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The impact of thin-capitalization rules on multinationals' financing and investment decisions

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Abstract

This paper analyzes the effectiveness of thin-capitalization rules in preventing debt finance by intercompany loans and explores their consequences for corporate decisions. A theoretical discussion emphasizes that limitations of the deduction of interest owed to foreign affiliates would not only affect multinationals' capital structure choice but also investment. An empirical investigation exploits a large firm-level panel dataset of multinationals in order to analyze the impact of thin-capitalization rules on capital structure choice and investment in the OECD and some further European countries in the time period between 1996 and 2004. The results indicate that thin-capitalization rules are effective in curbing tax planning via intercompany loans. However, investment is found to be adversely affected.

Keywords: Corporate Income Tax, Multinationals, Leverage, Thin-Capitalization Rules, Firm-Level Data

JEL Classification: H25, H26, G32

Non-Technical Summary

Tax planning of multinational corporations receives a lot of attention by tax administration and policy-makers. Multinational corporations seems to have enhanced opportunities to respond to taxation and capital market conditions with their financing and investment decisions. The adverse revenue consequences and the disadvantage of national companies create temptations for tax-policy makers to change details in the tax law in order to restrict certain types of tax planning. However, it is not obvious that an attempt to restrict tax planning is very effective. Moreover, if it is effective, it is not clear that the corporations' response to a restriction is generally beneficial for the imposing country. Since, as has been discussed in the theoretical literature, restricting certain opportunities for tax planning might result in adverse consequences for the level of investment undertaken by multinationals in high-tax countries which may also reinforce tax competition.

One important element in multinational corporations' tax-planning is their ability to adjust the financial structure not only by means of external debt but also internally by using intercompany loans. Governments often respond by imposing thin-capitalization rules. A general characteristic of these rules is that interest deduction for tax purposes is limited if the debt-to-equity ratio of an affiliate is above certain threshold. In fact, the imposition of thin-capitalization rules is widespread among European and OECD countries.

This paper investigates the effects of thin-capitalization rules on multinationals' financing and investment decisions. A theoretical model derives some basic empirical predictions about the consequences of imposing thin-capitalization rules for capital structure choice and invest-

ment. The empirical analysis employs a comprehensive micro-level panel database (*MiDi*) of virtually all German multinationals' foreign affiliates made available for research by the *Deutsche Bundesbank*. Combined with the information about corporate taxation, including thin-capitalization rules in all OECD and European Union countries over a period of 9 years, this dataset allows us to study the consequences of the introduction, removal, or change in thin-capitalization rules across countries and time.

Our empirical results confirm that thin-capitalization rules are quite effective in reducing tax planning by means of intercompany loans. Moreover, investment is not only found to be sensitive to local tax rates but is also to a significant degree adversely affected by the imposition of thin-capitalization rules. Thus, our results confirm that tax policy is facing a trade-off between limiting multinationals' tax planning and the real consequences of corporate taxation.

Nicht-technische Zusammenfassung

Die Steuerplanung grenzüberschreitend tätiger Konzerne findet besondere Beachtung durch die Steuerpolitik. Es gibt zahlreiche Hinweise, dass grenzüberschreitend tätige Konzerne zusätzliche Möglichkeiten zur Steuerplanung besitzen. Die daraus resultierenden Ausfälle beim Steueraufkommen und Nachteile für nur national tätige Unternehmen veranlassen die Steuerpolitik häufig zu einer Steuergesetzgebung, die grenzüberschreitende Steuerplanungs-möglichkeiten einschränken soll. Angesichts der Komplexität des Steuerrechts und der Viel-zahl grenzüberschreitender Sachverhalte ist jedoch unklar, ob entsprechende Regelungen wirk-sam sind. Zudem ist unklar, ob solche Beschränkungen der Steuerplanungsmöglichkeiten für ein Land auch vorteilhaft sind. Die theoretische Diskussion in der Literatur zum Steuer-wettbewerb lässt vielmehr vermuten, dass Restriktionen der Steuerplanung einen negativen Einfluss auf das Investitionsvolumen insbesondere an Hochsteuerstandorten hervorrufen. Dies würde letztendlich den Steuerwettbewerb verschärfen.

Für die Steuerplanung stellt die Ausgestaltung der Fremdfinanzierung ein bedeutendes Ele-ment dar. Internationale Konzerne können neben der Aufnahme von Fremdkapital am Ka-pitalmarkt darüber hinaus auch konzerninterne Darlehen einsetzen. Der Steuergesetzgeber reagiert darauf häufig mittels Beschränkungen der Fremdfinanzierung (*Thin-Capitalization Rules*). Diese Regelungen versagen üblicherweise den zusätzlichen steuerlichen Zinsabzug, wenn die Fremdfinanzierung ein bestimmtes Verhältnis von Fremd- gegenüber Eigenkapital überschreitet. Innerhalb der OECD Staaten und in Europa sind entsprechende Regelungen inzwischen weit verbreitet.

Dieses Papier untersucht deshalb die Auswirkungen von steuerlichen Beschränkungen der Fremdfinanzierung auf Finanzierungs- und Investitionsentscheidungen internationaler Konzerne. Mittels eines einfachen theoretischen Modells werden grundlegende Hypothesen für die empirische Analyse von Konsequenzen dieser steuerlichen Restriktionen auf die Kapitalstruktur- und Investitionsentscheidungen herausgearbeitet. Für die sich anschließende empirische Analyse wird ein umfangreicher Paneldatensatz (*MiDi*) genutzt, welcher Firmendaten von nahezu allen Tochtergesellschaften deutscher Unternehmen enthält. Dieser Datensatz wird von der Deutschen Bundesbank für Forschungszwecke zugänglich gemacht. In Kombination mit detaillierten Informationen zur Unternehmensbesteuerung, insbesondere zu den jeweiligen Regelungen zur Beschränkung der Fremdfinanzierung für alle OECD- und EU-Staaten über einen Zeitraum von 9 Jahren, versetzt uns dieser Datensatz in die Lage, die Konsequenzen der Einführung, Abschaffung oder Reformierung von steuerlichen Beschränkungen der Fremdfinanzierung empirisch zu überprüfen.

Die empirischen Ergebnisse bestätigen, dass steuerliche Beschränkungen der Fremdfinanzierung die Steuerplanung mittels konzerninterner Darlehensvergaben wirksam beschränken. Die empirischen Resultate zeigen jedoch auch, dass Investitionsentscheidungen internationaler Konzerne nicht nur vom jeweiligen lokalen Steuerniveau, sondern auch vom Grad der steuerlichen Beschränkung der konzerninternen Fremdfinanzierung negativ beeinflusst werden. Demnach bestätigen unsere Ergebnisse die Vermutung, dass die Steuerpolitik letztendlich eine Abwägung zwischen Beschränkungen der internationalen Steuerplanung und den hieraus resultierenden negativen Konsequenzen für Investitionsentscheidungen treffen muss.

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1 Introduction

While all companies will probably respond to taxation and capital market conditions with their financing and investment decisions, multinational corporations seem to have enhanced opportunities to do so. This includes well-known strategies of tax deferral and transfer pricing but extends to many more strategies. Though it is difficult to assess the revenue losses resulting from multinational corporations' tax planning efforts for high–tax countries like the US or Germany, tax planning by multinationals seems to be an important factor (Gravelle, 2004; Desai, 2005). Apart from adverse consequences for tax revenue, enhanced opportunities to save taxes may give the multinationals an advantage over companies operating only at a national level. This would distort the decision to operate multinationally rather than domestically (Bucovetsky and Haufler, 2007). The adverse revenue consequences and the disadvantage of national companies create temptations for tax-policy makers to change details in the tax law in order to restrict certain types of multinational tax planning. However, the many dimensions along which multinational corporations can structure their activities have already led

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to rather complex national tax policies with regard to transnational activities (Gresik, 2001). In this situation, it is not obvious that further attempts to restrict certain types of tax planning are very effective. Even if they are effective, it is not clear that the corporations' response to a restriction is generally beneficial for the imposing country: as has been discussed in the theoretical literature, restricting opportunities for tax planning might result in adverse consequences for multinationals' investment in high-tax countries and may reinforce tax competition (*e.g.*, Keen, 2001; Janeba and Smart, 2003; Peralta, Wauthy, and van Yperserle, 2006).

One important element in multinational corporations' tax planning is related to the financial structure. While the taxation of corporate profits generally results in an incentive to use debt instead of equity, multinationals can adjust the financial structure not only by means of external debt but also internally by using intercompany loans to and from foreign affiliates. Facing an increased ability of multinational corporations to use debt finance, governments often respond by imposing thin-capitalization rules (Weichenrieder, 1995:165pp., 1996). While these rules differ from country to country, a general characteristic is that interest deduction is limited if the debt-to-equity ratio of an affiliate is above a certain threshold. More precisely, interest payments associated with an excess leverage are generally not deductible from taxable profit. In the US, for example, corporations whose debt-to-equity ratio is in excess of 1.5:1, and which pay interest on debt owed to, or guaranteed by, certain non-US affiliates are subject to the so-called earnings stripping limitation of interest deduction (*cf.*, Sec. 163 (j) IRC). While the US was one of the first countries that imposed thin-capitalization

rules, many countries have followed recently. Figure 1 documents the increased use of thin-capitalization rules among the OECD and the European Union (EU) countries over the last decade. In the mid-nineties, less than a third of European countries and less than half of the OECD countries had thin-capitalization rules in place. In 2005, three fifths of European and two thirds of OECD countries imposed such rules. In the time period between 1996 and 2005 in all 39 countries considered in Figure 1, there were 19 cases where new restrictions on the admissible capital structure were enacted or where existing limitations were tightened; in only four cases have tax authorities weakened or entirely removed restrictions.

Despite the spread of thin-capitalization rules, however, empirical evidence on their consequences is generally lacking. In this paper, therefore, we will investigate the effects of thin-capitalization rules on multinationals' financing and investment decisions. A theoretical model derives some basic empirical predictions about the consequences of imposing thin-capitalization rules for capital structure choice and investment. The empirical analysis employs a comprehensive micro-level panel database of virtually all German multinationals' foreign affiliates made available for research by the German central bank (*Deutsche Bundesbank*). Combined with the information about corporate taxation, including thin-capitalization rules in all OECD and European Union countries over a period of 9 years, this dataset allows us to study the consequences of the introduction, removal, or change in thin-capitalization rules across countries and time.

The results confirm that thin-capitalization rules are quite effective in reducing tax planning by means of intercompany loans. Moreover, investment is not only found to

Figure 1: Share of Countries Imposing Thin-Capitalization Rules (in %)
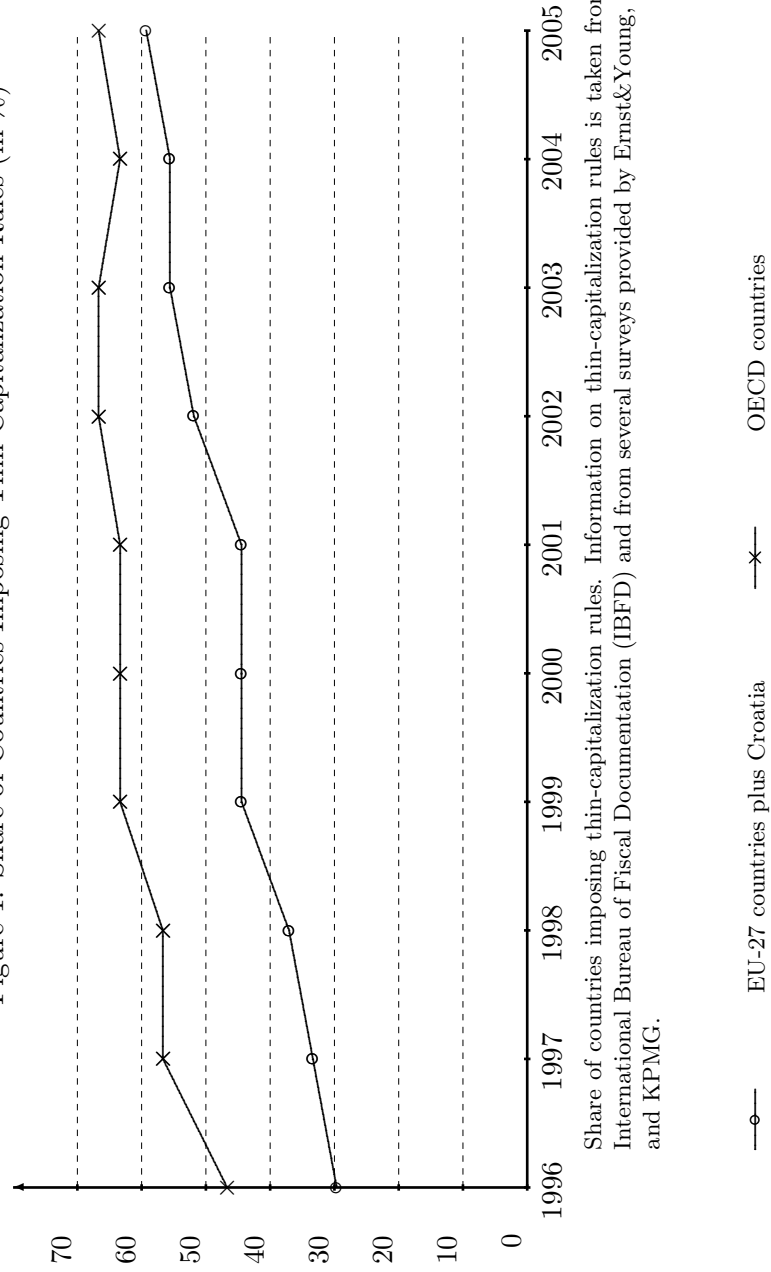
Share of countries imposing thin-capitalization rules. Information on thin-capitalization rules is taken from the International Bureau of Fiscal Documentation (IBFD) and from several surveys provided by Ernst&Young, PwC, and KPMG.

EU-27 countries plus Croatia   OECD countries

be sensitive to local tax rates but is also to a significant degree adversely affected by the imposition of thin-capitalization rules. In quantitative terms, the results suggest that the imposition of these rules is, on average, associated with a decline of investment by about 4.8%. This supports theoretical concerns that tax competition might be reinforced if governments restrict cross-border tax planning.

The paper is structured as follows. Section 2 provides a simple theoretical background considering the impact of thin-capitalization rules on financing and investment decisions of a multinational corporation and derives testable empirical predictions. Section 3 discusses the investigation approach. The subsequent sections are concerned with the empirical analysis. Section 4 gives a short description of the dataset, before Sections 5 and 6 present the results for capital structure choice and investment, respectively. Section 7 provides the conclusions.

2   Theoretical Implications of Thin-Capitalization Rules

In order to derive the impact of thin-capitalization restrictions on corporate decisions we will briefly discuss the decision of a multinational company based in country 1 which carries out activities in the host country 2. Consider the profits related to the stock of capital invested in country 2

$$
\begin{aligned}
\pi_{12} \;=\;& f\left(k_2\right)\left(1 - \tau_2\right) \\
& -\; \left(i_2 \lambda_2 k_2 + i_1 \mu_2 k_2\right)\left(1 - \tau_2\right) \;-\; r k_2 \left(1 - \lambda_2 - \mu_2\right)
\end{aligned}
\tag{1}
$$

$$- \quad c\left(\lambda_2, \mu_2\right) k_2 \quad - \quad \left(\mu_2 - \overline{\mu}_2\right) \varphi_2 i_1 k_2 \tau_2.$$

Here $f\left(k_2\right)$ denotes the output at location 2 where k_2 units of capital are employed. τ_2 is the local tax rate on capital income. The first term in the second line reports the interest cost, where $i_2\left(i_1\right)$ is the rate of interest for debt issued in country 2 (1), and μ_2 and λ_2 denote the share of capital financed with internal and external debt, respectively. Note that internal debt $\left(\mu_2 k_2\right)$ is remunerated at the interest rate in country 1.[1] The second term in this line captures the return on equity where r is the required rate of return. If both μ_2 and λ_2 are zero, all capital is financed with equity.[2] Before further considering the profit function, let us briefly discuss the tax incentive for using internal debt. Suppose that i_1 is not different from r. Then, a shift towards debt finance at location 2 (higher μ_2) will tend to raise profits after taxes, as a larger part of the earnings of capital is tax deductible. Even in this situation, the corporation will not finance all capital with debt due to additional cost of debt.[3] They are represented in the

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[1] The company might have an incentive to set the interest rates above the market value, but we assume that the arm's length principle is effective.

[2] Note that the profit function assumes that the parent incurs external debt in order to finance the inter-company loan. Thus interest income at the parent is offset with interest cost. The alternative is, of course, that the parent finances the loan with equity. In this case, however, the parent would have to pay taxes on the interest income which might be quite substantial if the parent is located in a high-tax country. Our focus here lies on the first case, since the empirical analysis below is concerned with German multinationals, where the parent company is indeed located in a high-tax country. The alternative case is discussed by Mintz and Smart (2004).

[3] The concept of additional cost of debt has been introduced by the corporate finance literature (for surveys see, *e.g.*, Myers, 2001; Graham, 2003). Basically, the literature emphasizes that a tax-induced increase in the leverage is associated with an increase in costs of financial distress (*e.g.*, Kraus and Litzenberger, 1973; Scott, 1976), or in agency costs of debt reflecting an inability to solve potential conflicts between equity and debt claimants by means of contracts (*e.g.* Jensen and Meckling, 1976; Myers, 1977). Another strand of the literature (*e.g.*, Jensen, 1986; Aghion and Bolton, 1989; Hart, 1988) is concerned with the relationship between shareholders and management. In this view, debt might be useful to ensure control rights of investors under

last line by a convex function of the affiliate's internal and external debt-capital ratios $c\left(\lambda_2,\mu_2\right)$.[4] The last term reflects the imposition of a thin-capitalization rule, which limits interest deductions up to a fixed share of internal debt, *i.e.* interest payments for an excess leverage cannot be deducted from the tax base. Hence, the profit function is extended to take account of the additional tax payments arising from an excess leverage above the admissible limit $\overline{\mu}_2$. In order to consider cases with and without restrictions on the tax deduction of interest, we will set $\varphi_2 = 1$ if the affiliate operates under a binding thin-capitalization rule, *i.e.* in cases where $\mu_2 > \overline{\mu_2}$, and $\varphi_2 = 0$ otherwise.

For internal debt used by the affiliate in country 2 we obtain the first-order condition

$$r - \left(1 - \tau_2\right)i_1 - \varphi_2 i_1 \tau_2 = c_\mu\left(\lambda_2,\mu_2\right). \tag{2}$$

Accordingly, the leverage related to intercompany loans is determined by the cost of equity relative to internal debt. If $r > \left(1 - \tau_2\right)i_1$, the convexity of c implies that μ_2 is positive. In other words, if the after-tax rate of interest is below the required return on equity, some internal borrowing is inevitable. If φ_2 equals 1, the marginal cost of intercompany borrowing jumps up to $i_1 + c_\mu\left(\lambda_2,\mu_2\right)$ as the tax deduction is no longer granted. As a consequence, the amount of internal debt μ_2 might be reduced. However, in the restricted case we have two possible outcomes. If the required return on equity is sufficiently large ($r > i_1 + c_\mu\left(\lambda_2,\overline{\mu_2}\right)$), the optimal choice of μ_2 obeys

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bad conditions, for instance, if a firm goes bankrupt. But since equity allows the manager to control the corporation under good conditions, a tax-induced increase in the debt-asset ratio relative to the optimal level would imply an inefficiency which contributes to the additional cost of debt.

[4] We assume that $c\left(0,0\right) = 0$, $c_\lambda\left(\lambda_2,\mu_2\right) > 0$, $c_\mu\left(\lambda_2,\mu_2\right) > 0$, and positive second-order differentials.

$r = i_1 + c_\mu (\lambda_2, \mu_2)$ with $\mu_2 > \overline{\mu_2}$. But if the required return on equity is lower such that

$(1 - \tau_2) i_1 + c_\mu (\lambda_2, \overline{\mu_2}) < r < i_1 + c_\mu (\lambda_2, \overline{\mu_2})$, we have a corner solution where $\mu_2 = \overline{\mu_2}$.

With regard to empirical implications, note that the imposition of thin-capitalization rules will not only affect the level of intercompany loans; it will also affect its tax-rate sensitivity. In order to see how, we derive the comparative static effect of an increase in the tax rate by differentiating the two first-order conditions to obtain

$$\frac{d\mu_2}{d\tau_2} = \frac{(1 - \varphi_2) i_1 c_{\lambda\lambda} - i_2 c_{\mu\lambda}}{c_{\mu\mu} c_{\lambda\lambda} - c_{\lambda\mu}^2}. \tag{3}$$

Without a thin-capitalization rule ($\varphi_2 = 0$) and if interest rates do not differ much, this term is positive and the strength of the response depends on the interest rate and on the cost function $c(\lambda_2, \mu_2)$.[5] However, if there is a thin-capitalization rule in place and it is binding ($\varphi_2 = 1$), the positive tax rate effect disappears. In fact, depending on the degree of substitution between internal and external debt, the effect might even be negative. Of course, if we have a corner solution such that μ_2 is fixed at $\overline{\mu}_2$, the impact of the tax rate is zero.

Beside effects on the capital structure, thin-capitalization rules might also affect the cost of capital and thus, investment. Consider the first-order condition for the capital stock

$$(1 - \tau_2) f_k (k_2) \overset{!}{=} (1 - \tau_2)(\mu_2 i_1 + \lambda_2 i_2) + (1 - \lambda_2 - \mu_2) r + c_2 (\lambda_2, \mu_2) + (\mu_2 - \overline{\mu_2}) \varphi_2 i_1 \tau_2. \tag{4}$$

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[5]It is reasonable to assume that the cross effects are always dominated by the own effects, *i.e.* $c_{\mu\mu} > |c_{\mu\lambda}|$ and $c_{\lambda\lambda} > |c_{\lambda\mu}|$.

Accordingly, the stock of capital is chosen such that the after-tax marginal product on the left-hand side equals the marginal cost of investment on the right-hand side. The latter consists of the interest cost (first term), of the cost of equity (second term), and of the additional cost of debt (third term). The last term, however, adds to the cost only if a thin-capitalization rule is imposed and binding ($\mu_2 > \overline{\mu}_2$ and $\varphi_2 = 1$). Then, the tax deduction is limited, borrowing is more costly, and the costs of investment are increased. The consequence will be a lower level of investment. Note, however, that the adverse effect on investment is increasing in the actual level of internal debt and is zero at the threshold ($\mu_2 = \overline{\mu}_2$).[6]

To sum it up, the theoretical discussion offers at least three sets of testable predictions: (i) First of all, the first–order conditions suggest that the amount of internal debt used by the affiliate is a declining function of the after-tax rate of interest if no thin-capitalization rule is imposed. Then, a lower interest rate and a higher tax rate would lead to an increase in internal debt. But, if a thin-capitalization rule is imposed in the host country and is binding, internal debt received from other affiliates of the multinational is reduced. If empirical results are supportive, we can say that tax planning via intercompany loans is effectively reduced by thin-capitalization rules. (ii) A second implication of the theoretical discussion is that the determination of an affiliate's capital structure is different under the restriction of a thin-capitalization rule. If affiliates are subject to binding restrictions, internal debt is no longer a shelter against corporate taxation, and thus a higher tax rate will no longer be associated with an in-

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[6]With additional assumptions about the properties of the production function, further implications might be drawn about the tax sensitivity of the capital stock.

crease of internal debt. If this is confirmed empirically, binding thin-capitalization rules would effectively remove the incentive for tax planning via intercompany loans. (iii) A third implication is related to the stock of capital. While the optimal capital stock of an affiliate is simply a function of the cost of capital, the imposition of a binding restriction on internal debt raises the cost of capital. Empirical analysis can test this prediction and quantify the adverse effect of thin-capitalization rules on investment.

3 Investigation Approach

The empirical analysis below aims at testing the theoretical predictions discussed in the previous section using a firm-level panel dataset of the affiliates of German multi-nationals in 36 European and OECD countries. This data, which will be described in greater detail below, provides information about the capital structure of each affili-ate including information about intercompany loans. Combined with the information about corporate taxation, including thin-capitalization rules, this dataset basically pro-vides us with three sources of empirical variation that can be used to study the effects of thin-capitalization rules. The first source is the variation in the existence of these rules in the set of countries over time, which we have noted already in the introduction. A second source is the variation in the threshold level of intercompany loans above which interest deduction is denied. A third source, however, stems from information on intercompany loans received by each individual affiliate. This information enables us to distinguish between affiliates where interest deduction is likely to be denied because

the host-country's thin-capitalization rule is binding, and affiliates where the rule is most likely not binding as the amount of intercompany loans is below the threshold level. As we will see below, this third source of variation can be used in particular to study the differences in the tax sensitivity of capital structure choice.

A natural starting point for the empirical analysis is to consider the effectiveness of the thin-capitalization rules that have been introduced by several countries. For this purpose, we first apply a simple dummy-variable approach, testing whether the imposition of such rules has noticeable effects on the capital structure of foreign affiliates in these countries. More precisely, we run panel regressions of the share of capital financed with intercompany loans $ICL_{j,k,t}$ of an affiliate in the host country j held by company k in period t on a complete set of affiliate- and time-specific effects and an indicator of the imposition of such rules

$$ICL_{j,k,t} \;\;=\;\; \gamma_t + \alpha_{j,k} + aRULE_{j,t} + u_{j,k,t}, \tag{5}$$

where $RULE_{j,t} = 1$ if a thin-capitalization rule is imposed in country j in period t and otherwise zero. If thin-capitalization rules are effective, a should be significantly negative. Note that the affiliate-specific effects nest country-specific fixed effects, and thus remove time-invariant differences across countries. Hence, a significant negative effect would indicate that the introduction of thin-capitalization rules is associated with a decline of intercompany loans.

In order to check that not only the imposition but also the actual tightness of thin-

capitalization rules affects intercompany loans, we employ the alternative approach

$$ICL_{j,k,t} = \gamma_t + \alpha_{j,k}, + aTHRESH_{j,t} + u_{j,k,t}, \qquad (6)$$

where $THRESH_{j,t}$ is an indicator of the tightness of thin-capitalization rules in country j as of time t. More precisely, $THRESH_{j,t}$ reports the admissible amount of internal debt above which interest deduction will be denied and is expressed as a fraction of total shareholder capital (inclusive of internal debt). Without any restrictions the admissible amount is 100%; if there are restrictions, this figure is lower. In the US case, for example, the limit implied by the earnings-strippings rule would be 60%.[7] With this definition of $THRESH$, we expect a significantly positive coefficient for a_1.

While the above approach provides some descriptive evidence on the effects of thin-capitalization rules, it fails to take account of other possible determinants of capital structure choice such as, for instance, the statutory tax rate. For the purpose of obtaining reliable quantitative estimates of the effects of thin-capitalization rules, we employ the indicator for the presence or tightness of the rules in an estimation equation for capital structure choice

$$ICL_{j,k,t} = a_0 + a_1 THRESH_{j,t} + a_2 \tau_{j,t} + a_3 x_{j,k,t} + \alpha_{j,k} + \gamma_t + \epsilon_{j,k,t}, \qquad (7)$$

where $\tau_{j,t}$ is the local profit tax rate and $x_{j,k,t}$ controls for further characteristics of the affiliate or the host country which possibly affect the use of debt or the access to credit.

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[7]To see this note that the debt-to-equity limit for internal debt of 1.5:1 implies a maximum amount of internal debt expressed as a fraction of total shareholder capital of $1.5/(1.5+1) = 0.6$.

Note that the time effect also captures the lending rate and the taxing conditions at the parent location, as we consider a set of companies which all share the same parent location. The affiliate-specific effect captures not only general characteristics of the affiliate, but also all time-invariant characteristics of the host country. Furthermore, because each affiliate is associated with a separate fixed effect, the specification nests company-specific effects. These effects capture company-specific opportunity cost of capital which might differ, for instance, with personal taxation at the level of the shareholder.

The estimation strategy presented so far has only tested whether the existence and tightness of a thin-capitalization rule in a host country are reflected in the amount of intercompany loans used. In order to test the predictions about the tax sensitivity of the capital structure, however, we need to explicitly take into account the conditions at the level of the affiliate and distinguish the decision of restricted from that of unrestricted affiliates. One way to approach the estimation problem is to follow Hu and Schiantarelli (1998) and to think of unrestricted and restricted affiliates as operating under two different *regimes*: the first *regime* refers to affiliates where the capital structure is such that all interest payments for intercompany loans can be deducted from gross profits. The second *regime* refers to affiliates where the thin-capitalization rule is binding, and thus the marginal gain from using intercompany loans is reduced. We therefore introduce an indicator variable $I_{j,k,t}$ taking on the value one if the thin-capitalization rule is binding for affiliate j of company k in period t, while otherwise zero. For each *regime* the financial structure is explained by the same set of variables, however,

intercept and slope coefficients may differ.

$$ICL_{j,k,t}^1 = a_0^1 + a_2^1 \tau_{j,t} + a_3^1 x_{j,k,t} + \alpha_{j,k}^1 + \gamma_t^1 + \epsilon_{j,k,t}^1 \qquad (8)$$

$$ICL_{j,k,t}^2 = a_0^2 + a_2^2 \tau_{j,t} + a_3^2 x_{j,k,t} + \alpha_{j,k}^2 + \gamma_t^2 + \epsilon_{j,k,t}^2$$

$$\text{where} \begin{cases} ICL_{j,k,t}^1 = ICL_{j,k,t} \text{ if } I_{j,k,t} = 0 \\ ICL_{j,k,t}^2 = ICL_{j,k,t} \text{ if } I_{j,k,t} = 1 \end{cases}$$

A basic problem in the estimation of this system of two equations is that selection into each of the two (sub-)samples is endogenous: the assignment of an affiliate to one of the samples depends not only on the tightness of the restriction, but also on the level of internal debt. However, as emphasized by Verbeek and Nijman (1992) and Vella (1998), fixed effects regressions would yield consistent estimates if sample selection depends on the individual-specific component, but not on the random component. This would imply, however, that firms do not switch between *regimes*.

In order to control explicitly for possible sample-selection effects, we follow Kyriazidou (1997), who proposes a two-step estimator yielding consistent estimates under more general conditions. The first step is concerned with the selection process captured by a binary regression model such as Chamberlain's (1980) fixed effects logit estimator. The second step is concerned with the estimation of the model in first differences using only affiliates that are observed in the same *regime* in both periods. The estimation uses a weighted least squares procedure, where the parameters of the selection equation are used to construct kernel weights, such that pairs of observations with larger differences in the selection effects receive a smaller weight.

With regard to the possible determinants of the selection equation, we note first that sample selection should depend on the determinants of capital structure choice. Another rather obvious variable would be the actual admissible internal debt limit as captured by $THRESH_{j,t}$. In addition, a useful predicting variable could be the ratio of nominal share capital to total capital, because an affiliate with more nominal capital, *ceteris paribus*, is expected to be less frequently restricted by the thin-capitalization rule.

Presuming that the analysis of internal debt supports the theoretical predictions about how thin-capitalization rules affect internal debt and curb the incentive to engage in tax planning via intercompany loans, we finally turn to the effects on investment. As suggested by the first-order condition, the optimal capital stock depends on the various components of the cost of capital including the statutory tax rate, the return on equity, as well as on the interest rates weighted with the components of the capital structure. As the first order condition is concerned with the capital–labor ratio, an analysis of the optimal stock of capital should further include determinants of employment such as wages or, in a more general setting, other indicators of costs and profits. The simple theory above has neglected any form of adjustment costs, which might be quite substantial at least with regard to real investment. In the presence of adjustment cost, however, it becomes necessary to at least invoke a simple partial adjustment mechanism where current investment aims at reducing the gap between optimal and existing stocks of capital. The empirical analysis, therefore, is concerned with investment as a function of the lagged stock of capital as well as of the determinants of the optimal stock of

capital. Thus, we specify a multivariate estimation equation

$$\Delta \log K_{j,k,t} \quad = \quad \rho \log K_{j,k,t-1} + \ b_0 + \ b_1 THRESH_{j,t} + \ b_2 z_{j,k,t} + \alpha_{j,k} + \gamma_t + \epsilon_{j,k,t} \quad (9)$$

where γ_t is a time-specific and $\alpha_{j,k}$ is an affiliate-specific effect. $z_{j,k,t}$ contains several controls, which may or may not be company specific. These reflect differences in the market size, in the local production cost including the corporate tax rate and depreciation allowances, or in other variables that affect the capital structure choice as captured above by $x_{j,k,t}$.

The estimation equation involves a dynamic specification in a panel-data context. Thus, one might be concerned about a possible dynamic panel bias (Nickell, 1981), even though the data covers no less than nine subsequent years. To address this problem, we will invoke a GMM estimator, exploiting the moment conditions related to lagged levels of the dependent variable in a first differenced setting as suggested by Anderson and Hsiao (1982) and Arellano and Bond (1991).

4 Data and Descriptive Statistics

The empirical analysis employs micro-level data for multinationals provided by the *Bundesbank*. This includes a comprehensive annual database of direct investment stocks of German enterprises held abroad. More precisely, the data provides information about each foreign affiliate's balance sheet and some further information about the ownership

as well as about the German investor. For the purpose of this study we use annual firm-level panel data for foreign affiliates controlled by a German parent, in the time period from 1996 to 2004. Data collection is enforced by German law, which determines reporting mandates for international transactions.[8] Since the above theoretical discussion is concerned with a multinational corporation that completely controls the capital structure of its affiliates, we focus on majority-owned subsidiaries and also exclude indirectly held investment. Furthermore, because the theoretical model only deals with productive affiliates, holdings and financial service providers as well as observations with zero capital and zero sales are excluded.

Table 1 provides some descriptive statistics on the size and geographic distribution of the foreign affiliates in the sample. The list of host countries comprises 36 countries; 28 of which are European countries. We include in particular all EU and OECD member states, where a complete set of control variables is available.[9] The table reports country-specific means for the two variables which are the focus of the empirical investigation, *i.e.* the share of internal debt and the stock of fixed assets. The share of internal debt is defined by ratio of internal liabilities to total capital consisting of nominal capital, capital reserves, profit reserves, and total debt. To study the investment decision we

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[8]Sec. 26 Aussenwirtschaftsgesetz (Law on Foreign Trade and Payments) in connection with Aussenwirtschaftsverordnung (Foreign Trade and Payment Regulations). Each German multinational has to report its foreign assets including both direct FDI and indirect FDI conditional on some lower threshold level for mandatory reporting. Since 2002, FDI has to be reported if the participation is 10% or more and if the balance-sheet total of the foreign object exceeds 3 million euros. For details see Lipponer (2006). Though previous years showed lower threshold levels, we apply this threshold level uniformly for all years in the panel.

[9]Although Romania is a EU member state, it is not included because lending rates are not available. Iceland is excluded since no affiliates in the dataset are reported there. Finally, Germany is not included as the parent companies' country.

Table 1: Foreign Affiliates by Country

Host Country	Observations		Fixed Assets (€ 1,000)	Share of Internal Debt
	Number	Share	Mean	Mean
Australia	955	1.97	4,649	.319
Austria	3,713	7.65	8,573	.224
Belgium	1,870	3.85	11,999	.249
Bulgaria	110	0.23	5,158	.237
Canada	782	1.61	11,125	.226
Croatia	156	0.32	38,573	.275
Cyprus [a]	-	-	-	-
Czech Republic	2,535	5.22	15,462	.259
Denmark	864	1.78	6,567	.255
Estonia [a]	-	-	-	-
Finland	355	0.73	10,119	.232
France	5,456	11.24	6,192	.242
Great Britain	3,710	7.64	7,177	.244
Greece	457	0.94	5,609	.284
Hungary	1,582	3.26	20,488	.228
Ireland	364	0.75	7,423	.225
Italy	3,714	7.65	7,533	.281
Japan	1,096	2.26	13,874	.218
Latvia	49	0.10	4,900	.201
Lithuania	67	0.14	2,932	.419
Luxembourg	243	0.50	8,043	.236
Malta	52	0.11	7,596	.186
Mexico	644	1.33	33,239	.279
Netherlands	2,354	4.85	6,739	.238
New Zealand	132	0.27	2,125	.262
Norway	370	0.76	13,553	.261
Poland	2,942	6.06	8,457	.261
Portugal	766	1.58	8,255	.228
Slovakia	537	1.11	19,057	.248
Slovenia	202	0.42	5,991	.252
South Korea	485	1.00	19,392	.213
Spain	3,110	6.41	11,105	.230
Sweden	1,042	2.15	7,818	.276
Switzerland	2,935	6.05	4,745	.179
Turkey	448	0.92	6,675	.214
USA	4,430	9.12	21,310	.283
Total	48,551	100.00	10,612	.247

Bundesbank (MiDi) data, based on 48,551 annual observations for the time period from 1996 to 2004. [a] confidential data.

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focus on the stock of fixed assets.

In order to capture the tax incentives for the capital structure, the analysis employs the statutory tax rate on corporate income modified by applicable restrictions on interest deductions, such as in the case of the Italian local business tax (IRAP). Thus, the employed statutory tax rate captures the tax savings from deducting one unit of interest. Since the effective tax reduction from using debt might be zero if a subsidiary carries forward any losses for tax purposes (MacKie-Mason, 1990), we also use a dummy variable indicating whether some loss carry-forward is reported. Of course, the existence of losses in the previous periods may capture other characteristics of the current decision problem of the company, such as the expected performance of a subsidiary. Hence, the overall effect on the capital structure is ambiguous.

Figure 2 depicts the development of the admissible amount of internal debt expressed as a fraction of total shareholder capital. Given the differences in the details of thin-capitalization rules across countries, the admissible amount of internal debt depicted in Figure 2 generally reflects an upper limit. In several countries, interest deduction may be denied even if internal debt is lower: external debt might be included if backed by the parent, and in some countries the limit is even expressed in terms of total debt rather than internal debt.[10] Figure 2 shows that the trend towards imposing thin-capitalization rules (see Figure 1) is reflected by the value of the threshold level. However, the mean value for European countries as well as for OECD countries in 2004

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[10]The US case serves as an example, because Sec. 163 (j)(3)(B) IRC explicitly includes external debt backed by the parent and Sec. 163(j)(2)(C) IRC refers to total debt.

Figure 2: Average Threshold Level for Internal Debt: OECD and European Countries
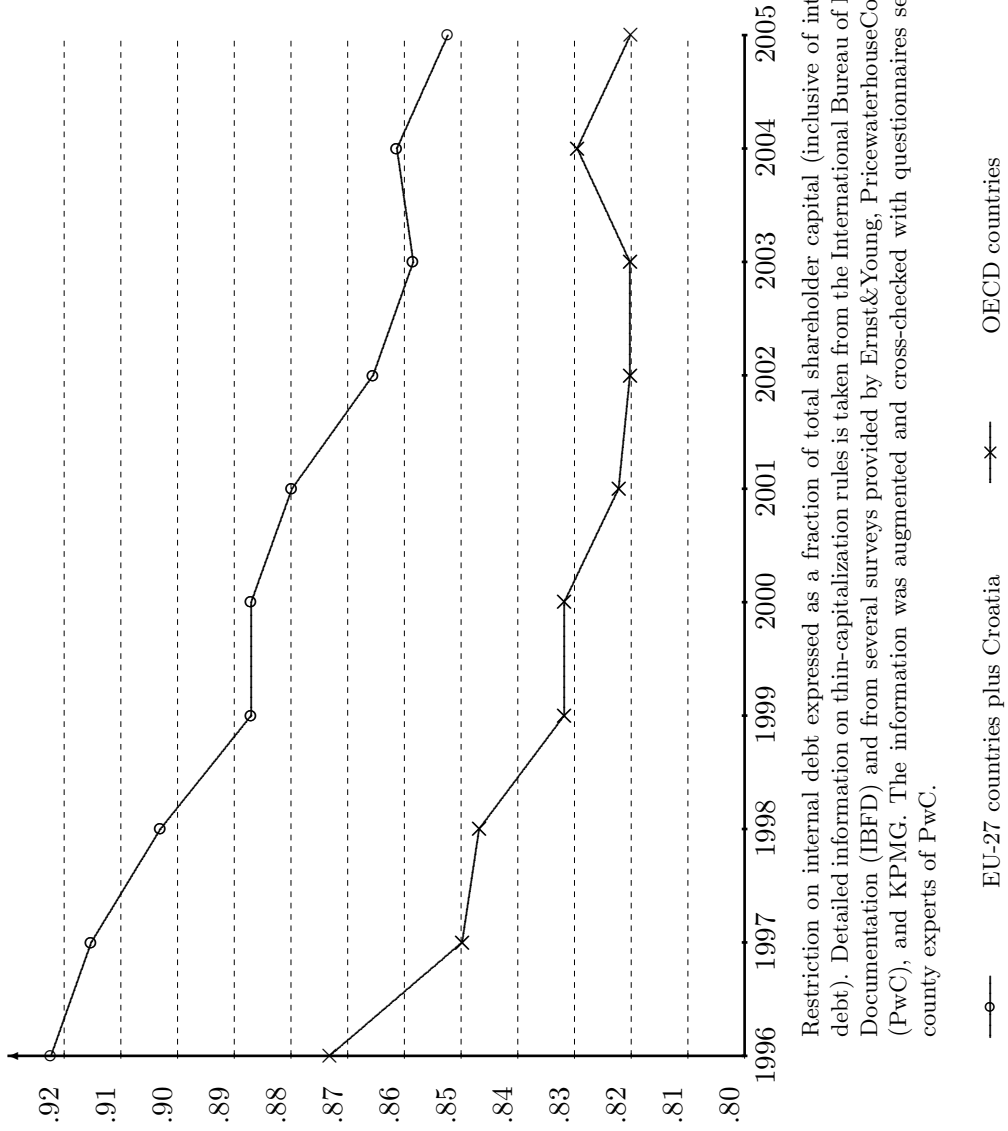
Restriction on internal debt expressed as a fraction of total shareholder capital (inclusive of internal debt). Detailed information on thin-capitalization rules is taken from the International Bureau of Fiscal Documentation (IBFD) and from several surveys provided by Ernst&Young, PricewaterhouseCoopers (PwC), and KPMG. The information was augmented and cross-checked with questionnaires sent to county experts of PwC.

EU-27 countries plus Croatia   OECD countries

is still above the US figure, where the threshold of the debt-to-equity ratio yields a limit of the admissible fraction of internal debt of 60%.[11]

As the firm-level data does not provide us with information about firm-specific interest expenses, we employ the lending rate for the private sector taken from the IMF, augmented, where possible, with OECD data. In order to control for company-specific variation in the borrowing conditions, we employ the affiliate's sales as an indicator of the cash flow of the subsidiary. Another variable that captures differences in borrowing conditions is the asset tangibility measured as the ratio of fixed assets to the balance-sheet total. Following the financing literature, a higher tangibility of assets should result in more favorable borrowing conditions because agency costs may be reduced by collateral (Jensen and Meckling, 1976). In order to interpret the signs of the coefficients, it is important to note that we focus on internal debt rather than total debt. Since internal debt shows a substitutive relationship with external debt (Desai, Foley, and Hines, 2004), higher external borrowing costs might be positively associated with internal debt.

With regard to the analysis of investment, we employ some additional controls. Because investment might not only be affected by the statutory tax rate but also by depreciation allowances, we include a control variable for the present value of depreciation

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[11]In the US case, the application of the earnings-stripping rule additionally requires that the corporation's net interest expense exceeds 50 percent of the adjusted taxable income of the corporation. Since we do not observe data on interest expenses, we will not attempt to take this additional requirement into account. However, for those regressions where we use information about the threshold level, we carried out robustness checks by excluding US observations and did not detect any qualitative differences to the results presented below.

allowances.[12] Further controls include hourly labor cost in manufacturing as available from the Bureau of Labor Statistics. In order to capture the market size we have included the GDP. Finally, the list of variables is augmented by a corruption perception index as the prevalence of corruption may deter foreign direct investment (*e.g.*, Wei, 2002). Table 2 provides descriptive statistics for the main variables.

5 The Impact of Thin-Capitalization Rules on Intercompany Loans

As discussed above, we will first carry out some general tests concerning the effectiveness of thin-capitalization rules. Column (1) of Table 3 reports results for the dummy-variable approach. Note that because estimation controls for affiliate level fixed effects, only variation in the existence of thin-capitalization rules within each country matters. Thus, the negative significance of the dummy variable, that captures the existence of a thin-capitalization rule, indicates that introducing such a rule exerts a significant impact on intercompany loans: the average amount of intercompany loans is reduced if a thin-capitalization rule is introduced. The magnitude suggests that the share of internal debt is reduced by 2.6 percentage points. Column (2) provides results where the simple dummy is replaced by the actual admissible threshold level of internal debt. The positive coefficient suggests that a tighter limit would actually be associated with less internal debt.

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[12]Note that due to restrictions of interest deduction, the tax rate used in the analysis of the capital structure differs slightly from the statutory tax rate used in the analysis of investment.

Table 2: Descriptive Statistics

Variable	Mean	Std.Dev.	Min.	Max.
Firm level variables				
Fixed Assets (stocks in € mill.)	10.6	100.1	0	9,240
Sales (in € mill.)	51.0	335.8	1.0	25,098
Total leverage(rel. to total capital)	.606	.251	0	1.0
Internal debt (rel. to total capital)	.247	.248	0	.991
Nominal capital (rel. to total capital)	.169	.169	0	1.0
Asset tangibility	.256	.233	.001	1.0
Loss carry-forward (binary)	.294	.456	0	1
Tax variables				
Statutory tax rate	.342	.069	0	.532
Present value of deprec.allow. [a]	.804	.047	.657	1.0
RULE (Thin-Capitalization rule exists) (binary)	.730	.444	0	1
THRESH (internal debt threshold rel. to shareholder cap.)	.782	.165	0.50	1.0
Internal debt above threshold (binary)	.192	.394	0	1
Further country characteristics				
Lending rate	.075	.065	.018	1.23
Hourly labor cost (US$) [a]	16.36	7.59	1.14	36.41
GDP (US$ bill.) [a]	1,599	2,798	5.46	11,750
Corruption perception [a]	6.83	1.76	2.66	10

Based on 48,551 ([a] 46,773) observations representing 36 countries in the time period from 1996 to 2004. Firm-level variables are taken from the Bundesbank (MiDi) data. Minimum and maximum values of firm-level variables are averages of the 3 smallest (largest) values. Corporate taxation data are taken from the International Bureau of Fiscal Documentation (IBFD), and from tax surveys provided by Ernst&Young, PwC and KPMG. The lending rate refers to private sector debt taken from the IMF International Financial Statistics Yearbook (2006) augmented with corresponding OECD figures. GDP in U.S. dollars at current prices is taken from World Bank World Development Indicators (2006). Labor costs in U.S. dollars for production workers in manufacturing are taken from the U.S. Bureau of Labor Statistics and Eurostat. The Corruption Perception Index is taken from Transparency International; the score ranges from 10 (country perceived as virtually corruption free) to 0 (country perceived as almost totally corrupt).

Table 3: Thin-capitalization Rules and Intercompany Loans

	(1)	(2)	(3)	(4)	(5)
Statutory tax rate			.195 **	.185 **	.163 **
			(.084)	(.079)	(.075)
RULE (Thin-Cap. Rule exists)	-.026 **			-.021 **	
	(.011)			(.009)	
THRESH (Threshold for internal debt)		.141 **			.113 **
		(.046)			(.038)
(ln)Lendingrate			.015 *	.013 *	.014 *
			(.008)	(.007)	(.007)
Asset tangibility			-.050 **	-.050 **	-.050 **
			(.012)	(.012)	(.012)
(ln)Sales			.001	.001	.001
			(.002)	(.002)	(.002)
Loss carry-forward			.035 **	.035 **	.035 **
			(.003)	(.003)	(.003)
R^2	.7486	.7487	.7504	.7505	.7506
Observations	48,551	48,551	48,551	48,551	48,551
Affiliate Fixed Effects	yes	yes	yes	yes	yes

Dependent variable: share of internal debt. Affiliate- and time-specific fixed effects included. Heteroskedasticity robust standard errors clustered at the level of country-year cells in parentheses. A star denotes significance at the 10% level and two stars at the 5% level.

In a further step, we employ a regression approach that includes control variables for other determinants of capital structure choice. Column (3) shows results of regressions with a standard set of controls. For all variables, the estimated coefficients show the expected signs. According to Column (3), an increase in the tax rate by 10 percentage points results in an increase in the internal debt share by about 2 percentage points. While this estimate is lower than results in the existing literature,[13] it should be noted

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[13]Desai, Foley, and Hines (2004) report an impact of a 10 percentage point increase of the tax rate of 3.3 percentage points for US multinationals. Mintz and Weichenrieder (2005) report results for foreign subsidiaries

that this coefficient only relates to internal debt. Desai, Foley, and Hines (2004) have considered the tax-sensitivity of internal debt with data for US multinationals and obtained a smaller coefficient, suggesting that an increase in the tax rate by 10 percentage points results in an increase of the internal debt share of 0.8 percentage points. However, given a lower share of internal debt in the case of US multinationals, the implied elasticity for the US case is 0.35 as compared to 0.25 in our case.

With regard to the indicators of borrowing cost, the results are in accordance with the theoretical predictions, given the above-mentioned substitutability between external and internal debt. Asset tangibility shows a negative effect suggesting that less internal debt is used if borrowing costs for external debt are reduced. Similarly, the positive effect of the lending rate indicates that more internal debt is used if borrowing costs deteriorate.

To test for the effects of thin-capitalization rules, Column (4) includes the dummy for the existence of a thin-capitalization rule; Column (5) employs the actual level of the threshold above which interest deduction is denied. Both specifications support the effectiveness of thin-capitalization rules. However, Column (5) is preferred since it includes information about the tightness of the rules. In order to illustrate the empirical magnitude, consider the case of a country which introduces a thin-capitalization rule with a 1.5:1 ratio of internal debt to equity (*i.e*, the US case). In this case, the threshold level of intercompany loans would come down from 1 to a figure of 0.6. According to the

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of German corporations of between 3.0 and 5.7 depending on the specification. For German affiliates of foreign investors, Ramb and Weichenrieder (2005) find a coefficient of 1.4; Huizinga, Laeven, and Nicodème (2006) find a somewhat lower estimate of 2.7 for a sample of European corporations.

point estimate in Column (5), the share of internal debt would drop by 4.6 percentage points.

While the results support the effectiveness of thin-capitalization rules, an investigation of the consequences for the tax-rate sensitivity would have to take into account that the rules are not equally relevant for all subsidiaries. In fact, thin-capitalization rules are only binding for a subset of subsidiaries. As we know from the above theory, only for the subsidiaries where the rule is not binding would we expect intercompany loans to be positively associated with the tax rate. In contrast, internal debt of restricted subsidiaries should not be positively affected by the tax rate; depending on the degree of substitutability and on whether or not affiliates are stuck in a corner solution, even a negative impact might be found.

To see whether, in fact, the tax sensitivity of the capital structure choice differs, we have to decompose the sample of subsidiaries into sub-samples where the subsidiaries have intercompany loans below or above the threshold, above which interest can no longer be deducted from the tax base.

In fact, as depicted in Columns (1) and (2) of Table 4, a significant positive tax-rate sensitivity of intercompany loans is found only for subsidiaries where the amount of intercompany loans falls below the threshold defined by the thin-capitalization rule.[14] For subsidiaries using more intercompany loans, the tax rate has no significant effect.

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[14]Affiliates are treated as restricted if internal debt as a fraction of total shareholder capital (inclusive of internal debt) exceeds the accepted threshold for internal debt. Since in the US the limit is expressed in terms of debt rather than internal debt (Sec. 163(j)(2)(C) IRC), we carried out regressions based on this modified definition of restricted subsidiaries. However, the results are very similar.

Table 4: Determinants of Intercompany Loans: Sample Split

	(1) Unrestricted firms	(2) Restricted firms	(3) Unrestricted firms	(4) Restricted firms
	All observations		Switching firms excluded	
Statutory tax rate	.203 **	.081	.197 **	-.094
	(.083)	(.116)	(.067)	(.204)
(ln)Lendingrate	.011	.008	.006	-.001
	(.008)	(.012)	(.007)	(.017)
Asset tangibility	-.024 **	-.064 *	-.033 **	-.120 **
	(.012)	(.037)	(.013)	(.056)
(ln)Sales	.002	-.008	.002	.057 **
	(.002)	(.005)	(.003)	(.010)
Loss carry-forward	.035 **	.051 **	.034 **	.036 **
	(.003)	(.007)	(.004)	(.003)
R^2	.7449	.8261	.7349	.8191
Observations	39,252	9,299	32,581	4,180

Dependent variable: internal debt share. Affiliate- and time-specific fixed effects included. Heteroskedasticity robust standard errors clustered at the level of country-year cells. A star denotes significance at the 10% level and two stars at the 5% level. Columns (3) and (4) are obtained for a sub-sample of subsidiaries which in all years belong either to the group of unrestricted or restricted firms.

As these results are obtained from fixed effects panel regressions, they are consistent if sample selection is driven by the time-invariant characteristics of the subsidiaries. Even though it seems rather restrictive to assume that sample selection effects are fully captured by the fixed effects, according to Columns (3) and (4), similar results are found if all those subsidiaries are removed that have been switching between the *regimes*. This suggests that the results are mainly driven by affiliates where the selection is time invariant.

In order to obtain consistent estimates in the presence of sample selection effects, we check for differences in the tax-rate sensitivity between restricted and unrestricted subsidiaries following Kyriazidou (1997). The results for the corresponding first-step estimation of the probability of a binding restriction as presented in Column (1) of Table 5 are clearly in line with the theoretical predictions.[15] A higher tax rate and a lower loss carry-forward provide an incentive for the affiliate to use more debt such that it is more likely to pass the threshold. Given the substitutability between internal and external debt, the positive significance of the local lending rate and of sales as well as the negative effect of tangibility are also in accordance with theoretical expectations. A significant adverse effect of the tightness of restrictions on the likelihood of being above the threshold is supported, and with regard to nominal capital, the estimation shows a negative effect. The former reflects the effectiveness of thin-capitalization rules for capital structure choice. The latter seems reasonable, because an increase in nominal capital makes it less likely that the thin-capitalization rule is binding. The

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[15]Note that the fixed effects logit estimator removes all observations where no change in the regime is observed. This explains why the number of observations is relatively small.

Table 5: Determinants of Intercompany Loans: Sample Selection Model

	(1) Logit estimates	(2) Unrestricted firms	(3) Restricted firms
Statutory tax rate	3.05 **	.072 *	-.096
	(1.44)	(.043)	(.160)
(ln)Lendingrate	.310 **	.004	-.027
	(.161)	(.006)	(.017)
Asset tangibility	-1.15 **	-.066 **	-.038
	(.341)	(.019)	(.048)
(ln)Sales	-.089	.001	-.009
	(.060)	(.003)	(.007)
Loss carry-forward	.122	.017 **	.040 **
	(.084)	(.004)	(.008)
THRESH (Threshold for internal debt)	-24.79 **		
	(1.47)		
Nominal capital	-21.16 **		
	(.825)		
Observations	11,790	29,328	5,570

Column (1): dependent variable is binary with zero if firms' intercompany loans are below threshold and unity if above. Fixed effects logit estimation for individual subsidiaries. Time-specific fixed effects included. Heteroskedasticity robust standard errors clustered at the level of country-year cells (in parentheses). A star denotes significance at the 10% level and two stars at the 5% level. Columns (2) and (3): dependent variable is share of internal debt. Weighted regression in first differences, based on subsidiaries where internal debt is below (above) the threshold in the current and previous period. Following Kyriazidou (1997), regressions employ kernel weights based on the selection equation in Column (1). Heteroskedasticity robust standard errors clustered at the level of country-year cells (in parentheses).

results for the second-step estimation are reported in Columns (2) and (3). Column (2) shows the determinants of intercompany loans in the sub-sample of firms where a thin-capitalization rule is not binding; Column (3) is concerned with the group where a thin-capitalization rule is binding. Basically, the results confirm our findings from Table 4. For the unrestricted subsidiaries, asset tangibility and the existence of a loss carry-forward show the expected effects and the statutory tax rate shows a significantly positive effect. For the restricted firms, the coefficients for asset tangibility and the existence of a loss carry-forward show the same signs, but only the latter proves significant. Moreover, the coefficient for the statutory tax rate is negative, albeit insignificantly. The difference in the effects of the tax rate supports the view that binding thin-capitalization rules would effectively remove the tax incentive for tax planning via intercompany loans.

6 The Impact of Thin-Capitalization Rules on Investment

Let us finally consider the consequences for investment. Because no information about actual purchases of capital or about depreciation is given in the data, we have to rely on the balance-sheet information for each individual affiliate's stock of fixed assets. As a dependent variable we compute the change in the stock of fixed assets (in logs) with regard to the previous period. Table 6 provides the respective regression results. Columns (1) and (2) report results from regressions without controlling for a partial adjustment process. While Column (1) employs the binary indicator of whether a

Table 6: Thin-Capitalization Rules and Investment

	(1)	(2)	(3)	(4)	(5)	(6)
Statutory tax rate	-.559 *	-.557 *	-.753 **	-.737 **	-.714 **	-.723 **
	(.285)	(.285)	(.253)	(.255)	(.169)	(.169)
RULE (Thin-cap. rule exists)	-.072 **		-.042 **		-.054 **	
	(.023)		(.016)		(.021)	
THRESH (Int.debt threshold)		.353 **		.156 **		.218 **
		(.095)		(.070)		(.093)
(ln)Fixed assets$_{(t-1)}$			-.490 **	-.490 **	-.352 **	-.353 **
			(.020)	(.020)	(.047)	(.047)
Present value depreciation	-.519	-.529	-.104	-.101	-.193	-.192
	(.384)	(.382)	(.273)	(.274)	(.246)	(.246)
(ln)Corruption perception	-.173	-.180	-.107	-.101	-.210 **	-.199 **
	(.110)	(.109)	(.087)	(.087)	(.082)	(.082)
(ln)Labor cost	-.196	-.187	-.075	-.069	-.015	-.022
	(.197)	(.196)	(.160)	(.160)	(.124)	(.124)
(ln)GDP	.186	.177	.448 **	.446 **	.280 **	.286 **
	(.204)	(.202)	(.159)	(.159)	(.131)	(.131)
(ln)Lendingrate	.209 **	.207 **	.123 **	.122 **	.172 **	.171 **
	(.037)	(.036)	(.027)	(.027)	(.025)	(.025)
(ln)Sales	.082 **	.082 **	.224 **	.224 **	.124 **	.124 **
	(.012)	(.012)	(014)	(.014)	(.016)	(.016)
Loss carry-forward	-.050 **	-.050 **	-.038 **	-.030 **	-.031 **	-.031 **
	(.013)	(.013)	(.012)	(.013)	(.013)	(.013)
Observations	36,825	36,825	36,825	36,825	27,537	27,537
R^2	.2862	.2862	.4598	.4598		
Hansen test ($\chi^2(6)$)					10.07	10.14
AR(1) (z-value)					−10.71	−10.71
AR(2) (z-value)					−0.71	−0.71

Dependent variable is the logarithmic difference of the fixed assets. Columns (1) to (4) report OLS estimates. Affiliate- and time-specific fixed effects included. Heteroskedasticity robust standard errors clustered at the level of country-year cells in parentheses. Column (5) and (6) report results from a first-differenced estimation following Arellano and Bond (1991). Heteroskedasticity robust standard errors clustered at the level of country-year cells following the suggestions of Windmeijer (2005) in parentheses. A star denotes significance at the 10% level and two stars at the 5% level.

thin-capitalization rule exists or not, Column (2) utilizes the threshold level for internal debt instead. Both estimations account for affiliate- as well as time-specific fixed effects. Nevertheless, both regressions report significant effects of thin-capitalization rules. Column (1) indicates that the introduction of a thin-capitalization rule is accompanied with lower investment, whereas Column (2) indicates that tighter thin-capitalization rules exert an adverse effect on investment.

Columns (3) and (4) report results including the lag of the stock of fixed assets (in logs). Even though the lagged stock of capital is significant, the results on the control variables are not much different, qualitatively. However, a problem with the dynamic specification in Columns (3) and (4) is that it ignores a possible dynamic panel bias. Therefore, Columns (5) and (6) report results from a consistent dynamic panel data estimation procedure as suggested by Arellano and Bond (1991).[16] Because test statistics for overidentifying restrictions and autocorrelation do not point at specification errors, and because the lagged stock of fixed assets shows a different coefficient, these instrumental variable specifications are preferred.

Again, we find significant effects for both the existence of thin-capitalization rules and their tightness. Moreover, in accordance with theoretical predictions, a lower statutory tax rate is associated with a higher level of investment.[17] With regard to the further

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[16]Given a time period of nine years available for the analysis, we employ a parsimonious GMM specification exploiting only the additional moment conditions with the level of the capital stock two periods ago.

[17]While the statutory tax rate was adjusted in order to take account of special provisions for debt finance (see above), for the purpose of studying investment, both the basic statutory tax as well as the adjusted tax rate would matter. However, probably due to the rather small differences between the two tax rates, various alternative specification showed no significant differences.

control variables, we should note that estimations control for affiliate-specific fixed effects which nest country-level fixed effects, and thus entirely remove cross-sectional variation across countries. This might explain why, for instance, labor cost proves insignificant. The lending rate shows a positive effect which potentially picks up inflation. Sales shows a strong positive coefficient pointing at positive market-size effects. The negative impact of the loss carry-forward might simply reflect unfavorable profit prospects. Both regressions point to a significant adverse effect of thin-capitalization rules: firm-level investment is lower if a thin-capitalization rule is introduced or if these rules are tightened.

With regard to the implied magnitudes, we note first that according to Column (5) the introduction of a thin-capitalization rule is associated with a decline in investment by about 5 percentage points. To illustrate the effect of the tightness of restrictions in Column (6) consider, once again, the case of a thin-capitalization rule with a debt-equity threshold of 1.5:1. If such a rule were to be repealed, the THRESH variable would jump from a level of 0.6 to unity. According to the point estimate in Column (6), investment would increase by 8.72 percent.[18] However, considering that the mean limit in the dataset is 0.782, the removal of restrictions would exert a positive impact on investment of 4.8 percent on average.

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[18]If we took the coefficient of the lagged stock of capital as a measure of the adjustment speed, we could derive a point estimate of 24.7% for the long-term effect on the stock of capital.

7 Conclusions

In the last decade, governments in Europe and in other OECD countries have increasingly restricted debt finance of multinationals by means of thin-capitalization rules. These rules typically limit interest deduction if the debt-capital ratio related to shareholders is above a certain threshold. While the motivation of this measure of tax policy is to curb tax planning of multinationals by means of intercompany loans to and from foreign affiliates, effectiveness and consequences have not been analyzed, so far. Using a micro-level panel dataset of German multinationals, this paper studies both the effectiveness of the limitations as well as their impact on corporate decisions with regard to capital structure choice and investment.

A theoretical discussion suggests that binding thin-capitalization restrictions would not only result in a reduction of internal debt but also in a lower tax sensitivity of internal debt. At the same time, binding restrictions should exert adverse effects on capital cost and, hence, reduce investment.

The empirical investigation is concerned with capital structure choice and investment of the subsidiaries of German multinationals in 36 countries in the time period between 1996 and 2004. An analysis of the capital structure shows that more internal debt is used in host countries with high tax rates and where the borrowing cost of external debt are high. The analysis also confirms that imposition and tightening of thin-capitalization rules is, in fact, associated with a significant reduction in the use of internal debt.

In a second step of the analysis, we compare the internal debt-to-capital ratio of the individual affiliate with the restrictions in the respective host country. This allows us to distinguish affiliates which are most likely subject to binding thin-capitalization restrictions from the others. A fixed effects panel regression for subsidiaries shows that a significant tax sensitivity of internal debt is only found for those affiliates that do not face binding restrictions. This result is further confirmed in a panel data sample selection model. It indicates that thin-capitalization restrictions effectively remove the incentive for tax planning by means of intercompany loans.

In a third step of the analysis, we consider investment in the subsidiaries' stock of capital. While the analysis confirms an adverse effect of the local tax rate, investment is shown to be adversely affected by the imposition of a thin-capitalization rule. This result is confirmed in regressions where investment is assumed to follow a partial adjustment process towards an optimal capital stock. The point estimate for the adverse impact of thin-capitalization rules on investment suggests that repealing a strict 1.5:1 debt-equity ratio would result in an increase of investment by about 8.72 percent. Given that most countries have less restrictive rules, the average impact of the removal of restrictions on investment is estimated to be 4.8 percent.

Thus, our results confirm that tax policy is facing a trade-off between limiting multinationals' tax planning and the real consequences of corporate taxation. This suggests that tax policy should take account of the adverse investment effects of restrictions on tax planning by means of debt finance. Imposing restrictions alone does not enable tax policy to escape the fundamental questions concerning the corporation tax raised by

the emergence of multinationals.

Datasources and Definitions

Firm-level data are taken from the micro-level dataset (MiDi) of the Deutsche Bundesbank. (See Lipponer (2006) for an overview.) The share of internal debt is determined by the level of balance-sheet internal liabilities divided by total capital consisting of nominal capital, capital reserves, profit reserves, and total debt. Investment is defined as the logarithmic difference in the balance-sheet position of fixed assets. Asset tangibility is defined as the ratio of fixed assets to balance-sheet total.

Corporate taxation data are taken from the International Bureau of Fiscal Documentation (IBFD) and from tax surveys provided by Ernst&Young, PricewaterhouseCoopers (PwC), and KPMG. The statutory tax rate variable contains statutory profit tax rates modified by applicable restrictions on interest deductions.

Thin-Capitalization rules: Basic information about thin-capitalization rules is obtained from the same sources as the tax data. This information was augmented and cross-checked with questionnaires sent out to country experts of PricewaterhouseCoopers.

Present values of depreciation are calculated for investments in machinery, assuming a discount rate of 7.1 percent. Depreciation rules are taken from the references considered in case of corporate taxation data (see above).

Lending rates refer to private sector debt taken from the IMF International Financial Statistics Yearbook (2006) augmented with corresponding OECD figures.

GDP in U.S. dollars, nominal. Source: World Bank World Development Indicators (2006).

Labor cost: Hourly compensation costs in U.S. dollars for production workers in manufacturing. Source: U.S. Bureau of Labor Statistics and Eurostat.

Corruption Perception Index is published annually by Transparency International, which ranks countries in terms of perceived levels of corruption as determined by expert assessments and opinion surveys; the score ranges from 10 (country

perceived as virtually corruption free) to 0 (country perceived as almost totally corrupt).

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