.0000	1.0000
Financial leverage	1999	10181	0.6222	0.2129	0.0000	1.0000
Financial leverage	2000	10709	0.6250	0.2122	0.0000	0.9854
Financial leverage	2001	11235	0.6254	0.2117	0.0000	1.0000
Financial leverage	2002	11741	0.6236	0.2105	0.0000	0.9591
Financial leverage	2003	9592	0.6175	0.2115	0.0000	0.9501
Adjusted financial leverage	1994	5051	0.4951	0.2702	0.0000	1.0000
Adjusted financial leverage	1995	6367	0.4906	0.2711	0.0000	0.9807
Adjusted financial leverage	1996	7014	0.4871	0.2692	0.0000	0.9773
Adjusted financial leverage	1997	8135	0.4903	0.2677	0.0000	0.9518
Adjusted financial leverage	1998	8783	0.4887	0.2672	0.0000	1.0000
Adjusted financial leverage	1999	9676	0.4952	0.2656	0.0000	0.9999
Adjusted financial leverage	2000	10236	0.4981	0.2660	0.0000	0.9843
Adjusted financial leverage	2001	10756	0.5008	0.2648	0.0000	1.0000
Adjusted financial leverage	2002	11297	0.4972	0.2655	0.0000	0.9483
Adjusted financial leverage	2003	9201	0.4893	0.2658	0.0000	0.9482
Effective marginal tax rate	1994	5317	0.3828	0.0658	0.2500	0.6700
Effective marginal tax rate	1995	6652	0.3815	0.0696	0.2500	0.6400
Effective marginal tax rate	1996	7347	0.3831	0.0716	0.2366	0.6320
Effective marginal tax rate	1997	8615	0.3720	0.0766	0.1964	0.6379
Effective marginal tax rate	1998	9210	0.3678	0.0648	0.1964	0.6316
Effective marginal tax rate	1999	10181	0.3613	0.0647	0.1964	0.6316
Effective marginal tax rate	2000	10709	0.3531	0.0589	0.0000	0.5647
Effective marginal tax rate	2001	11235	0.3451	0.0492	0.0000	0.5100
Effective marginal tax rate	2002	11741	0.3416	0.0488	0.0000	0.4921
Effective marginal tax rate	2003	9592	0.3315	0.0423	0.0000	0.4865
Tax incentive to shift debt	1994	2352	-0.0012	0.0473	-0.3633	0.2987
Tax incentive to shift debt	1995	3442	-0.0019	0.0523	-0.4086	0.3156
Tax incentive to shift debt	1996	4196	-0.0016	0.0569	-0.3945	0.3851
Tax incentive to shift debt	1997	5604	-0.0003	0.0585	-0.4215	0.3884
Tax incentive to shift debt	1998	6428	0.0003	0.0527	-0.4000	0.3906
Tax incentive to shift debt	1999	7904	0.0007	0.0555	-0.3633	0.3939
Tax incentive to shift debt	2000	8789	0.0014	0.0500	-0.4402	0.4108
Tax incentive to shift debt	2001	9759	0.0032	0.0409	-0.4597	0.4173
Tax incentive to shift debt	2002	10816	0.0033	0.0414	-0.4883	0.3261
Tax incentive to shift debt	2003	7172	0.0023	0.0377	-0.4264	0.3598

Appendix D. Correlation matrix of main regression variables

	Effective marginal tax rate	Tax incentive to shift debt	Tangibility	Adjusted tangibility	Log of sales
Tax incentive to shift debt	0.435***				
	(0.000)				
Tangibility	-0.004	-0.009**			
	(0.233)	(0.017)			
Adjusted tangibility	-0.012***	-0.029***	0.606***		
	(0.001)	(0.000)	(0.000)		
Log of sales	0.025***	0.007	0.054***	0.108***	
	(0.000)	(0.114)	(0.000)	(0.000)	
Profitability	0.033***	0.015***	-0.017***	0.085***	0.066***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)