

# ***The impact of introducing an interest barrier - Evidence from the German corporation tax reform 2008***

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**Abstract:** In this study we investigate the impact of the thin capitalization rule introduced in Germany in 2008 on firms' capital structure, investment and profitability. The identification of the causal effects is based on the escape clauses in the regulation using a difference-in-difference approach. Our results suggest that firms strongly react to the new regulation: in order to avoid the limited deductibility of interest expenses either by decreasing their debt ratio or by splitting the firms' assets to use the exemption limit. We further show that the effect on firms' investment depends on its financial situation. With respect to the aim of restricting the profit shifting of multinational firms our results indicate that the sensitivity of investment to corporate income taxes increases for firms which are affected by the thin capitalization rule. Moreover, our analysis shows that the thin capitalization rule is quite successful in broadening the tax base.

**Keywords:** thin capitalization, earnings stripping rule, debt ratio, profitability, investment.

**JEL Classification:** H25, H26, G32.

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## **1. Introduction**

Profit shifting is a severe problem for governments in Europe and the US as prior studies have shown (Huizinga and Laeven, 2008; Weichenrieder, 2009). While the growing international tax competition has led to a general decline of the statutory corporate tax rates, several countries – especially larger countries – have introduced or tightened thin capitalization rules (TCR) which cause a broadening of the tax base (see Haufler and Runkel, 2008). The main objective of these rules is to prevent firms from shifting profits abroad.

How effective thin capitalization rules are and which behavioral adjustments they provoke, however, has not yet been analyzed in great detail. Buettner et al. (2008) analyzed the impact of TCRs using a firm level panel data set of the affiliates of German multinationals in 36 countries combined with information on corporate taxation in each of these countries. They find that thin capitalization rules reduce the amount of intercompany loans (internal debt of firms). Additionally, their results suggest a decrease of the tax sensitivity of internal debt: Firms for which a TCR is binding show a weaker reaction of intercompany loans to tax rate changes. Furthermore, they report an overall reduction in investment as a response to TCRs.

Using different data and a different econometric approach Overesch and Wamser (2010) confirmed the first result of Buettner et al. (2008) showing that the German TCR in the period 1996 to 2004 reduced internal borrowing significantly. However, Wamser (2008) reported in his study that the reduction of internal borrowing was accompanied by an increase in external debt.<sup>2</sup> None of these studies considers the profitability of the firms affected by the TCR and thus the impact of TCRs on the tax base. To fill this gap and to give a comprehensive picture of the effects of TCRs is the aim of this study. To do so, we first analyze, how the capital structure (taking into account internal and external debt) of firms was affected by the new TCR introduced in Germany in the year 2008. In a second step, we

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<sup>2</sup> The study of Wamser (2008) is based on data for affiliates of foreign corporations in Germany from Deutsche Bundesbank and uses the 2001 reform of the German thin capitalization rule as a quasi-natural experiment.

study the impact of the TCR on investment. Finally, we investigate how effective the newly introduced TCR was with respect to the aim of broadening the tax base.<sup>3</sup>

The TCR reform of 2008 intended to avoid the shortcomings of the old regulation, where only payments to direct shareholders had been considered. The disadvantages of the regulation were, on the one hand, that firms substituted external and internal debt as shown by Wamser (2008) and, on the other hand, that it was hard to distinguish between shareholders and third parties as creditors in complex group structures. Under the new regime, interest expenses (independent of the creditor) may only be fully deducted if the net interest expenses do not exceed 30% of EBITDA, adjusted for tax purposes. Therefore, in principle all firms in Germany are affected by the limited interest deductibility. However, as the German government was not interested in harming its own economy by implementing this broad concept of a TCR it included several escape clauses as well. The most important one for the majority of firms is the tax exemption limit for the net interest result of 1 million euro<sup>4</sup>. This is also the regulation on which we base the identification strategy in this paper to analyze our research questions.

Our analysis uses a nearly complete set of financial statements data for all incorporated German firms. Methodically, we use a difference-in-difference approach to identify the causal effect of the TCR. Our results suggest that firms strongly react to the new regulation in order to avoid the limited deductibility of interest expenses either by decreasing their debt ratio or by splitting the firms' assets to use the exemption threshold. We further show that the effect on firms' investment depends on the firms' financial situation. With respect to the aim of restricting the profit shifting of multinational firms our results indicate that the sensitivity of investment to corporate income taxes increases for firms, which are affected by the TCR. Moreover, our analysis shows that the newly introduced TCR is quite successful in broadening the tax base.

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<sup>3</sup> Note that although financing decisions and the tax base are in principle positively related, the changes in both items as a reaction to a thin capitalization rule need not be identical. For example, the tax base might increase less than equity if firms try to avoid the expected increase in the tax burden by relying more on other profit shifting opportunities, for instance the choice of transfer prices.

<sup>4</sup> The threshold of 1 million euro has been increased by the Peoples' Relief Act (Bürgerentlastungsgesetz) (temporarily) and the Growth-Enhancement Act (Wachstumsbeschleunigungsgesetz) (permanently) in the year 2009 to 3 million euro. However this was after December 31, 2008.

The outline of the paper is as follows. In the next section we provide a summary of the new thin capitalization regulation in Germany. Section three describes the empirical methodology. The following section presents our dataset. Results are reported and discussed in section five, whereas section six concludes.

## ***2. Institutional Background***

In the coalition contract signed by the so called large coalition of Christian democrats and Social democrats on November 11, 2005, the coalition partners announced a major corporation tax reform. A first draft bill for this reform ("Unternehmensteuerreform 2008") was presented by the German government on February 5, 2007 (see Rödder and Stangl, 2007, p. 479). The law passed the last stage of the legislation process (Bundesrat) on July 6, 2007 and was published on August 14, 2007. Those parts relevant for this study were enacted at the beginning of the year 2008.<sup>5</sup>

One of the important elements of the corporation tax reform 2008 was the introduction of a new interest barrier which limits the deductibility of interest payments under certain conditions and is in several characteristics more restrictive than the regulations that preceded it. The new interest barrier takes into account interest payments from all types of creditors and applies to all types of companies. Before the reform in 2008 interest payments were generally deductible from total revenues as regular expenses. The only major exception from this rule was made for interest payments on credits provided by shareholders of limited liability companies whose share in the company exceeded a certain threshold (article 8a German Income Tax Code in the year 2007 and earlier).<sup>6</sup> Obviously, the government did not regard the old regulation as being effective in preventing companies from shifting profits to lower taxing countries (see Rödder and Stangl, 2007, p. 479, Deutscher Bundestag, 2007, p. 29). The main cause for the ineffectiveness of the former regulation might have been the problem of differentiating between financing of owners and

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<sup>5</sup> The probably most important change of the reform was the reduction in the tax rate of the corporation tax from 25 to 15%. Gradual changes of the law which are of interest here were included in the Peoples' Relief Act (Bürgerentlastungsgesetz) and the Growth-Enhancement Act (Wachstumsbeschleunigungsgesetz). The former passed the Bundesrat on July 10, 2009 and the latter on December 18, 2009.

<sup>6</sup> These interest payments were regarded as masked (covered) profit transfers and were qualified as hidden dividend payments and taxed respectively.

third parties in cases where a relation between them could be suspected but not proved (Thiel, 2007).

The basic rule of the new regulation states that interest payments are deductible as long as they are balanced by interest income or, in case interest payments exceed firms' interest income, as long as the exceeding payments are less or equal to 30% of earnings before interest, taxes, depreciation and amortisation (EBITDA) (see Art. 4h German Income Tax Code). The new regulation applies to the corporate income, the local business and also to the income tax. Interest payments which are not deductible in one year may be carried forward indefinitely and - given sufficiently high levels of EBITDA in later years - may be deducted then.<sup>7</sup>

In order to prevent small firms and firms with a somehow "sufficient" equity financing from an additional tax burden, the interest barrier comes with several "escape clauses". Small companies should not face a burden as already the initial code in the year 2008 provided a tax exemption limit (Freigrenze) of 1 million euro.<sup>8</sup> The second escape clause applies to companies which do not belong to a group and do not rely on significant shareholder debt financing (stand-alone-escape, Art. 8a, 2 Corporation Tax Code). The stand-alone escape may also apply to consolidated tax groups. If all members of a group form a single tax group, the whole group is regarded (and treated in the same way) as a single company. The whole group is thus exempted from the interest barrier in case that no harmful financing by owners is present.

The third escape type is provided for members of a group which do not qualify as a tax group. A group member may deduct all interest payments if the member's equity rate (equity over total assets) is not lower than the equity rate in the whole group (according to the consolidated statement of the group including the company under consideration). The

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<sup>7</sup> Excess interest payments are not re-qualified as hidden dividend payments as was the case with the earlier interest barrier which applied to affiliates only. Thus, for foreign creditors whose interest income is taxable at home, the new legislation leads to a double taxation of the interest payments. As stated in the explanatory statement to accompany the new legislation, foreign creditors should be given an incentive to finance investments in Germany with equity. While paying the tax on the excess interest would be equal to paying the tax on dividends of the same amount in Germany, the corporations would avoid the double taxation in the second case as dividend payments from abroad are usually tax free in the home country of the investor.

<sup>8</sup> This limit was first increased to 3 million euro in the peoples' relief act (Bürgerentlastungsgesetz) in the year 2009 for business years which started on May 25, 2007 the earliest and ended on January 1, 2010. The Growth-Enhancement Act (Wachstumsbeschleunigungsgesetz) suspended the time limitation of the increased tax exemption limit.

initial regulation of the corporation tax reform 2008 included a tolerance level of 1 percentage point.<sup>9</sup> Like the second escape type, also this third type is granted only for member companies of groups if limits for shareholder debt financing are not violated by any member in the whole group (Art. 8a, 2 Corporation Tax Code).<sup>10</sup>

Another escape option is directly related to the exemption limit mentioned above. Firms with interest expenses above the exemption limit may incorporate new subsidiaries and shift some of their assets over to these new entities. If this is possible, we would expect firms to do so since in this case the firms and their subsidiaries are not affected by the interest barrier and can still shift profits and/or have high leverage ratios.

Since the regulation described above was not executed as it has been changed in 2009 retrospectively we only include observation up to the year 2008 in our analysis as in these years firms behaved as the regulation would apply.<sup>11</sup>

### **3. Methodology**

To analyze the causal effects of the TCR on firms' financing and investment decision and on their profitability we rely on a difference-in-difference approach.<sup>12</sup> In a difference-in-difference estimation the effect of a reform is measured by comparing the outcome for a treatment (which is affected by the reform) and a control group before and after a reform. For a valid difference-in-difference design three important requirements have to be fulfilled. Firstly, treatment and control group should exhibit the same trend with respect to the dependent variable before the treatment. We show in the data section that this requirement is met. The second requirement is that there are no other confounding treatments. Although this cannot be tested formally, we carefully form treatment and control group such that

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<sup>9</sup> This level was raised to 2 percentage points in the Growth-Enhancement Act in 2009.

<sup>10</sup> Probably as a reaction to the criticism during the economic downturn in the year 2009, the Growth-Enhancement Act (Wachstumsbeschleunigungsgesetz) in the year 2010 introduced an EBITDA carry forward. As mentioned above, the basic rule of the interest barrier states that net interest payments up to 30% of current EBITDA are deductible. Under the new legislation, companies with interest payments below 30% of EBITDA in a calendar are granted an EBITDA carry forward. The amount of the carry forward is equal to the difference between 30% of EBITDA and the net interest payments. The EBITDA carry forward may be used in the five following years and is simply added to the value of current EBITDA (see Rödding, 2009).

<sup>11</sup> The most important changes of the regulation in 2008, which apply also for the year 2008, was that the exemption threshold was increased to 3 million euro and that the unused amount of deductible interest expenses based on the ratio of 30% of net interest expenses to EBITDA could be carry forward.

<sup>12</sup> For a general introduction, see Meyer (1995).

other confounding treatments can be ruled out. Thirdly, the treatment has to be exogenous. This we ensure as well due to the formation of the treatment and control group. We come back to this.

Given our data, we are in principle in the position to identify these firms in our sample which are entitled to each of the escape clauses outlined above. The only escape clause we cannot model is the equity group comparison escape clause. Since this regulation is quite complex and might result in changes in the group structure which are costly, we may reasonably assume that only firms with interest expenses far above the exemption limit will use this regulation. Thus, without loss of generality, for the analysis of the other regulation, we restrict our investigation of the reactions to the interest barrier on companies for which it seems to be a realistic option to reduce their interest payments below the tax exemption limit. For these companies (or their owners) it is likely that using the exemption limit is their option of first choice.<sup>13</sup>

The treatment in this study is whether a firm is affected by the TCR or not. Since we focus on firms with net interest expenses around the exemption threshold of 1 million euro, we assume that the TCR applies when firms' net interest expenses exceeds the threshold. To ensure exogenous treatment, we use firms' 2006 characteristics to form treatment and control group, since at the time the regulation of the TCR has been unknown.<sup>14</sup> To make sure, that the common trend assumption for treatment and control group is fulfilled, we restrict our sample further with respect to how far away are firms' net interest expenses from the threshold. We choose to include all firms with interest expenses within a range of 500 thousand euro above and below the threshold. This restriction ensure as well that for the firms included in the analysis it can reasonably be assumed that a reduction of their interest payments below the exemption limit is their option of first choice in order to avoid the interest barrier. To avoid misclassification at the threshold, we excluded firms with net interest expenses between 800 and 1,200 thousand euro. Our control group therefore consists of firms with net interest expenses in 2006 between 500 thousand and 800

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<sup>13</sup> In this case, adjustments of equity dominated by the demands of the whole group are probably less severe than for companies for which interest payments are much higher than the exemption limit. Nonetheless, they might be present and might in part of the cases prevent companies from increasing their equity in order to keep their interest payments below the tax exemption limit.

<sup>14</sup> See Section 2.

thousand euros, our treatment group shows expenses between 1,200 and 1,500 thousand euro.

Since firms can be assumed to be forward looking, we also exclude all observations in 2007 as in this year the graphical analysis (see section 4) shows that firms started to adjust their debt ratio in order to avoid the limited deductibility of interest expenses.

The first question we analyze in this study is the impact of the new interest barrier on firms' debt ratio. We follow the literature and define the debt ratio as ratio of total liabilities to total assets (DR). The difference-in-difference specification for debt ratio as dependent variable is shown in equation (1).  $Const$  is a constant and  $Const(i)$  a firm specific effect,  $Treatment$  a dummy which is one for the treated firms and  $After$  a dummy which is one for years after the 2007.  $\varepsilon$  is an iid error term. All other factors which affect the debt ratio are summarized into  $X(i,t)$ . These variables are in our study besides the tax rate on business income firm size, firm age, firms' share of tangible assets and the ratio of EBITDA to total assets. The construction of the variables is described in section 4. Whereas  $Treatment$  captures differences between treatment and control group with respect to the debt ratio,  $After$  captures time difference for the debt ratio between for and after the reform. The effect we are interested in is given by  $\gamma$ , which sums up the different evolution of the debt ratio for the firms which are affected by the TCR.

$$Debt\ Ratio(i, t) = Const + Const(i) + \beta Treatment(i, t) + \theta After(i, t) + \gamma(Treatment(i, t) * After(i, t)) + \rho X(i, t) + \varepsilon(i, t) \quad (1)$$

To avoid biased results due to the firm specific effects, we estimate equation (1) in difference between 2008 and 2006. The equation we estimate is given by (2). The dependent variable is now the change in the debt ratio between 2008 and 2006. Noteworthy, since we estimate in differences and construct the two groups based on the firm characteristics in 2006 we do not have to control for differences between the treatment and control group.

$$\Delta Debt\ Ratio(i) = \theta \Delta After(i) + \gamma \Delta(Treatment(i) * After(i)) + \rho \Delta X(i) + \Delta \varepsilon(i) \quad (2)$$

Since the TCR introduced in 2008 does not only include the exemption limit of 1 million euro for the net interest result but also other escape clauses (see section 2), it is likely that the coefficient  $\gamma$  in equation (2) is biased. Thus, we model the most important other escape

clauses in order to identify the effect of the regulation. These are the EBITDA escape, the stand-alone and the tax group stand-alone escape clause. We construct dummy variables for each of the modeled escape clauses and interact them with the *Treatment (i,t)\*After (i,t)* and the *After (i,t)* variable from equation 1 and then construct differences between 2008 and 2006. The dummies for the entitlement of another escape clause are modeled in such a way that the treatment effect is still given by  $\gamma$ . The equation we estimate is exemplary given for one other escape clause in equation (3). Note again, that since we model the entitlement based on the firms' characteristics in 2006 and estimate in differences, we do not have to control for time invariant differences between the firms which are entitled and which not. The coefficient  $\vartheta$  captures difference for firms which are entitled to the escape clause before and after the reform and  $\varphi$  captures how treated firms (firms which have interest expenses above 1 million euro) but which are entitled to another escape clause change their debt ratio. If we capture these firms perfectly we expect that  $\gamma = -\varphi$ , since there should be no difference between firms with interest expenses below the threshold and above the threshold which are not affected by the interest ceiling rule since they use another escape clause.

$$\begin{aligned} \Delta Debt\ Ratio(i) = & \theta \Delta After(i) + \vartheta \Delta (After(i) * EscapeClause(i)) \\ & + \gamma \Delta (Treatment(i) * After(i)) + \varphi \Delta (Treatment(i) * After(i) * EscapeClause(i)) \\ & + \rho * \Delta X(i) + \Delta \varepsilon(i) \end{aligned} \tag{3}$$

To analyze whether firms have split up their assets in order to avoid the interest barrier, we rely on a slightly different estimation design. In case a firm splits up, we expect that the number of subsidiaries increases more compared to firms who do not split up. Thus, in case firms split up their assets to avoid the application of the TCR, we would expect that their behavioral responses with respect to the debt ratio and the profitability are less strong. Their capital stock, however, should decrease more compared to treated firms, which do not split up. Since the number of additional subsidiaries may vary for different industries we dichotomize the change in the number of subsidiaries between 2008 and 2006. To account for different trends in the debt ratio of firms where the number of subsidiaries increases we include the dummy indicating whether the number of subsidiaries increased or not itself in the estimation equation ( $D(\Delta subsidiaries(i))$ ). Further, to analyze the effect of interest we include the interaction term between this dummy and the  $\Delta (Treatment * After)$  variable.

The coefficient of this variable captures how the debt ratio has changed for these firms. The equation we estimate is given in (4).

$$\Delta Debt Ratio(i) = \theta \Delta After(i) + \pi \Delta After(i) * D(\Delta subsidiaries(i)) + \gamma \Delta (Treatment(i) * After(i)) + \varphi \Delta (Treatment(i) * After(i)) * D(\Delta subsidiaries(i)) + \rho * \Delta X(i) + \Delta \varepsilon(i) \quad (4)$$

For the analysis of the impact of the interest barrier on investment and on the tax base of firms, we use, in principle, the same econometric approaches as described above. However, in the investment analyses we consider two additional specifications. This is on the one hand, whether internal finance matters differently for treated and untreated firms and on the other hand, whether the sensitivity of firms' investment with respect to the tax rate differential (TRD), which is defined as the difference between the tax rate on business income in Germany and tax rate of the country of origin of the global ultimate owner, differs.

To analyze the possible different effect of internal finance on the investment decision of treated firms, we include internal cash flow itself as well as an interaction term between cash flow and the treatment variable in equation (2). In case the coefficient of the interaction terms is positive and significant, this would indicate that internal cash flow played an important role for the investment reaction of treated firms.

To analyze whether firms, which are affected by the TCR, react differently to a TRD we start from specification (5), which is then transformed to (6) due to estimating in differences between 2008 and 2006. In equation (6), the coefficient  $\omega$  captures the pre-reform effect from the tax rate differential variable,  $\psi$  measures the difference between treatment and control group with respect to the TRD. Last but not least,  $\chi$  captures the effect of the tax rate differential after the reform for the control group. In case firms had shifted profits before the introduction of the interest barrier, we expect a positive effect of the TRD on the investment quota, indicating that the larger the gap between tax rate in the host and the foreign country, the higher the investment. Thus, if the TCR effectively reduces profit shifting, we expect a negative sign for interaction term between *Treatment \* After* and *TRD*.

$$\begin{aligned}
Investment(i, t) = & Const + Const(i) + \beta Treatment(i, t) + \omega TRD(i, t) + \psi TRD(i, t) * \\
& Treatment(i, t) + \theta After(i, t) + \alpha TRD(i, t) * After(i, t) + \\
& \gamma(Treatment(i, t) * After(i, t) + \chi(Treatment(i, t) * After(i, t) * TRD(i, t))) + \\
& \rho X(i, t) + \varepsilon(i, t)
\end{aligned} \tag{5}$$

$$\begin{aligned}
\Delta Investment(i, t) = & \theta \Delta After(i) + \gamma \Delta (Treatment(i) * After(i)) + \omega \Delta TRD(i) \\
& + \alpha \Delta (After(i) * TRD(i)) + \psi \Delta (Treatment(i) * TRD(i)) \\
& + \chi \Delta (Treatment(i) * After(i) * TRD(i)) + \rho \Delta X(i) + \Delta \varepsilon(i)
\end{aligned} \tag{6}$$

The construction of the variables follows in the next section, where we also describe the data set on which our study is based.

## 4. Data

The database for our study is the financial statements collection DAFNE provided for German firms by Bureau van Dijk. The main source for this data base is the registrar of companies in Germany. The dataset contains individual balance sheets, profit and loss accounts, and information on ownership structures. For years after 2005 the database covers nearly all incorporated firms in Germany as for these firms strict publication requirements apply.<sup>15</sup> For unincorporated business the database is only representative for unlimited partnerships with a limited liability company as general partner (*GmbH & Co. KG*). However, as we are interested in firms with net interest expenses above 500 thousand euros (see section 3) and probably only few partnerships with unlimited liability have interest payments above this amount the insufficient representation of these firms in our data base should not have a severe impact on the results of our empirical analysis.

From the description of the rules of the interest barrier given above, it is obvious that the information on the net interest result is crucial for the analysis. The net interest result can generally be calculated based on the information in DAFNE, however the relevant information is directly observed only for a subsample of the data. The reason is that the disclosure rules are less strict for the income statement than for the balance sheet. Small

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<sup>15</sup> In principle all German incorporated companies have to publish their financial statements according to Art. 325 Commercial Code, only subsidiaries companies which fulfill special requirement (see Art. 264 III Commercial Code) are not obliged to do so. To the best of our knowledge only a few thousand companies fulfill these requirements.

companies are not legally liable to publish the income statement at all.<sup>16</sup> In the DAFNE wave which we use for our empirical study (wave 174 from August 2011), we observe in total around 870 (940) thousand companies with a valid information for the balance sheet (total assets available) in the year 2006 (2008).<sup>17</sup> From these companies, around 100 (90) thousand also provide an income statement and thus we directly observe the information on the net interest result. For only a subsample of them we also have information on the ownership structure which is important to determine which firms are entitled to escape clauses of the TCR.

Since the selection of companies with an income statement and the selection of companies with the necessary ownership information are probably nonrandom, we construct three different estimation samples to check whether sample selection drives our results and to what extent conclusions can be drawn for the whole population. In the first sample, we only include observations for which an income statement *and* information on the ownership structure is given. In the second sample, we include all firms for which we observe an income statement and in the third sample, we include all firms. To construct control and treatment group in the latter sample, we impute net interest expenses in 2006 using the observed firm balance sheet characteristics.<sup>18</sup>

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<sup>16</sup> The criteria for size are total assets, sales and number of employees. Small companies fulfill at least two of the following three conditions: 1. total assets are equal or less than 4.015 million euros, sales are equal or less than 8.030 million euros and the number of employees is equal to or less than 50. A medium sized company does not fulfill at least two of the conditions which qualify for a small company and does fulfill at least two of the following three conditions: 1. total assets are equal to or less than 16.060 million euros, sales do not exceed 32.120 million euros and the number of employees does not exceed 250. For a large company, at least two of the values for assets, sales and employees exceed the respective thresholds for a medium sized company. Moreover all companies listed at an organized bond market are considered as large companies. See article 267 of the German commercial code.

<sup>17</sup> All numbers refer to companies with non-consolidated statements. Companies for which only a consolidated statement is available are neglected here and in the empirical analysis.

<sup>18</sup> The imputation was done with an OLS regression where the following covariates have been included: Unpaid contributions on subscribed capital, fixed assets, assets in between fixed and current assets, current assets, equity, special item with an equity portion, accruals, liabilities, deferred income (all scaled by the book value of total assets), intangible assets, tangible assets, financial assets (all scaled by the book value of fixed assets), inventories, receivables and other assets, securities, cash-in-hand (all scaled by the book value of current assets), liabilities up to one year, liabilities with a majority of more than one year, loans, liabilities to banks, payments on account of orders, trade payables, liabilities from central settlement, liabilities on bills accepted and drawn, liabilities to shareholders, payable to affiliated enterprises, payable to enterprises in which participation are held, other liabilities (all scaled by the book value of liabilities). We further include the log of total assets as well as legal form and industry dummies. The  $R^2$  of the regression amounts to 0.47. The results are not shown but available upon request from the authors.

Noteworthy, from all samples, we excluded financial firms as well as firms within the sectors public administration and defense, education, health and social work and other community activities and firms with negative equity. The number of observations in sample 1 (2 and 3) amounts to 704 (1,090 and 1,728), from which 168 (270 and 447) belong to the treatment group.

We turn to the construction of variables next. For our first research question the dependent variable is the change in the debt ratio between 2008 and 2006. We follow the literature and define the debt ratio as the ratio of liabilities to the book value of total assets. Besides the interaction term between the dummy indicating treatment and the dummy indicating the year after the reform, we include the following other determinants as covariates for the change in the debt ratio as dependent variable: change in firm size (log. of total assets in thousand euro), log firm age, firms' share of tangible assets (ratio of tangible assets to book value of total assets) as well the ratio of EBITDA to the book value of total assets. Further, we include the tax rate on business income to control for changes due to the German corporate tax reform in 2008. For incorporated firms the tax rate on business income captures the corporate income tax and the trade tax.<sup>19</sup> For incorporated business the tax rate depends on the shareholder structure as these firms divide their income among the shareholders and pass it through to the shareholders. For non-natural persons as shareholder the tax rate captures the tax rate on corporate income and the trade tax; for natural persons it is the tax rate on business income plus trade tax.<sup>20</sup>

Descriptive statistics of the variables used in the estimation for the whole sample (sample 1) and for treatment and control group are shown in table 1. On average a firm in sample 1 has in 2006 a debt ratio of 64 %, an investment rate of 11 % and a ratio of profit to total assets of 4.8 %. Debt ratio and investment rate do not differ between treatment and control group. The profitability of firms in the control group is, however, higher than for treated firms (5.2% to 4.4%). With respect to the control variables, treatment and control group differ significantly in their firm size and in their share of tangible assets. Further, both

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<sup>19</sup> We obtained the local trade tax rates by merging the local business tax rates provided by the Statistical Offices (2004-2009) to the database by using the firms' postal codes provided in Dafne.

<sup>20</sup> In case the ownership structure of a partnership firm is not observed, we used imputed average ownership structure.

groups operate partly in different industries. Descriptive statistics for sample 2 and sample 3 are given in table A1 in the Appendix A.

**Table 1: Firm characteristics 2006 of treatment and control group (Sample 1)**

Variable	N	Full Sample		Control Group	Treatment Group	t-test
		Mean	Std dev.	Mean	Mean	p-value
liabilities (thd. €)	704	28.044	37.528	23.974	41.027	0.00
interest rate	704	0.040	0.030	0.038	0.044	0.01
debt ratio	704	0.644	0.184	0.648	0.631	0.32
investment quota	704	0.108	0.416	0.099	0.135	0.385
Profitability	704	0.048	0.080	0.052	0.036	0.02
firm age	704	2.964	1.018	2,969	2,947	0,81
tangibility	704	0,514	0,284	0,492	0,585	0,00
firm size (thd. €)	704	52.644	121.510	46.182	73,585	0.01
corporate tax rate	704	0,396	0,031	0,397	0,395	0,42
<b>Industries (shares):</b>						
manufacturing	704	0,338	0,473	0,351	0,298	0,21
trade	704	0,229	0,420	0,246	0,173	0,05
services	704	0,051	0,220	0,043	0,077	0,08

Notes: Statistics are for 2006.

Source: DAFNE firm database, 2006, own calculations.

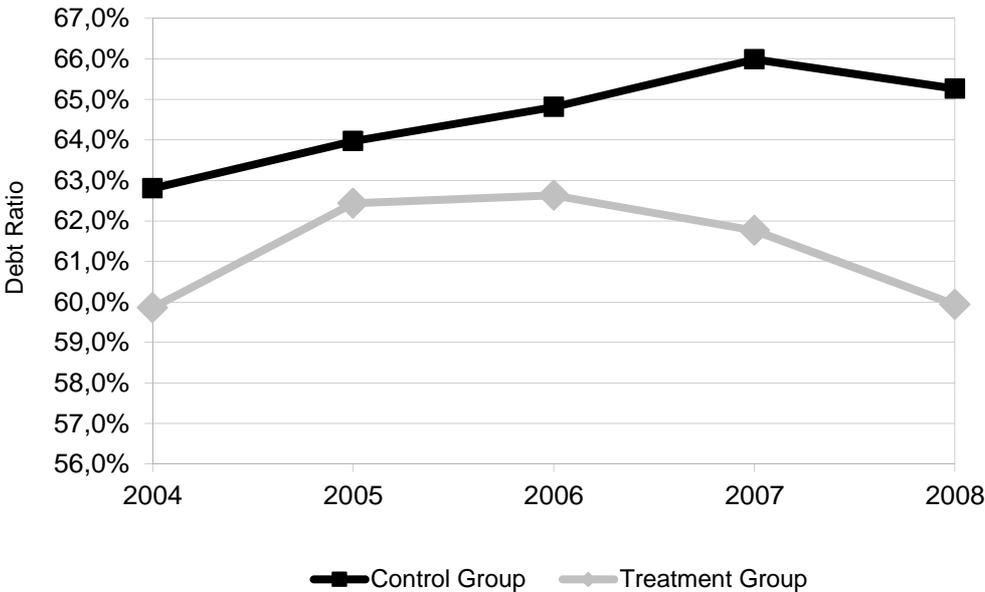
Since the exemption threshold is not the only escape clause included in the newly introduced interest barrier, we modeled - where possible - also the other escape clauses in order to account for them in the estimation. Given our data, we are able to consider (to a certain extent) the stand-alone-clause, the tax group stand-alone-clause and the EBITDA escape clause. The entitlement of each escape clause was modeled as follow:

*Stand-Alone-Clause:* In principle a firm is considered as a stand-alone firm if it does not belong to a group and does not rely on significant shareholder debt financing. We assume that every firm which has a German natural person as global ultimate owner is a stand-alone firm. This consideration is based on the fact that given a natural person is the ultimate owner, the firm may actually stand-alone or, if this is not the case, the firm is part of a group which can be tax consolidated. In both cases, the TCR does not apply. In sample 1 where only firms with ownership information have been included, 66 firms with net interest expenses above 1 million euro are entitled to the stand-alone-escape clause.

*Tax Group Stand-Alone-Clause:* In case the firm had a profit and loss agreement in place and the global ultimate owner is a German company, we considered the firm as being a part of a tax consolidated group and thus assumed that the TCR does not apply. 36 firms of the 168 treated firms in sample 1 are based on our modeling entitled to tax group stand-alone-escape clause.

*EBITDA-Clause:* In case a firm has a ratio of interest expenses to for tax purposes adjusted EBITDA below 30 % the TCR does not apply. We construct the for tax purposes adjusted EBITDA by adding back the depreciation allowance, the net interest result and the provisions which are not allowed for tax purposes to the before tax profit. For this escape clause 56 firms of the treated 168 firms in sample 1 are entitled.

**Figure 1: Debt Ratio for Treatment and Control Group: Common Trend Assumption**



Notes: Sample 1, for further descriptive statistics see table A1 in the appendix.  
 Source: DAFNE firm database, own calculations.

Before we turn to the description of the variables for our second and third research question, we plot the development of the mean debt ratio for treatment and control group in sample 1 to check whether treatment and control group exhibit a common trend before the reform (Figure 1). Two things are obvious in the figure. First, between 2004 and 2006 both groups show a similar evolution of the mean debt ratio, thus we conclude that the

common trend assumption for treatment and control group is satisfied.<sup>21</sup> Secondly, already the graphic analysis shows a strong decline in the debt ratio for the treated firms indicating that the TCR affected firm's financial structure.

For our second research question, the outcome variable is the change of the capital stock between 2008 and 2006, scaled by the capital stock in 2006. We refer to this variable as the investment quota. As control variables we include into the estimation equation two important factors of the investment quota, the change in the tax rate on business income and the change of the log firm age. Additionally, due to the observed difference between treatment and control group with respect to these variables, we further control for firm size and firms' share of tangible assets with their values in 2006. Two additional variables which are used in this analysis are cash flow and the TRD. Cash flow is calculated as the sum of the cash flow (profit plus depreciation allowances) in 2006 and 2007 scaled by the book value of total assets in 2006. The TRD is calculated as the difference between the tax rate on business income minus the corporate tax rate in the country of origin of the global ultimate owner.<sup>22</sup>

To analyze whether the interest barrier broadens the tax base, we use the change in the profit before taxes scaled by the book value of total assets between 2008 and 2006. As for investment, we include the change in the business tax rate, the change in the log firm age as well as the 2006 levels of firm size and firms' tangibility.

## ***5. Results***

We start the presentation of our results with the analysis of the impact of the TCR in Germany on the debt ratio of our treatment and control group as defined in the last section. Then we will present our findings on the impact of this TCR on investment. In the last subsection, we report the results on the question whether the interest barrier has broadened the German tax base.

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<sup>21</sup> The figure for the development of the debt ratio in sample 2 and 3 are very similar to the one shown above. Also for investment and probability the common trend is clearly observed in all samples. Figures are not shown but are available upon request.

<sup>22</sup> The global ultimate owner is defined as last shareholder which owns more than 50%.

### ***Debt Ratio***

In the first specification we regress the change of the debt ratio between 2008 and 2006 on the *Treatment \* After* variable as well as on the control variables. The result for this specification is reported in specification (1) in table 2. The estimated coefficient for the impact of the TCR (line *Treatment \* After* in table 2) states that firms, which are affected by the TCR have, on average, reduced their debt ratio by about 2.5 percentage points. Given this adjustment, at least part of these firms are able to fully deduct their interest expenses because a lower debt ratio implies lower interest expenses. In all cases where the interest expenses after adjustment fall below the exemption limit, these expenses are fully deductible.

Since it is very likely that firm size and firm's tangibility are endogenous in the equation for the debt ratio because they are affected by changes in the firms' finance structure, the estimated coefficients are probably biased. In specification (2), we thus used an instrumental variable approach to deal with the endogeneity of the two variables. As excluded instruments we used the twice lagged level of the variables. In specification (2), the coefficient of interest is 0.028 and thus slightly higher than in specification (1). However, the test statistics, shown in the notes of table 2, indicate that these instruments are weak. In specification (3) we have used the twice lagged levels of firm size and firm's tangibility as explanatory variables. In this case, the coefficient for the *Treatment \* After* variable increases further to 0.032. Since also the efficiency of the estimates rises we stick to this specification of the control variables for all further estimations.

**Table 2: Regression Analysis: Change in Debt Ratio for Treatment and Control Group**

	(1)	(2)	(3)	(4)
$\Delta(\text{Treatment} * \text{After})$	-0.025** (0.010)	-.028** (0.013)	-0.032*** (0.011)	-0.054*** (0.018)
$\Delta(\text{Treatment} * \text{After} * \text{EBITDA ESCAPE})$				-0.015 (0.021)
$\Delta(\text{After} * \text{EBITDA ESCAPE})$				0.008 (0.009)
$\Delta(\text{Treatment} * \text{After} * \text{Stand Alone})$				0.046** (0.020)
$\Delta(\text{After} * \text{Stand Alone})$				0.003 (0.009)
$\Delta(\log \text{ Firm size})$	0.075*** (0.027)	-0.315 (0.279)		
$\Delta(\log \text{ Firm age})$	-0.012* (0.007)	-0.013 (0.009)	-0.013* (0.007)	-0.013* (0.007)
$\Delta(\text{Tangibility})$	-0.029 (0.071)	0.118 (0.482)		
$\Delta(\text{Tax rate business income})$	0.025 (0.091)	0.009 (0.143)	0.088 (0.099)	0.032 (0.104)
$\Delta(\text{EBITDA/Total assets})$	-0.261*** (0.081)	-0.220** (0.110)	-0.246*** (0.083)	-0.248*** (0.082)
L2. log Firm size			0.008 (0.006)	0.007 (0.007)
L2. Tangibility			0.018 (0.013)	0.027** (0.014)
$\Delta(\text{After})$	-0.003 (0.007)	0.031 (0.026)	-0.084 (0.059)	-0.083 (0.063)
Observations	704	704	704	704
R <sup>2</sup>	0.086	.	0.060	0.074

*Notes:* Dependent variable is the two year change of the debt ratio, defined as liabilities to total assets.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro. In the specification (2) we use an instrumental variable approach for  $\Delta(\log \text{ Firm size})$  and  $\Delta(\text{Tangibility})$ . The F-test (Shea's Partial R<sup>2</sup>) amounts to 2.294 (0.008) for  $\Delta(\log \text{ Firm size})$  and to 7.926 (0.015) for  $\Delta(\text{Tangibility})$ . As excluded instrument we use the twice lagged level of the variables. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

*Source:* DAFNE firm database, years 2006 and 2008, own calculations.

Although the control variables are no longer subject to endogeneity issues, it is still very likely that the estimated coefficient of interest is downward biased as our treatment group only accounts for the exemption limit but not for other escape clauses. In order to consider these escape clauses in the estimation, we add suitable interaction terms to the estimation equation (see section 3 above). The first term interacts the *Treatment \* After*

variable with a dummy for the stand-alone-escape clause (including the tax group stand-alone escape clause). The second term interacts the *Treatment \* After* variable with a dummy for the EBITDA escape clause. Two further interaction terms are formed in the same way using the dummy *After* instead of the dummy *Treatment \* After*. The result for specification (4) is in line with our expectations: the coefficient of the variable *Treatment \* After* increases considerably (to 0.054). However, given that the escape clauses are used by the firms which are entitled to them, we would also expect that the two respective interaction terms with *Treatment \* After* were significant. However, this is the case only for the stand-alone-escape clause. The coefficient for this interaction term amounts to 0.046, which indicates that firms which had interest expenses above 1 million euro in 2006 and which are entitled to the stand alone escape clause did not reduce their debt ratio. This is in line with our expectations. Contrary to our expectation, the point estimate for the interaction between *Treatment \* After* and the dummy indicating whether a firm is not affected by the interest barrier because the firms' interest expenses amount to less than 30 % of EBITDA is negative (although insignificant). We see two possible explanations for this result. First, our measure of EBITDA, adjusted for tax purposes, is not very accurate. We might therefore actually not capture the firms we intend to capture. Second, the EBITDA escape clause could be a very risky option as interest rate shocks or demand shocks affect this ratio strongly. It seems that this option is rarely used. Since we cannot assess the relevance of these causes, we leave the question to future research. Further, since the estimated coefficients for the EBITDA escape clause variables are insignificant, we leave them out in the following specifications.

Further, as the interaction term for the stand-alone escape clause with the *After* variable is also not significant and the reaction for firms which are entitled to the stand-alone-escape clause is not statistically different from zero ( $-0.054 + 0.046$ ), we redefine our treatment group. In the following, our treatment group only consists of firms which have net interest expenses between 1,200 and 1,500 thousand euro and which are not entitled to the stand-alone-escape clause. In the control group, we include firms which are entitled to the stand-alone-escape clause or which show net interest expenses between 500 and 800 thousand euros. Specification (1) in table 3 shows the results for the baseline specification with the redefined treatment and control groups. The coefficient for *the Treatment \* After*

variable amounts to - 0.061 and indicates that treated firms decreased their debt ratio by about 6.1 percentage points.

**Table 3: Regression Analysis considering the number of subsidiaries: Change in debt ratio**

	(1)	(2)
$\Delta(\text{Treatment} * \text{After})$	-0.061*** (0.016)	-0.075*** (0.018)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		0.075*** (0.029)
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		-0.018* (0.010)
$\Delta(\log \text{ Firm age})$	-0.013* (0.007)	-0.014** (0.007)
$\Delta(\text{Tax rate business income})$	0.050 (0.103)	0.058 (0.102)
L2. log Firm size	0.008 (0.005)	0.010* (0.005)
L2. Tangibility	0.025* (0.013)	0.025** (0.013)
$\Delta(\text{After})$	-0.093* (0.054)	-0.102* (0.053)
Observation	704	704
R2	0.041	0.050

*Notes:* Depend variable is the two year change of the debt ratio, defined as liabilities to total assets.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006 and which are not entitled to the stand-alone-escape clause. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro and these firms which are entitled to the stand-alone-escape clause. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

*Source:* DAFNE firm database, years 2006 and 2008, own calculations.

In the following specification, we analyze whether firms exploit the exemption limit of 1 million euro by splitting up their assets. Since the most preferable way to divide the firm's assets is to incorporate a subsidiary to which a part of the assets is carried over we used for this analyses the change of the number of the firms' subsidiaries between 2008 and 2006. We construct a dummy variable which is one in case the number of subsidiaries increased and zero else. This dummy variable is interacted with the *Treatment \* After* as well as the *After* variable. In case, firms used the exemption limit to avoid the application of the TCR, the interaction term with *Treatment \* After* should be positive, since these firms do not have to reduce their debt ratio if their net interest expenses are below the 1 million euro threshold. Further, the effect of the treated firms should increase as without controlling for

firms who split up the estimated coefficient was downward biased. The results of specification (2) in table 3 support the view that firms used the exemption threshold. The coefficient for the *Treatment \* After* variable increases to -0.075 and the one for the interaction term between the dummy indicating whether the number of subsidiaries has increased and *Treatment \* After* amounts to 0.075. Thus, firms which split up their assets did not reduce their debt ratio between 2008 and 2006.

Before we analyze the impact of the interest barrier on firms' investment decisions, we come back to our two other samples which we defined in section 4 above. For both samples, we cannot model the escape clauses besides for the firms already included in sample 1. We expect thus the coefficient of interest is more in line with the specification (3) in table 1 where the escape clauses have not been considered. For both samples, we estimate the baseline specification and the specification for the "splitting up" hypothesis. The results are shown in table A2 in the appendix. For the second sample, where all firms with an income statement have been included the coefficient for the *Treatment \* After* variable amounts to 0.039 and is thus slightly higher than the estimates in specification (3) for sample 1, which is not surprising given that we account for the a part of the escape clause. In the second specification for the split up behavior the coefficient for *Treatment \* After* increase to 0.046. Also for the second sample, the interaction term for the treated firms which increased their number of subsidiaries is positive. This confirms our analysis for sample 1. For the third sample, the results are weaker given that only for less than half of the firms the escape clauses can be modeled. However, the results for the baseline specification are only slightly smaller than those from specification (3) with sample 1.

Our results so far confirm the studies by Overesch and Wamser (2010) and Buettner et al. (2008) who find that firms react to TCRs. The results are however not directly comparable since the TCRs they analyzed are based on equity debt ratios whereas the one analyzed in this paper is based on the exemption threshold. Further, our analysis has shown that firms use different strategies to avoid the interest barrier. Firms which have the possibility to split up do so with the result that the TCR does not affect their finance behavior compared to firms who cannot split and have to reduce their debt ratio by several percentage points.

### ***Investment quota***

In this section we report our results for the effect of the introduction of the interest barrier on firms' investment behavior. The investment behavior could be affected due to two different channels. The first channel depends on the substitutability of debt and equity. If equity and debt are imperfect substitutes and therefore finance frictions are present, the reduction of the debt ratio which was found in the analysis above should have a negative impact on investment. The second channel why investment could be affected due to the interest barrier is related to international profit shifting. In case firms shift profits, the tax burden on investment is lower compared to firms which do not shift profits. If now a TCR is imposed, which prevents firms to shift profits the tax burden on investment increases. Thus investment should be adversely affected. The negative effect should be higher the higher the gain of profit shifting before the introduction of the interest barrier was. Noteworthy, the effect on investment is not negative per se but depends whether the TCR is introduced in a high or in low tax country.

Given these considerations, we start our analysis with the redefined treatment and control. The dependent variable is the change in the capital stock between 2008 and 2006 scaled by the capital stock in 2006. We refer to this as the investment rate. As control variables we include the change of the tax rate on business income, the change of the firm age as well as the level of firm size and firms' tangibility in 2006 to control for differences between treatment and control group. The results for the baseline specification are reported in table (4), specification (1); the coefficient of the *Treatment \* After* variable is negative but insignificant. This indicates that treated firms had on average sufficient equity to finance its investment project. In the second specification, we also included the growth rate of sales between 2008 and 2006 (measured as difference of the log of total sales in thousand euros). The coefficient for the *Treatment \* After* variable remains insignificant.

Before, we come to the specification where we control for internal cash and the tax rate differential between host and foreign country to analyze the hypothesis outlined above, we analyze whether firms for which we think they split up their assets indeed do this. To analyze this question, we interact the dummy indicating whether the number of subsidiaries has increased with the *Treatment \* After* variable. Specification (3) in table 4 reports the results.

The interaction term is indeed negative and amounts to - 0.144. This indicates that firms split up to use the exemption threshold in order to avoid the interest barrier.

**Table 4: Change Investment Quota for Treatment and Control Group**

	(1)	(2)	(3)	(4)	(5)
$\Delta(\text{Treatment} * \text{After})$	-0.025 (0.047)	-0.023 (0.050)	0.003 (0.055)	-0.118** (0.047)	0.033** (0.015)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$			-0.144* (0.081)		
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$			0.053 (0.040)		
$\Delta(\text{TRD})$					0.415* (0.238)
$\Delta(\text{Treatment} * \text{TRD})$					1.245*** (0.307)
$\Delta(\text{After} * \text{TRD})$					-0.750*** (0.181)
$\Delta(\text{Treatment} * \text{After} * \text{TRD})$					1.721*** (0.497)
Cash flow to total assets				0.198 (0.121)	
$\Delta(\text{Treatment} * \text{Cash flow to total assets})$				0.854*** (0.279)	
$\Delta(\text{Tax rate business income})$	-0.392 (0.481)	-0.514 (0.525)	-0.415 (0.480)	-0.526 (0.476)	
d2_firmage	0.012 (0.023)	-0.002 (0.025)	0.014 (0.023)	0.000 (0.000)	0.018* (0.010)
L2. log Firm size	-0.008 (0.021)	0.006 (0.023)	-0.013 (0.021)	-0.015 (0.020)	-0.002 (0.011)
L2. Tangibility	-0.350*** (0.060)	-0.325*** (0.060)	-0.350*** (0.060)	-0.350*** (0.060)	-0.371*** (0.014)
$\Delta(\log \text{ sales})$		0.120*** (0.043)			
$\Delta(\text{After})$	0.402* (0.221)	0.213 (0.241)	0.437** (0.222)	0.425** (0.213)	0.386*** (0.114)
Observation	704	565	704	704	704
R <sup>2</sup>	0.062	0.081	0.064	0.100	0.069

*Notes:* Depend variable is the change of the capital stock between 2008 and 2006 scaled by the capital stock in 2006.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006 and which are not entitled to the stand-alone-escape clause. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro and these firms which are entitled to the stand-alone-escape clause. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

*Source:* DAFNE firm database, years 2006 and 2008, own calculations.

In specification (4) and (5) we test whether there is effect heterogeneity in the investment behavior of firms (see section 2 for specifications and hypotheses). In specification (4) we analyze whether the internal finance decision affects the investment

behavior. The findings show (specification (4) in table 4) that indeed the investment effect depends on the internally available cash flow for the treated firms. The coefficient for the interaction term amounts to 0.854 and thus indicates that almost every free available euro is used for investment by the treated firms.

In the last specification, we checked whether the investment behavior of the treated firms depends on tax rate differential (TRD), which is defined as the difference between the tax rate in the host and the tax rate in the foreign country (see section 2 for the estimation equation). The results are presented in table 4, specification (5). The coefficient for the *Treatment \* After \* TRD* variable is positive. This indicates that treated firms are more sensitive to the TRD. This might be surprising at first sight since we would expect that treated firms are restricted in their profit shifting activities. However, our treated firms avoid the application of the TCR by reducing their debt ratio. Thus, our results seem to suggest that firms still shift profits and either accept that the overall debt ratio is lower or try in the long run to split to avoid the application of the interest barrier. The coefficient for the TRD sensitivity of the control group before the reform is positive and amounts to 0.415. This indicates that also the investment of the control group depends on the TRD. However, the coefficient for the TRD sensitivity of the control group is three times as large (1.245). Noteworthy, due to the reform in 2008, the TRD sensitivity of the control group was reduced by 0.75.

Before we turn to analysis of the firms' profitability, we compare our estimates for sample 1 with the ones for sample 2 and 3. For both sample, the corresponding specification to the specifications (1) and (3) for sample 1 are shown in table A3 in the appendix. For both samples, an overall negative impact of the TCR is reported. The coefficient for the *Treatment \* After* variable amounts to -0.059 resp. 0.058 in sample 2 resp. sample 3. Thus, on average the investment quota of firms affected by the TCR was about 5.8 percentage points lower than the one of the control group. This seems reasonable given the fact, that either for part of these firms no ownership information (sample 2) or no ownership information and no income statement (sample 3) are available. Thus, it seems reasonable that these firms have a higher likelihood to be financial constraints such that the average impact of the TCR is negative.

The results from the specification for the analysis whether firms split up their assets are less strong than for sample 1 (table A3). Although the interaction term for the *Treatment \* After* variable with the dummy indicating an increased number of subsidiaries is negative, the point estimates are insignificant. However, this might be due to fact that we are not able to model the escape clauses for these firms accurately.

### **Profitability**

In this last subsection we focus on the effects of the interest barrier on firms' tax base. As proxy for the tax base we use the profit before taxes scaled by the book value of total assets. Given the results from the previous section, we have so far two hypotheses. First, we expect that due to the reduction of the debt ratio for the treated firms, the profitability of these firms' increases. The correlation coefficient between change of profitability and change in debt is for the years 2005 to 2006 0.28 in our data. Thus, if we assume that there is a linear relationship between debt and profitability, we expect an increase in the profitability of  $7.5 * 0.28 = 2.1$  percentage points. Further, we expect that the profitability of firms that split up their assets and thus did not reduced their debt ratio decreased less.

The results for our hypothesis are shown in table 5. All estimations are done using the redefined treatment and control group which account for the firms who may use the stand-alone-escape clause (see the section on the debt ratio above). The finding in specification (1) indicates that profitability of treated firms increased between 2006 and 2008 by 1.7 percentage points. This is somewhat smaller compared to the effect we expect given the decrease in the debt ratio by 7.5 percentage points. In the following, we check whether firms which split up, showed a smaller increase in the profitability. We do so by using the same procedure as for the debt ratio and the investment. We interact the *Treatment \* After* variable with the dummy indicating whether the number of subsidiaries has increased. In specification (2) the estimated coefficients are reported. The coefficient for the *Treatment \* After* variable increases slightly to 0.019. Further, the interaction term *Treatment \* After \* Increase Number Subsidiaries* is indeed negative. This supports our hypothesis although the interaction term is not significant which might be due to the small sample size.

**Table 5: Regression Analysis: Change in Profitability**

	(1)	(2)
$\Delta(\text{Treatment} * \text{After})$	0.017*** (0.007)	0.019*** (0.007)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		-0.010 (0.015)
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		0.004 (0.007)
$\Delta(\text{Tax rate business income})$	-0.074 (0.085)	-0.076 (0.085)
$\Delta(\log \text{ Firm age})$	-0.001 (0.005)	-0.000 (0.005)
L2. log Firm size	-0.012*** (0.004)	-0.013*** (0.004)
L2. Tangibility	0.018* (0.010)	0.018* (0.010)
$\Delta(\text{After})$	0.097** (0.039)	0.100** (0.039)
Firm-year-observations	704	704
R <sup>2</sup>	0.021	0.022

Notes: Dependent variable is the two year change of profitability, defined as before tax profits scaled by the book value of total assets.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1,2 and 1,5 million EUR in 2006 and which are not entitled to the stand-alone-escape clause. The control group includes firms with net interest expenses between 0,5 and 0,8 million euro and these firms which are entitled to the stand-alone-escape clause. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

Source: DAFNE firm database, years 2006 and 2008, own calculations.

Compared to the results for sample 1, the results for both specifications shown above for sample 2 are less clear (see table A4 in the appendix). The effect of interest (*Treatment \* After*) is, although slightly positive, insignificant. Further, also the interaction term between (*Treatment \* After*) with the dummy indicating whether the number of subsidies has increased is even positive. This indicates that strong conclusions on the effects of TCR can only be drawn in case of an appropriate modeling of the regulation.

## 6. Summary and Conclusions

National governments use two instruments to avoid the up to now observed profit shifting of multinational firms. On the one hand, tax competition has led to a significant decrease in corporate tax rates over the last decades, on the other hand, in particular large and high-tax countries implemented different versions of TCRs in order to prevent profit

shifting. To analyse how effective these regulations are is the aim of this study. Earlier contributions have shown that firms react to TCRs by changing their finance structure. Moreover, also negative investment effects have been found.

Our study contributes to the existing literature twofold. Firstly, our analysis does not only consider the effects of TCRs on the finance structure and on investment but additionally focuses on the question whether the firms' tax base is broadened due to the introduction of a TCR. Secondly, our study is the first that investigates the impact of the newly introduced interest barrier in Germany as one specific version of thin capitalization regulations.

To identify the causal effects of the TCR we use the exemption limit of the German interest barrier and apply a difference-in-difference approach. We further account for other escape clauses which firms might use to avoid the application of the interest barrier (stand-alone-escape for single firms, tax-group escape for German tax groups, EBITDA escape for firms with a "sufficient" ratio of EBITDA to interest expenses). Our results show that firms with interest expenses near the exemption limit avoid the application of the regulation by either reducing their debt ratio or by splitting up the firms' assets. Whereas in the first case, the TCR is shown to be successful in broadening the tax base, in the latter case it's not. Firms which split up do not decrease their debt ratio; also their profitability seems to increase less than the profitability of firms who do not split up.

With respect to firms' investment our result suggests that the adverse effect found in prior studies is not a general finding, but depends on the firms' financial situation. Thus, negative investment effects are only present for firms which are constrained by their internal finance. Further, our analysis shows that the sensitivity of investment to corporate income taxes increases due to the introduction of TCRs.

Given our result that firms split up their assets to avoid the application of the interest barrier, one has to expect that the raise of the exemption limit for the application of the interest barrier from 1 to 3 million euro in 2009 leads to similar adjustments by much larger firms. This would severely hamper the impact of the interest barrier and should be validated by future research. As we have not considered the so called equity escape which intends to exempt large groups with foreign members and "sufficient" equity financing, future research should try to assess the impact of this specific part the German interest barrier.

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## APPENDIX A

**Table A1: Descriptive statistics for the samples**

	Sample 1 (N = 704)		Sample 2 (N = 1090)		Sample 3 ( N = 1,728)	
	Mean	S.D	Mean	S.D	Mean	S.D
debt ratio	0.644	0.184	0.642	0.186	0.676	0.190
investment quota	0.108	0.416	0.090	0.361	0.099	0.504
profitability	0.048	0.080	0.048	0.077	.	.
firm size (thd. €)	52,644	121,510	51,966	103,842	48,217	87,190
firm age	2.964	1.018	2.956	1.068	2.692	1.156
corporate tax rate	0.396	0.031	0.397	0.030	0.403	0.320
tangibility	0.514	0.284	0.529	0.292	0.644	0.302
<b>industrie shares</b>						
manufacturing	0.338	0.473	0.683	0.465	0.566	0.496
trade	0.229	0.420	0.317	0.465	0.434	0.496
services	0.051	0.220	0.310	0.463	0.212	0.409

*Notes:* Statistics are for 2006.

*Source:* DAFNE firm database, 2006, own calculations.

**Table A2: Regression Analysis: Change in debt ratio.**

	Sample 2		Sample 3	
	(1)	(2)	(3)	(4)
$\Delta(\text{Treatment} * \text{After})$	-0.039*** (0.009)	-0.046*** (0.010)	-0.028*** (0.007)	-0.027*** (0.007)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta$		0.036** (0.018)		-0.005 (0.017)
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		-0.011 (0.008)		-0.002 (0.008)
$\Delta(\log \text{ Firm age})$	-0.007 (0.005)	-0.008 (0.005)	-0.005 (0.004)	-0.005 (0.005)
$\Delta(\text{Tax rate business income})$	0.047 (0.081)	0.045 (0.081)	-0.065 (0.060)	-0.066 (0.060)
L2. log Firm size	0.009** (0.004)	0.009** (0.004)	0.012*** (0.004)	0.012*** (0.004)
L2. Tangibility	0.010 (0.010)	0.011 (0.010)	0.014** (0.007)	0.014* (0.007)
$\Delta(\text{After})$	-0.090** (0.045)	-0.093** (0.044)	-0.133*** (0.041)	-0.135*** (0.041)
Observations	1090	1090	1728	1728
R2	0.023	0.026	0.016	0.016

Notes: Dependent variable is the two year change of the debt ratio, defined as liabilities to total assets.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro. In the specification (2) we use an instrumental variable approach for  $\Delta(\log \text{ Firm size})$  and  $\Delta(\text{Tangibility})$ . As excluded instrument we use the twice lagged level of the variables. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels

Source: DAFNE firm database, years 2006 and 2008, own calculations.

**Table A3: Regression Analysis: Change in investment.**

	Sample 2		Sample 3	
	(1)	(2)	(3)	(4)
$\Delta(\text{Treatment} * \text{After})$	-0.059**	-0.047	-0.058***	-0.050**
	(0.028)	(0.033)	(0.021)	(0.022)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		-0.064		-0.055
		(0.056)		(0.050)
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		0.019		0.035
		(0.033)		(0.032)
Cash flow to total assets				
d2_treat_fc				
$\Delta(\text{Tax rate business income})$	-0.302	-0.299	-0.025	-0.018
	(0.353)	(0.353)	(0.252)	(0.252)
$\Delta(\log \text{ Firm age})$	0.009	0.010	0.015	0.016
	(0.018)	(0.018)	(0.015)	(0.015)
L2. log Firm size	0.019	0.018	0.030*	0.028
	(0.018)	(0.019)	(0.017)	(0.017)
L2. Tangibility	-0.263***	-0.264***	-0.296***	-0.292***
	(0.048)	(0.049)	(0.037)	(0.038)
$\Delta(\text{After})$	0.085	0.091	0.004	0.019
	(0.187)	(0.189)	(0.173)	(0.174)
Observation	1090	1090	1728	1728
R <sup>2</sup>	0.044	0.044	0.061	0.061

Notes: Dependent variable is the change of the capital stock between 2008 and 2006 scaled by the capital stock in 2006.  $\Delta$  indicates the change between 2008 and 2006. L2 indicates twice lagged variables. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006 and which are not entitled to the stand-alone-escape clause. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro and these firms which are entitled to the stand-alone-escape clause. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

Source: DAFNE firm database, years 2006 and 2008, own calculations.

**Table A4: Regression Analysis: Change in profitability**

	Sample 2	
	(1)	(2)
$\Delta(\text{Treatment} * \text{After})$	0.005 (0.006)	0.003 (0.006)
$\Delta(\text{Treatment} * \text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		0.014 (0.010)
$\Delta(\text{After}) * \text{Dummy}(\Delta \text{Subsidiaries})$		-0.001 (0.006)
$\Delta(\text{Tax rate business income})$	-0.054 (0.067)	-0.055 (0.067)
$\Delta(\log \text{ Firm age})$	-0.001 (0.003)	-0.001 (0.003)
L2. log Firm size	-0.010*** (0.003)	-0.010*** (0.003)
L2. Tangibility	0.023*** (0.008)	0.023*** (0.008)
$\Delta(\text{After})$	0.074** (0.031)	0.075** (0.031)
Observation	1090	1090
R <sup>2</sup>	0.016	0.017

*Notes:* Dependent variable is the two year change of profitability, defined as before tax profit scaled by the book value of total assets.  $\Delta$  indicates the change between 2008 and 2006. The treatment group consists of firms with net interest expenses between 1.2 and 1.5 million EUR in 2006 and which are not entitled to the stand-alone-escape clause. The control group includes firms with net interest expenses between 0.5 and 0.8 million euro and these firms which are entitled to the stand-alone-escape clause. Stars (\*\*\*/\*\*/\*) indicate significance at the 1%/5%/10% levels.

*Source:* DAFNE firm database, years 2006 and 2008, own calculations.