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## On the interdependency of profit shifting channels and the effectiveness of anti-avoidance legislation

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Shifting Channels and the Effectiveness  
of Anti-Avoidance Legislation**

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# **On the Interdependency of Profit Shifting Channels and the Effectiveness of Anti-Avoidance Legislation**

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The issue of base erosion and profit shifting has been on the international policy agenda for several years now. The aim of this paper is to examine how firms adjust their profit shifting mechanisms in a changing institutional environment. In particular, we test whether firms substitute one profit shifting strategy for another if respective costs change. To this end, we exploit changes in the strictness of transfer pricing regulations and thin capitalization rules over time in a panel of European multinational firms and study a quasi-experimental reform setting in France. We confirm existing evidence that tightening transfer pricing regulations reduces the tax sensitivity of earnings before interest and taxes (EBIT) substantially. Our results show, however, that this reduction includes both a reduction in profit shifting activity via the transfer pricing channel and a substitution with debt shifting. Moreover, firms using debt shifting to begin with rely more heavily on tax optimization of transfer prices when thin capitalization rules are strengthened. If transfer pricing regulations are also strict, the conditional reform effects show that the substitutive response is more pronounced for a subsample of firms with a high share of intangible property (IP). The difference-in-difference approach for the French tax reform illustrates an increase in profit shifting based on transfer prices for treated firms facing new restrictions on debt shifting. Again, the effect is stronger for IP intensive firms.

**Keywords:** profit shifting channels; tax planning; corporate taxation; anti-avoidance legislation

**JEL-Classification:** H25, F23, H26, H3

# 1 Introduction

Base erosion and profit shifting (BEPS) is a phenomenon the existence of which has been illustrated by case study evidence and archival studies using broad financial or administrative datasets. In particular, the cases of large companies such as Google, Apple, Amazon, Starbucks and others engaging in tax avoidance schemes as well as the enormous amounts of estimated foregone revenue have gained huge media attention and led to a remarkable upheaval in tax policy. Several unilateral countermeasures were implemented at the national level, while action plans such as the OECD/G20 BEPS Report (OECD, 2015) and the EU Corporate Taxation Action Plan (EU Commission, 2015) were launched to encourage coordination in the fight against aggressive tax avoidance. Highly prominent anti-avoidance rules include transfer pricing documentation requirements and interest deduction limits (such as thin capitalization rules or earnings-stripping rules).

These initiatives to fight BEPS are yet to be matched by a thorough understanding of how the introduction or the tightening of anti-avoidance legislation affects firms' profit shifting strategies. What has been shown so far is that countermeasures seem to be successful in reducing profit shifting via the particular channel<sup>1</sup> the measures are targeting but the overall effects remain elusive. Existing studies in this area consider profit shifting channels separately and find that thin capitalization rules or transfer pricing regulations are strongly effective at limiting profit shifting via the respective channel. It is puzzling, however, that the measured effectiveness and the suspected increase in the cost of capital (Ruf and Schindler, 2015) does not seem to entail negative side effects on investment (Weichenrieder and Windischbauer, 2008, Buslei and Simmler, 2012). One exception is Buettner et al. (2017) who identify negative investment responses for thin capitalization rules but not for transfer pricing rules.

While these studies tend to focus on the outcome of unobserved profit shifting decisions, evidence on the firm-specific mechanisms for developing tax strategies is rather scarce. Understanding this mechanism, however, is of great importance for understanding, explaining and predicting profit shifting behavior in a changing institutional environment (Shackelford and Shevlin, 2001). Due to the nature of firms' internal decision-making processes, this question is difficult to answer with archival data. Nonetheless, recent studies by Hopland et al (2017), de Simone (2016), and Kim et al. (2015) show that specific research designs, reform settings and

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<sup>1</sup> For the effect of anti-avoidance legislation on the debt channel see, for example, Buettner et al, 2012, Blouin et al, 2014. For the effectiveness of transfer pricing regulations see, for example, Klassen and Laplante, 2012, Blouin et al., 2010, Lohse and Riedel, 2013, Beer and Loeprick, 2015, Saunders-Scott, 2015

estimation techniques make it possible to draw inferences on the formation of profit strategies even from archival data.

Against this background, the objective of this paper is to further elucidate how profit shifting strategies are developed, in particular with respect to firms' reactions to anti-avoidance legislation. The main question we would like to address in this paper is whether firms optimize the use of different profit shifting strategies jointly and in particular, whether they substitute different profit shifting strategies for one another other if the channel specific costs change due to anti-avoidance legislation. This substitution could explain why studies looking at the effect of each profit shifting strategy separately find that anti-avoidance legislation has a strong effectiveness but little or no effect on investment responses. Our question links to Hopland et al. (2017) who investigate the flexibility of adjusting transfer pricing and debt shifting strategies within each year to react to changing benefits (due to losses) at given costs. Similar to de Simone (2016) we study how institutional changes affect firms' decisions on profit shifting strategies. Finally, identifying substitutive relationships between profit shifting strategies also provides indirect evidence for the existence of a target level of tax avoidance as put forward by Kim et al. (2015).

Our identification strategy includes two empirical approaches and focuses on the potential interdependency between transfer pricing shifting and debt shifting. Firstly, we use firm-level panel data from 2004 to 2012 on European companies from the Amadeus database. During this time span, several changes in tax rates and anti-avoidance regulations took place. We analyze how restricting one profit shifting channel affects the use of an unrestricted channel and determine the effects if both channels are restricted. These conditional reform effects allows us to identify substitutive behavior and to disentangle the reduction in profit shifting activity from these substitution effects. Secondly, we exploit a tax reform in France that came into force 2007 as a quasi-experimental setting. This reform tightened thin capitalization rules for one group of French affiliates that had been exempt before (in particular firms with European shareholders) while the regulations remained unchanged for all other affiliates located in France. Since transfer pricing rules and tax rates remained constant in France during our period of observation, this reform provides an appropriate setting to complement our findings on the substitution of profit shifting channels. In addition to the explicit comparison of treatment and control groups, an important advantage of the second design is that the strictness of thin capitalization rules and transfer pricing rules do not have to be quantified. In both approaches, we take into account that the potential for firms to substitute in particular profit shifting via

transfer prices for debt shifting depends on firms' flexibility to deviate from arm's length prices. This flexibility is closely related to the specificity of intra-group transactions (Dischinger and Riedel, 2011). To that end, we also study subsamples of firms belonging to multinational groups with a high versus low intellectual property (IP) intensity.

The conditional reform effects confirm that firms react towards a tightening of transfer pricing regulations or thin capitalization rules by reducing profit shifting via the newly restricted channel. In addition, we provide new evidence that this reduction is in part due to firms substituting the restricted profit shifting strategy with an unrestricted profit shifting strategy. Further, we show that if anti-avoidance regulations restrict both channels, firms still have some leeway to continue their profit shifting activities via the transfer pricing channel but not via the debt channel. This effect is particularly pronounced in firms belonging to IP (intellectual property) intensive groups.

The paper is structured as follows: Section 2 provides a brief outline of the relevant literature on profit shifting decision-making and existing evidence on the impact of anti-avoidance rules. Section 3 explains the theoretical rationale of our investigation and outlines the main hypotheses. Section 4 describes the main data sources and defines the variables used in the estimations. In section 5, we explain our two empirical designs. Section 6 presents the results of the panel data analysis and the quasi-experimental setting. Section 7 summarizes our main findings and concludes.

## **2 Literature Review**

Existing research on profit shifting can be divided up into four broader research questions:

- (1) What characterizes BEPS in terms of the consequences for reported profits (tax rate elasticity, identification issues, proxies for BEPS)? (e.g. meta-study by Heckemeyer and Overesch, 2017, surveys by Hanlon and Heitzman, 2010, Dharmapala, 2014)
- (2) Can we identify determinants of BEPS that explain the observed heterogeneity in profit shifting behavior? (e.g. Desai and Dharmapala, 2006, Dyreng, 2010, Robinson et al., 2012, Armstrong et al., 2013, Rego and Wilson, 2012, Armstrong et al., 2015)
- (3) What are the firm-level mechanisms enabling profit shifting, and how do firms develop their tax strategies? (e.g. survey evidence by Klassen et al., 2017, Hoopes et al., 2015, evidence from archival data by Hopland et al., 2017, de Simone, 2016, Kim et al., 2015).

(4) Which channels/strategies are used to reallocate profits to lower tax jurisdictions and how effective are anti-avoidance regulations? (e.g. Buettner et al, 2014, Buettner et al, 2012, Blouin et al, 2014, Beer and Loeprick, 2015, Lohse and Riedel, 2013, Saunders-Scott, 2015)

While the first two questions are fairly well understood so far, evidence on the firm-specific mechanisms for developing tax strategies are rather scarce. In this context, survey studies provide crucial insights into what has been called the “black box” of profit shifting (Hanlon and Heitzman, 2010) Due to the nature of internal corporate decision-making processes, this question is difficult to answer with archival data. Nonetheless, recent studies by Hopland et al (2017), de Simone (2016), and Kim et al. (2015) address the call from Shackelford and Shevlin (2001) to move beyond merely documenting income shifting to better explaining, understanding and predicting it.

Based on valuable insights from the tradeoff literature, which suggest that firms trade off tax benefits against the costs of tax planning, Kim et al. (2015) explicitly investigate whether firms adjust to a target level of tax avoidance and how quickly they meet this target. This is a relevant question due to the constantly evolving tax environment faced by firms. They use data from Compustat for the years 1990-2011 and estimate a partial adjustment model as is often used in the literature on capital structure choice (e.g. Flannery and Rangan, 2006). In this partial adjustment model, firms close a part of the gap between the actual and the target level of tax avoidance each year. The regression coefficient yields the speed of adjustment. Kim et al. (2015) use cash ETR and GAAP ETR as dependent variables, which they explain by the determinants of tax avoidance documented in the literature. Their results confirm the notion that firms actually possess target levels of tax avoidance which they move towards? A typical firm closes about 69% of the gap between actual tax avoidance and target level of avoidance within three years, which is faster than the speed of adjustment documented for capital structure choice. This speed of adjustment is shown to be heterogeneous and is, for example, higher for multinational firms.

Hopland et al. (2017) also look at the adjustment of profit shifting decisions and in particular investigate firms’ flexibility in terms of using income shifting strategies within a single tax year to react to operating losses. They consider transfer prices and debt as profit shifting strategies which can potentially be adjusted to shift profits into group entities making a loss either ex-post (after the fiscal year), or ex-ante (before the current year). Based on Norwegian Data on direct transfer payments and internal debt for the years 1998-2005, they show that firms react to operating losses by adjusting transfer prices ex-post. Since they do not find such flexibility for



debt shifting, they conclude that firms tend to take decisions on debt shifting at the beginning of each year when the likelihood of operating losses can only be anticipated. According to Hopland et al. (2017) the reason why most studies find only small tax rate sensitivities of debt is because they neglect the timing of debt shifting decisions in view of anticipated losses.

De Simone (2016) also investigates how firms make profit shifting decisions and in this context focuses on how a particular accounting change (the introduction of IFRS for unconsolidated financial reporting in Europe) interacts with tax incentives to affect profit shifting. Her research design exploits the fact that the mandatory or voluntary introduction of IFRS for unconsolidated accounts increases multinationals' ability to justify favorable transfer prices, as the pool of comparable firms (using IFRS reporting) grows larger. Based on unconsolidated data from the AMADEUS database for the years 2003 to 2012, she estimates the income shifting model from Huizinga and Laeven (2008) augmented by an indicator variable for IFRS adoption affiliate-years. Her results show that the average mandatory IFRS adopting affiliate shifts 11.5 percent more profits relative to pre-adoption and non-adopter affiliate-years.

Our study is closely related to the above studies that look into how profit shifting decisions are made. Based on a better understanding of that mechanism, we want to provide new insights into the question of how firms react to changes in the taxation environment, in particular with respect to anti-avoidance regulations such as thin capitalization rules and transfer pricing rules. The following paragraphs provide a brief outline of the existing empirical evidence on the impact of these anti-avoidance rules. With one exception (Saunders-Scott, 2015), the studies all look at each profit shifting channel separately and do not consider a potential interdependency between both channels or mutual effects of the countermeasures.

With respect to debt shifting, Wamser (2014), Weichenrieder and Windischbauer (2008), and Overesch and Wamser (2010) find a reduction in intra-group loans granted to German companies by their foreign affiliates following a German tax reform in 2001 which tightened thin capitalization rules. Weichenrieder and Windischbauer (2008) also study the effect of thin capitalization rules on real investment in multinational enterprises; however, they do not find a visible impact. Buettner et al. (2012) confirm the negative impact of interest deduction restrictions on the use of intra-group debt based on comprehensive micro-level data from the Microdatabase Direct Investment (MIDI) database on German outbound investment. A recent study by Blouin et al. (2014) investigates the influence of interest deduction restrictions on a company's leverage using micro-level data on US multinationals and their foreign subsidiaries in 54 countries over the period between 1982 and 2004. They find that the presence of interest

deduction restrictions reduces an affiliate's debt-to-assets ratio, with more pronounced results in cases where there are more limitations on borrowing from a parent company compared to other group members. Furthermore, they posit that interest deduction restrictions on leverage have a stronger impact in countries that automatically apply anti-avoidance rules, in contrast to countries that have discretionary enforcement.

Testing the impact of transfer pricing documentation requirements is not straightforward, as the strictness of these rules is much more difficult to measure. Based on sectoral data, Bartelsman and Beetsma (2003) empirically illustrate that international differences in corporate income tax rates along with several other attributes of the tax system including an enforcement of transfer pricing regulations constitute major incentives or discouragements for multinational enterprises (MNEs) to shift profits. Lohse and Riedel (2013) develop an indicator for transfer pricing strictness and find that transfer pricing regulations substantially reduce the tax sensitivity of earnings before interest and taxes (EBIT) of up to 80%. Beer and Loeprick (2015) use the years since the introduction of mandatory documentation requirements as a strictness indicator and show that within four years of the introduction of mandatory documentation requirements, the amount of profits being shifted between subsidiaries of MNEs decreases by around 60%. They show that the profit shifting behavior of subsidiaries with high intangibles-to-total-assets ratios is less influenced by documentation requirements than the profit shifting behavior of affiliates with a low fraction of intangible assets.

So far, only Saunders-Scott (2013) tests whether thin capitalization rules have an impact on EBIT. This effect can be interpreted as a first sign of a potential substitutive relationship between the transfer pricing and the debt shifting channel because a direct influence via interest payments is ruled out by using EBIT as a dependent variable. Her results support this hypothesis, with the implementation of thin capitalization rules in an affiliate's country reducing its earnings before interest and tax by 3.8%. Conditional effects of both anti-avoidance regulations, however, are not taken into account.

In view of the broad evidence on the effectiveness of thin capitalization and transfer pricing rules, it remains puzzling that most studies do not find negative side effects on investments or employment. Closing down profit shifting opportunities should lead to an increase in the cost of capital thus inducing negative investment responses. So far, only one study has been able to establish the expected negative effect on FDI (Buettner et al., 2017). Their results indicate that introducing or tightening a thin capitalization rule exerts significant adverse effects on FDI (-2.5%) and employment in high-tax countries. Meanwhile, they do not find such a negative side

effect for transfer pricing regulations despite the strong effectiveness of these rules shown in existing studies. They conclude that further research is needed to determine the reasons behind the lack of real responses to the strengthening of transfer pricing regulations.

Our paper aims to contribute to this strand of the literature by providing new insights into the question of how profit shifting decisions are made and, in particular, whether firms substitute one profit shifting strategy for another when the costs of these strategies change. This substitution could explain why previous studies were not able to establish a clear link between anti-avoidance regulations and the investment behavior of multinationals.

### **3 Theoretical Considerations and Hypothesis Development**

#### **3.1 A profit shifting model with two profit shifting channels**

We consider a multinational corporation that consists of two affiliates that reside in two different countries: a high-tax country with a tax rate  $\tau_H$  and a low-tax country with a tax rate  $\tau_L$ . The high-tax affiliate can shift part or all of its true pre-tax profit  $\pi_H$  to the affiliate in the low-tax country.  $\pi_H$  is defined as the taxable profit that would have been reported in the absence of profit shifting.<sup>2</sup> The true profit can be shifted from the high-tax to the low-tax affiliate by increasing internal debt or manipulating interest rates on intra-group loans. It can also be relocated by increasing intra-group trade or overpaying for intangible assets, tangible goods, and services provided by the low-tax affiliate.  $S$  denotes the combined volume of shifted profits via the channel of internal debt and intra-group trade. The respective intra-group payments are deductible from the tax base of the high-tax affiliate and increase the low-tax affiliate's profits  $\pi_L$ .

Profit shifting may induce costs  $C$ , which are assumed to be non-tax-deductible.<sup>3</sup> These costs may be split into general (or non-channel-specific) costs and channel-specific costs, depending on whether they arise from the use of a particular profit shifting channel or from profit shifting as such. Further, we can distinguish costs related to tax regulations (general: tax enforcement, tax audit probabilities relating to overall shifting volume; specific: anti-avoidance rules targeting specific profit shifting channels). General costs may result from an increased risk of being audited, an increased need for mitigation strategies, as well as potential adjustments of intra-group transactions via one or both channels if profits are below a certain threshold. In

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<sup>2</sup> See Fuest et al. (2011).

<sup>3</sup> Some costs may in fact be tax-deductible (see Dharmapala and Riedel, 2013). We assume that the deductibility of shifting costs does not fundamentally affect our results.

addition, by shifting high volumes of profits MNEs may run the risk of damaging their reputation. Moreover, a multinational might also have to bear the costs of complying with the regulations aimed at tackling intra-group profit shifting and of establishing circumvention strategies. For example, an arm's length principle is a basic anti-avoidance regulation, which requires intra-group transactions to follow the same conditions as transactions between independent parties and targets both profit shifting channels.<sup>4</sup>

The channel-specific costs include negative channel-specific side effects from profit shifting. Despite a potentially lower capacity to raise external debt, there are no obvious costs from side effects of profit shifting via intra-group debt.<sup>5</sup> By contrast, profit shifting via transfer pricing manipulation potentially results in conflicts within internal performance measurement and incentive programs.<sup>6</sup> This subsequently leads to inefficiency costs that increase with a growing difference between the real transfer price and the tax-optimal transfer price.<sup>7</sup> If companies use two sets of books for tax-optimal transfer prices and internal transfer prices, these inefficiency costs can be avoided, which results in the shifting costs being limited to the additional administrative expenses needed to operate a two-book system.<sup>8</sup> Moreover, some countries have introduced channel-specific anti-avoidance regulations such as transfer pricing rules and interest deduction limits.

Assuming that  $C$  represents both the channel-specific and the general costs of profit shifting, the aim of the multinational corporation is to maximize its total after-tax profit  $\Pi$  as shown in equation 1.

$$\Pi = (1 - \tau_H)(\pi_H - S) + (1 - \tau_L)(\pi_L + S) - C \quad (1)$$

It can be identified from equation 1 that the optimal amount of shifting out of the high-tax country  $S^*$  arises when the tax advantage from profit shifting equals marginal costs:

$$\frac{\partial C}{\partial S^*} = (\tau_H - \tau_L) \text{ with } \tau_H = 0 \text{ if } S > \pi_H \quad (2)$$

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<sup>4</sup> See Eden (2009) and see Zinn et al. (2014) for a cross-country overview.

<sup>5</sup> Costs from secondary effects that arise from external debt financing, in particular bankruptcy costs and costs from information asymmetries, do not play a relevant role in determining internal financing under a precondition that the total third-party debt of a multinational corporation defines its risk of bankruptcy. See Chowdhry and Nanda (1994), Gordon (2010), and Overesch and Wamser (2014) for further details.

<sup>6</sup> These costs arise from tax induced intra-group transactions that deviate from the optimal structure of intra-group trade from a management perspective.

<sup>7</sup> See Hiemann and Reichelstein (2012).

<sup>8</sup> See Hiemann and Reichelstein (2012), p. 4.

According to equation 2, the tax advantage from profit shifting will be zero or negative for each unit of profit shifted in excess of the high-tax affiliate's true profit because the corresponding deductions will not reduce its tax payments in the same year.

If we consider profit shifting via debt or transfer prices as two alternative “input factors” producing the “output” shifted profits, the value of shifting one unit via a certain channel equals the value of shifting one unit via the other channel. Hence, the multinational is per se indifferent as to which of these two input factors it uses and will always choose the cheaper shifting channel.

Consequently, the total cost function of profit shifting is derived from the minimum cost combinations of the two input factors (which equal the two shifting channels) for all potential output levels:

$$C(S_T^*(S), S_D^*(S)) = \sum_{x=0}^{x=S_T^*(S)} C_T(x) + \sum_{y=0}^{y=S_D^*(S)} C_D(y) \quad (3)$$

In equation 6,  $C_T(x)$  and  $C_D(y)$  denote the costs of shifting unit  $x$  via transfer pricing and unit  $y$  via debt. Whether substituting one profit channel for the other is optimal depends on how these costs per shifted unit are determined. Following the existing literature, we assume that all profit shifting costs are convex in the amount of shifted profits.<sup>9</sup> This can be formalized as follows:

$$C_i(S_i), C'_i(S_i) > 0 \text{ and } C''_i(S_i) > 0 \text{ with } i [D, T, Total] \quad (4)$$

### 3.2 Substitution of Profit Shifting Channels

Firms trade off the tax advantage of profit shifting against its costs. The optimal shifting amount is achieved if marginal costs of shifting equal the marginal benefits, i.e. the tax rate differential between high and low tax jurisdictions. When the costs change, firms converge to a new optimum. This raises the question in which cases we might observe one profit channel being substituted for the other. The conclusions depend on the respective underlying cost structure. We consider two cases: (1) The costs of profit shifting depend exclusively on the amount shifted via the respective channel and not on the total amount shifted. Hence, the costs of debt shifting have no influence on the cost of transfer pricing shifting or vice versa. (2) Non-channel-specific costs of shifting exist that depend on the total amount of profits shifted via both channels (e.g. due to higher audit risk, damage to the firm's reputation etc.).

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<sup>9</sup> See as examples: Dharmapala and Riedel (2013), p. 7 and Saunders-Scott (2015).

*The costs of profit shifting depend exclusively on the amount shifted via the respective channel and not on the total amount shifted.*

If the costs for each profit shifting channel depend only on the volume of profits shifted via the respective channel (i.e.  $C_T(S_T)$  and  $C_D(S_D)$ ),<sup>10</sup> the optimal amount of profit shifting from the high-tax country to the low-tax country via each channel is determined by equations 5 and 6.

$$\frac{\partial C_D(S_D^*)}{\partial S_D^*} = (\tau_H - \tau_L) \text{ with } \tau_H = 0 \text{ if } S > \pi_H \quad (5)$$

$$\frac{\partial C_T(S_T^*)}{\partial S_T^*} = (\tau_H - \tau_L) \text{ with } \tau_H = 0 \text{ if } S > \pi_H \quad (6)$$

Whether it is optimal to switch to the other profit shifting channel following a cost increase of the channel currently used depends on the cost level of total profit shifted in the optimum before the change. If the optimal amount of profit shifting has been below the total true profits ( $S^* < \pi_H$ ), an increase in the marginal channel-specific costs will decrease the optimal amount of profit shifted via this channel while leaving the amount shifted via the other channel unchanged as neither its costs nor the determination of the tax benefits are influenced. In this case, no substitution will occur.

By contrast, if it has been optimal to shift total true profits ( $S^* = \pi_H$ ), an increase in the channel-specific costs may either have no impact on profit shifting behaviour at all or reduce the optimal amount being shifted via this channel. This is because, the marginal benefit function is a step function which is constant with the positive values of the tax differential ( $\tau_H - \tau_L$ ) up to the amount of total true profit and turns negative for all units above the total true profits. It is, thus, possible that the last unit shifted via one or both profit shifting channels in the optimum bears marginal costs below the tax advantage ( $\tau_H - \tau_L$ ). Up to the level of the true profits, the company will always choose the cheaper channel for each unit shifted. For this reason, if the costs of one channel increase while still remaining below the tax rate differential and also leaving the price ratio of the two channels for all units of shifted profits unaffected, the shifted amount via both channels should remain unchanged. Again, no substitution occurs.

If, *ceteris paribus*, the price ratio reverses for certain units of shifted profits because of the increase of the costs of one channel (that now exceed the marginal costs of the other channel), the amount shifted via the channel with increased costs should decline and the amount shifted via the other channel should increase. With respect to equations 5 and 6, this substitution of one

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<sup>10</sup> See Saunders-Scott (2015) for different assumptions regarding the cost function.

channel for another in response to a reversion of the price ratio for certain units of shifted profits results from a change in the value of  $\tau_H$  (from its real value to zero and vice versa) in both equations. In addition, if it is optimal to shift total true profits, an increase in the cost of one channel also decreases the amount shifted via this channel if the marginal costs rise above the tax advantage ( $\tau_H - \tau_L$ ). A substitution for the other channel will only then be optimal if the last unit shifted via the other channel yields costs below or equal to the tax differential.

*Non-channel-specific costs of shifting exist that depend on the total amount of profits shifted via both channels*

Given that the probability of being audited rises with the total amount of profits shifted or that the risk to the firm's increases if the large scale of total profits shifted becomes public, it is likely that there is also a cost component of profit shifting that is not channel-specific but depends on the total amount shifted via both channels. In this case, the high-tax affiliate determines the optimal amount of shifting using the two channels according to the following conditions:

$$\frac{\partial C_D(S^*)}{\partial S^*} = (\tau_H - \tau_L) \text{ with } \tau_H = 0 \text{ if } S > \pi_H \quad (7)$$

$$\frac{\partial C_T(S^*)}{\partial S^*} = (\tau_H - \tau_L) \text{ with } \tau_H = 0 \text{ if } S > \pi_H \quad (8)$$

Equations 7 and 8 establish that the marginal profit shifting costs of each channel no longer depend on the amount shifted via the respective channel only (as in equations 5 and 6) but on the total amount  $S^*$ . In this setting, an increase in the channel-specific shifting costs for one channel potentially induces substitution for the other channel regardless of whether the total amount shifted is close to or considerably below the true profits  $\pi_H$ . This is because an increase in the channel-specific costs of a certain channel will increase the marginal costs of profit shifting for this channel and consequently reduces the optimal amount that can be shifted via this channel and, ceteris paribus, the total amount of profits shifted  $S$ . The reduction in the total amount shifted  $S$ , in turn, reduces the marginal costs of shifting via the other channel with unchanged channel-specific costs, thus inducing an increase in the optimal level of profits shifted via this channel. Part of the initial reduction of profit shifting via the channel facing increased costs is therefore substituted with an increase in profit shifting via the other channel.

In summary, if the shifting costs are entirely channel-specific, companies may only substitute between the channels if it is optimal to shift the total true profits. However, if there are other

non-channel-specific costs which depend on the total amount shifted via both channels, companies may substitute one channel for another even if it is optimal to shift less than the total true profits.

### **3.3 Development of Hypotheses**

The considerations above suggest situations where changes in channel specific profit shifting costs should induce substitution between both channels. In the following, we focus on anti-avoidance regulations as important drivers of channel-specific profit shifting costs. We look at the interdependency of debt shifting and transfer pricing shifting, which are considered important instruments for the cross-border allocation of profits to low tax jurisdictions. We derive our hypotheses starting from a situation where specific anti-avoidance regulations are absent and only a general arm's length principle applies. Sequentially, we add restrictions for each channel separately and finally consider a simultaneous application of anti-avoidance regulations for both channels. To acknowledge that firms differ in their profit shifting potential especially with respect to the degree of leeway they have to adjust transfer prices upwards or downwards, we distinguish between firms belonging to multinational groups with an above-average share of intellectual property and those below. The rationale is that we expect firms with highly specific intra-group transactions related to the use of intellectual property to be more flexible in setting tax minimizing transfer prices, which are more difficult for fiscal authorities to challenge.

In the absence of formal anti-avoidance regulations, the arm's length principle still applies. With regard to intra-group debt, Burnett (2014) posits that there is usually a large range of possible arm's length amounts of debt and corresponding interest rates, which form a comparison group for intra-group borrowing in multinationals. In the case of intra-group royalty payments, an arm's length price is often hard to determine due to the highly specific nature of intangible assets. Therefore, it is relatively easy to justify high levels of profit shifting via this channel, even when the arm's length principle is applied. With respect to the transfer of common tangible goods and services, Dawson and Miller (2009) note that companies should find themselves more restricted in their profit shifting behaviour even in the absence of detailed transfer pricing regulations, since tax authorities may compare related-party transactions to the available third-party payments. As a result, for corporations that trade tangible assets or services that are easy to value, severe transfer pricing manipulation may result in double taxation even



if no strict transfer pricing regulations exist. Based on these considerations, we derive Hypothesis 1 of our study:

*H1: In absence of strict anti-avoidance regulations, non-IP-intensive companies mainly shift profits via intra-group debt, whereas IP-intensive firms shift profits via royalty payments.*

If a high-tax country has thin capitalization rules in place, interest payments on debt above the safe haven ratio will no longer be deductible and face double taxation. Consequently, the tax benefit of profit shifting will turn negative for excess interest payments. For companies relying on the debt channel, it will be optimal to reduce the amount shifted via intra-group interest payments below the threshold. Likewise, if a high-tax country introduces transfer-pricing rules (in the absence of thin capitalization rules) a multinational corporation will face the additional costs of documenting transfer prices if any intra-group transactions are present. In addition, strict transfer pricing regulations reduce the flexibility of setting tax minimizing transfer prices if justifying this price becomes more costly. For companies using transfer prices for profit shifting, it will be optimal to reduce the amount shifted via transfer prices. Therefore, Hypothesis 2a is straightforward and reads:

*H2a: If one profit shifting channel is becoming more costly, firms using this channel will reduce the amount shifted via this channel.*

Under the conditions described in Section 3.2, i.e. if either total economic profits are shifted or the optimal amounts shifted via each channel also depend on the total amount shifted, we can expect substitutive behavior. As a result, if the costs of profit shifting via the transfer pricing channel increase and the costs of debt shifting remain stable or vice versa, firms may rely more heavily on the unrestricted channel as long as the marginal costs do not exceed the marginal benefits. Of course, such a substitution will only take place in firms that have been using the respective profit shifting channel prior to the restriction.

Hypothesis 2b thus reads:

*H2b: If one profit shifting channel is becoming more costly while the other channel is unrestricted, firms may substitute shifting via the restricted channel with profit shifting via the unrestricted channel.*

Turning to a setting in which an anti-avoidance rule is introduced and/or strengthened for one channel while the other channel is already restricted, the substitution of transfer pricing shifting for debt shifting might still occur but not vice versa. Transfer pricing regulations are typically more flexible than thin capitalization rules, which establish a fixed threshold of deductible interest expenses. Determining the arm's length price is often very difficult, particularly in the case of firm-specific IP due to missing comparable transactions. Consequently, in the presence of transfer pricing regulations and thin capitalization rules it is not unlikely that firms substitute debt shifting with transfer pricing shifting as long as the marginal tax advantage still offsets the increased costs of documenting and justifying the manipulated transfer price. Firms are, however, unlikely to substitute debt shifting for transfer pricing shifting in this situation, as thin capitalization rules are prohibitive in the sense that the fixed threshold for deductible interest eliminates the tax advantage of shifting any Euro of interest above the threshold.

Consequently, Hypothesis H3a states:

*H3a: If thin capitalization rules are introduced in cases where transfer pricing rules are already strict, firms may still be able to substitute transfer pricing shifting for debt shifting.*

The more specific (or IP reliant) intra-group transactions are, the easier it should be for firms to substitute transfer pricing shifting for debt shifting in the presence of existing transfer pricing rules. On the contrary, the leeway for transfer pricing manipulation is likely to be smaller in the case of tangible goods compared to intangible assets. We capture this in H3b:

*H3b: The potential to substitute transfer pricing shifting for debt shifting in the presence of transfer pricing regulations and thin capitalization rules should be higher for IP-intensive firms.*

## **4 Data**

### **4.1 Firm-Level Data**

We use firm-level data from the Amadeus database provided by the Bureau van Dijk in the empirical section of our paper. This database includes accounting information and data on group structures for more than 21 million companies in Europe. We limit our sample to firms that report unconsolidated accounts, since we require information on the activities of single companies. In addition, we focus on the affiliates of MNEs and exclude purely domestic firms from our sample. In order to determine these multinational groups, we use information on direct

parent firms and their subsidiaries.<sup>11</sup> Since intra-group profit shifting requires a substantial ownership share, we follow Beer and Loeprick (2015) and consider affiliates with an ownership share of at least 90%. Furthermore, we exclude headquarter firms from our sample due to the findings of Dischinger and Riedel (2010) and Dischinger et al. (2014) who argue that the location of profits and profitable assets may be biased in favor of the headquarters. Moreover, loss-making firms are excluded because they face different tax planning incentives than profitable enterprises (see Huizinga and Laeven, 2008 and Dischinger and Riedel, 2011). Finally, we eliminate firms active in the financial sector as well as years with implausible values for our main variables of interest.

Our empirical analysis includes two identification strategies: the first identification strategy employs a panel of European companies that belong to a multinational group.<sup>12</sup> This analysis covers the period between 2004 and 2012 and includes firms located in 32 countries. In total, 103,714 firms provided the information required for the analysis of the substitution of profit shifting via transfer prices for debt shifting and 85,949 companies provide the necessary data for the analysis of debt shifting as a substitute for profit shifting via transfer prices. Table A1 in the appendix gives an overview of a cross-country distribution of observations in this sample. The second identification strategy is established by conducting a difference-in-difference estimation of a tax reform that was introduced in France in 2007. For this analysis, we use a balanced panel of 1,040 French affiliates of multinational groups in the period between 2004 and 2009.

#### **4.2 Data on Tax Rates and Anti-Avoidance Regulations**

The data on tax rates was obtained from the EU Commission's effective tax rates report and augmented by the University of Oxford's *CBT Tax* database, Ernst & Young's Worldwide Corporate Tax Guides and the *Global Corporate Tax Handbooks* published by the International Bureau of Fiscal Documentation (IBFD). The information on transfer pricing regulations was collected from the transfer pricing guides published by Deloitte, Ernst & Young, KPMG, and PwC. Data on thin-capitalization and earnings stripping rules was obtained from *Global Corporate Tax Handbooks*. For both types of anti-avoidance rules, we consider not only their

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<sup>11</sup> Since data on ownership is static in the Amadeus database, we use information on ownership structures in 2012 and assume that it did not change in previous years.

<sup>12</sup> We define a company as a part of a multinational group if at least one firm in the group is located in a different country.

presence but also their level of strictness, since tough regulations are more likely to have an impact on profit shifting behavior of MNEs.

Our main measure of transfer pricing strictness are the years since the introduction of mandatory transfer pricing documentation requirements (Beer and Loeprick, 2015). Transfer pricing documentation requirements constitute a crucial element of increasing transparency in the determination of transfer prices. The length of time in which these rules have been in force is a plausible proxy for its strictness as it usually takes tax authorities several years or more to gain the necessary experience and knowledge of intra-group transfer prices to effectively detect mispricing. A further important advantage is its clear definition making it an objective measure of strictness. For the empirical estimation, it also brings a lot of variation. Other papers use different variables to measure the strictness of transfer pricing rules and in order to ensure that our findings are robust, we test our baseline results by employing a binary transfer pricing variable comparable to the one used by Lohse and Riedel (2013). This variable also focuses on formal transfer pricing documentation rules. However, it does not take into consideration how long the rules have been in place and therefore exhibits significantly less variation in our dataset. The variable is set to one if formal transfer pricing documentation rules exist and equals zero otherwise. In a further robustness check, we take into account the existence of informal transfer pricing documentation rules. Informal transfer pricing documentation requirements exist if a country has not explicitly implemented the requirements for transfer pricing documentation in its tax law but requires the preparation of transfer pricing documentation in practice. We use a measure for the existence of informal transfer pricing rules while simultaneously controlling for the years since the introduction of formal transfer pricing regulations. The respective variable is set to zero if neither formal nor informal transfer pricing documentation rules exist and it is equal to one if informal transfer pricing documentation rules are present. Furthermore, starting from the year in which formal transfer pricing documentation rules are introduced, the years following their introduction are also counted. Table A2 in the appendix gives an overview of the formal and informal transfer pricing documentation rules across all countries in our sample.

In our baseline analysis, we rely on a comprehensive variable that enables thin-capitalization rules and earnings stripping regulations to be taken into account. This variable classifies interest deduction restrictions into three different categories as follows: all countries that do not have rules restricting the deductibility of interest payments (which go beyond a general application of the arm's length principle) are assigned to category 1. Countries that apply thin capitalization

rules with a safe haven ratio above the average safe haven ratio of all countries in the sample (which is 3) are assigned to category 2. Countries that do not use a general thin capitalization rule but apply some kind of anti-avoidance regulation against excessive intra-group debt shifting are also classified in this category.<sup>13</sup> In addition, countries that have a general thin capitalization rule with a safe haven ratio of 3 or less but exclude a broad range of transactions from their application are also assigned to category 2.<sup>14</sup> Category 3 comprises all countries that apply a thin capitalization rule with a safe haven ratio of 3 or below without broad exceptions. In addition, the earnings stripping rules applicable in Germany (from 2008), Italy (from 2008), and Spain (from 2012) are assigned to category 3. This reflects the fact that particularly in Italy and Spain the earnings stripping rules have been perceived to be stricter than the thin capitalization rules that were previously applicable. In Germany, assigning earnings stripping rules to category 3 reflects an unchanged level of strictness compared to prior years where a thin capitalization rule with a debt-to-equity ratio of 3:1 was present. Table A3 in the appendix summarizes our main indicator for interest deduction limitations by country and year.

In addition, we implement a robustness check by including an alternative proxy for interest deduction restrictions in our benchmark estimation. Here, we attempt to reflect the safe harbor debt-to-equity ratio<sup>15</sup> in countries with thin capitalization rules. According to Buettner et al. (2012), a direct use of this ratio is not feasible, since it approaches infinity when no restrictions are imposed. Therefore, we follow Buettner et al. (2012) who conduct a non-linear transformation of the safe harbor ratio denoted by  $\sigma$  and use it as a proxy for the strictness of thin capitalization rules.<sup>16</sup>

$$Strictness = \frac{1}{1+\sigma} \quad (10)$$

In equation 10, *Strictness* stands for the measure of the strictness of thin capitalization rules and  $\sigma$  denotes a country's safe harbor ratio. *Strictness* can only be determined for countries that apply a thin capitalization rule; therefore, it is equal to zero if a country does not have these types of regulations. The level of the safe haven ratio varies between 1.5 and 8 in our sample, which yields a maximum value of 0.5 for the strictness indicator. Table A3 in the appendix

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<sup>13</sup> Table 9 in the appendix provides information on these special interest deduction limitations.

<sup>14</sup> An example includes France during the years between 2004 and 2006, during which time only interest payments to parent companies resident in certain non-EU countries were covered by thin capitalization rules.

<sup>15</sup> A safe harbor debt-to-equity ratio indicates the level up to which interest deduction can be safely granted by the host-country's tax system. See OECD (1987) for more details.

<sup>16</sup> See Buettner et al. (2012), p. 933.

gives an overview of the debt-to-equity ratios applied under thin capitalization rules in the countries under analysis.

### **4.3 Macroeconomic Controls**

The data on gross domestic product (GDP), GDP growth, and GDP per-capita was extracted from the World Bank's *Development Indicators*<sup>17</sup> and is measured in constant USD. We also obtained the information on the unemployment rate from the World Bank's *Development Indicators*. This indicator represents a country's total unemployment rate as a percentage of its total labor force as estimated by the International Labor Office. Information on corruption is derived from the World Bank's *Control of Corruption Indicator*.<sup>18</sup> Data on inflation is taken from the database *World Economic Outlook*<sup>19</sup> provided by the International Monetary Fund which reflects the percentage change in average consumer prices. Table A6 in the appendix provides detailed descriptive statistics on all variables included in the panel estimation. Table A7 gives an overview of all variables included in the analysis of the French tax reform.

## **5 Research Design**

### **5.1 Estimation Based on the Variation of Tax Parameters over Time**

To test whether firms' decisions on profit shifting involve cost-induced substitution of different profit shifting channels, we augment existing approaches with proxies for the costs of the respective other profit shifting channel. To that end, we look at the tax rate sensitivity of EBIT not only at different strictness levels of transfer pricing regulations but also at different strictness levels of interest deduction restrictions. The latter do not have a direct or technical impact on the dependent variable as EBIT explicitly exclude interest payments. Hence, the measured effect can only be an indirect one via more transfer pricing shifting. This allows us to identify a potential substitution of transfer pricing shifting for debt shifting if interest deduction limitations are introduced. This first step of the analysis is similar to Saunders-Scott (2015). In order to test whether this substitution is also mirrored by an opposing effect for debt shifting, we augment the standard regression of debt ratio on interest deduction limitation rules by an indicator for transfer pricing strictness. Again, no technical relationship exists, which means that the identified impact can be considered an indication that the two profit shifting

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<sup>17</sup> See World Bank (2017).

<sup>18</sup> See World Bank (2016).

<sup>19</sup> See International Monetary Fund (2016).

strategies are substituted for one another. According to our hypotheses, the scope for substitution is different in settings where both channels are restricted. We test this by studying also the triple interaction of the tax rate, transfer pricing strictness and interest deduction limitations, which reflects the impact of one anti-avoidance regulation conditional on the strictness of the other.

The full specification of the EBIT regression is shown in equation 11:

$$\begin{aligned} \text{Log}(EBIT)_{it} = & \beta_0 + \beta_1 CIT_{it} + \beta_2 TP_{it} + \beta_3 CIT_{it} \times TP_{it} + \beta_4 TC_{it} + & (11) \\ & + \beta_5 CIT_{it} \times TC_{it} + \beta_6 TC_{it} \times TP_{it} + \beta_7 CIT_{it} \times TP_{it} \times TC_{it} + \\ & + \beta_8 X'_{it} + \mu_i + \delta_{jt} + \varepsilon_{it} \end{aligned}$$

$\text{Log}(EBIT)$  is the dependent variable that denotes a natural logarithm of earnings before interest and taxes of affiliate  $i$  in year  $t$ .  $CIT$  represents a corporate income tax rate augmented by local taxes on profits levied in year  $t$  in the country where firm  $i$  resides and reflects the general profit shifting incentive (Lohse and Riedel, 2013, Beer and Loeprick, 2015). We expect its coefficient to be negative. Furthermore, in line with Lohse and Riedel (2013), Beer and Loeprick (2015), and Saunders-Scott (2015), we expect that strict transfer pricing regulations  $TP$  effectively reduce the tax rate sensitivity of EBIT ( $\beta_3 > 0$ ). According to our hypothesis the tax rate sensitivity of EBIT should become more negative ( $\beta_5 < 0$ ) if interest deduction restrictions are tightened but transfer pricing regulations remain weak. While the double interaction reflects the case where the other profit shifting channel remains unrestricted, the triple interaction captures the conditional effect if both channels are strict. According to our hypothesis H3a, we expect that some leeway for substitution towards transfer pricing shifting persists ( $\beta_7 < 0$ ).

$X'$  represents a vector of relevant firm- and country-level controls that determine true profits and vary over time. It includes companies' main input factors, such as fixed assets and employees costs. In addition, it captures a host country's characteristics including GDP, GDP per capita, GDP growth rate, and unemployment rate.  $\mu_i$  and  $\delta_{jt}$  are company and industry-year fixed effects respectively, with  $\varepsilon_{it}$  representing an error term.

In order to trace the substitution effect also on the level of the debt channel, we look at the tax rate sensitivity of the debt ratio (loans to total assets) at different strictness levels of anti-avoidance rules. This can be considered an extension of studies like Desai et al. (2004), Overesch and Wamser (2010), Buettner and Wamser (2013), and Wamser (2014). In equation 12,  $DebtRatio$  is the dependent variable and it denotes loans to total assets by firm  $i$  in year  $t$ .

Previous authors in this field of literature have used affiliate's total or internal debt as a dependent variable. However, our data does not allow us to distinguish between internal and external debt. The full specification of the debt regression is shown in equation 12:

$$\begin{aligned}
DebtRatio_{it} = & \beta_0 + \beta_1 CIT_{it} + \beta_2 TP_{it} + \beta_3 CIT_{it} \times TP_{it} + & (12) \\
& + \beta_4 TC_{it} + \beta_5 CIT_{it} \times TC_{it} + \beta_6 TC_{it} \times TP_{it} + \\
& + \beta_7 CIT_{it} \times TP_{it} \times TC_{it} + \beta_8 X'_{it} + \mu_i + \delta_{jt} + \varepsilon_{it}
\end{aligned}$$

The main independent variables of interest  $CIT$ ,  $TP$ , and  $TC$  are identical to the ones described in equation 11. The vector  $X'$  in equation 12 includes firm- and country-level controls. In line with existing studies we include firm-level controls such as a *logarithm of a company's profit*, *the ratio of net property, plant, and equipment to total assets*, and *cashflow* in our estimation. We also control for inflation at the country level. In line with equation 11,  $\mu_i$  and  $\delta_{jt}$  in equation 12 are company and industry-year fixed effects respectively and  $\varepsilon_{it}$  is an error term.

Sub-sample analyses for firms belonging to IP-intensive or less IP-intensive groups shed light on the heterogeneity in potential for substituting two profit shifting channels for one another.

According to Hypothesis 1, we expect that companies belonging to multinational groups with a high IP intensity rely more heavily on trade mispricing for profit shifting while other companies engage in profit shifting via intra-group debt if none of the profit shifting channels are restricted. Beer and Loeprick (2015) show that the profit shifting behavior of subsidiaries with high intangibles-to-total-assets ratios is less influenced by anti-avoidance legislation than the profit shifting behavior of affiliates with a low fraction of intangible assets. Against this background, we estimate the benchmark models presented in sections 5.1 and 5.2 for IP-intensive and non-IP-intensive companies. We classify IP-intensive firms as those that belong to MNEs with an IP intensity above the mean of our sample,<sup>20</sup> with IP intensity defined as the ratio of intangible assets to total fixed assets.<sup>21</sup>

Since certain countries, such as Germany, do not allow the capitalization of self-created intangible assets, we additionally assign all companies active in R&D-intensive industries to the subsample of IP-intensive firms. We define R&D-intensive industries based on the

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<sup>20</sup> We refer to the IP intensity of a group, because the opportunity to shift profits via royalty payments does not depend on the company's own level of IP intensity but rather on the existence of valuable intangible assets at the level of any of the group's affiliates.

<sup>21</sup> We test alternative definitions of IP intensity in the robustness checks.



*Stifterverband* report,<sup>22</sup> which shows the aggregate internal R&D investments per industry in 2008. Hence, we classify all industries that invested more than one billion EUR in R&D in 2008 as R&D-intensive. This includes the following sectors:

- Manufacturing of chemicals and chemical products;
- Manufacturing of basic pharmaceutical products and pharmaceutical preparations;
- Manufacturing of computers, electronics, and optical products;
- Manufacturing of electrical equipment;
- Manufacturing of machinery and equipment;
- Manufacturing of motor vehicles, trailers, and semi-trailers;
- Manufacturing of air and spacecraft;
- Information and communication;
- Scientific research and development.

## **5.2 Quasi-Experimental Analysis of a French Tax Reform**

The estimation approach presented in the previous section relies on firms' reactions to a variation of relevant tax parameters over time and a correct classification of anti-avoidance strictness. A common concern of studies using this approach is that the detected results are potentially prone to confounding effects that are not controlled for in the regression analysis. Hence, to complement the identification of the interdependence between profit shifting strategies and further validate our findings from the panel analysis, we exploit a quasi-experimental reform setting in France using a difference-in-difference approach. Besides the comparison to a control group, one additional advantage of this approach is that we do not have to model the strictness of thin capitalization and transfer pricing rules. In the difference-in-difference design, we compare the average changes in EBIT for firms experiencing an increase in the strictness of thin capitalization rules with those not affected by the reform in 2007. Both the corporate income tax rate and the strictness of transfer pricing regulations remained unchanged in France during the years considered in our analysis. In addition, we are not aware of any other reforms that might have had different effects on the treatment and control groups.

The French tax reform of 2007 expanded the application of French thin capitalization rules to related parties within the European Union (EU). The preceding regulation, stipulating a restriction on interest payments to controlling shareholders, was changed in 2004 due to EU

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<sup>22</sup> See *Stifterverband für die Deutsche Wissenschaft* (2013).

case law (European Court of Justice, 2002) and since then (until the 2007 reform) was no longer applicable to interest payments made to controlling shareholders resident in the EU and those resident in specific tax treaty countries. The Finance Act of 2006<sup>23</sup> has introduced new interest deduction restrictions for fiscal years beginning on or after January 1, 2007. These rules applied to related parties regardless of their residence and covered interest transactions to parent companies and to other associated firms. Associated companies are defined as two companies in which one holds directly or indirectly a minimum of 50% of the other firm's capital or as two companies in which a third enterprise holds directly or indirectly 50% of their capital. The strictness of the new thin capitalization rule was now defined by two thresholds: a debt-to-equity ratio of 1.5:1 (as before 2007) and in addition a limitation of 25% of a company's EBITDA. The interest that exceeds the higher of the two thresholds was considered non-deductible for tax purposes. If the non-deductible interest was 150,000 EUR or less, all interest is considered deductible. According to these regulations, we classify a firm as belonging to the treatment group if it faced unrestricted debt shifting opportunities prior to the reform and became subject to interest deduction restrictions from 2007 onwards. This is the case if three conditions are met: (1) Its parent company is located in one of the countries covered by the exemption of thin capitalization rules between 2004 and 2006 (EU member states or certain treaty-exempted countries). (2) Its reported median interest payments in the three years prior to the reform exceed 150,000 EUR (since this amount of interest remained deductible after the reform irrespective of a company's debt-to-equity ratio). (3) It faces a higher tax rate than its parent firm since otherwise no tax incentive for high debt levels would be present (Graham, 2013). Consequently, the control group includes companies with parent firms that reside in countries covered by thin capitalization rules before 2007 as well as companies without a tax incentive and firms with low interest payments.

We use the following difference-in-difference specification to study the impact of the 2007 reform:

$$\begin{aligned} \text{Log}(EBIT)_{it} = & \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{After}_t + \beta_3 \text{Treat}_i * \text{After}_t + & (13) \\ & + \beta_4 X'_{it} + \mu_i + \delta_{jt} + \varepsilon_{it} \end{aligned}$$

In equation 13,  $\text{Log}(EBIT)$  is the dependent variable that denotes a natural logarithm of a firm's  $i$  earnings before interest and taxes in year  $t$ .  $\text{Treat}$  is a binary variable that is equal to one for

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<sup>23</sup> See Ernst & Young (2008).

all firms that are assigned to the treatment group and is set to zero for all companies assigned to the control group. The variable *After* equals zero for pre-reform years between 2004 and 2006 and takes on the value of one for the post-reform period between 2007 and 2009.

The coefficient of interest in equation 13 is  $\beta_3$ . The identifying assumption is that in the absence of a reform the dependent variable would have followed a similar trend in both treatment and control groups. Since treated firms face a higher cost of shifting profits via interest payments, they are expected to rely more on trade mispricing upon policy intervention if they have some discretionary leeway of doing so. Consequently, we expect  $\beta_3$  to be negative. This would suggest that firms affected by the reform are more likely to reduce their EBIT than the unaffected companies.  $X'$  in equation 13 comprises firm-level controls such as fixed assets and the employee costs. In addition, equation 13 contains industry-year fixed effects  $\delta_{jt}$  and company fixed effects  $\mu_i$ .  $\varepsilon_{it}$  is an error term.

## 6 Results

### 6.1 Results 1: Panel data estimation of the interaction between thin capitalization and transfer pricing

This part of the paper refers to the research design and the regression equation described in Section 5.1.1. Table 1, Column I displays a negative and statistically significant tax sensitivity of reported EBIT. With all other factors remaining constant, on average a one percentage point increase in the tax rate leads to a -0.35% decrease in a company's reported profits. This negative relationship has already been presented in the earlier literature on profit shifting (see the meta-study of Heckemeyer and Overesch (2013) for an overview). The effect size is, however, somewhat smaller than the average effect size derived in this meta-study.

Table 1. Regression Results:  $\text{Log}(EBIT)$  as a Dependent Variable

	Full Sample		IP	Non-IP
	I	II	III	VI
CIT	-0.351*** (0.107)	-0.013 (0.194)	-0.857*** (0.260)	0.559* (0.307)
TP	0.020*** (0.002)	0.054*** (0.005)	0.054*** (0.006)	0.052*** (0.008)
CIT x TP	0.103*** (0.024)	0.517*** (0.079)	0.521*** (0.107)	0.551*** (0.123)
TC		0.027*** (0.007)	0.010 (0.009)	0.043*** (0.011)
CIT x TC		-0.358*** (0.109)	-0.014 (0.148)	-0.473*** (0.168)
TP x TC		-0.025*** (0.003)	-0.023*** (0.003)	-0.027*** (0.004)
CIT x TP x TC		-0.228*** (0.044)	-0.278*** (0.060)	-0.206*** (0.069)
Log(Fixed Assets)	0.082*** (0.003)	0.082*** (0.003)	0.079*** (0.004)	0.084*** (0.004)
Log(Costs of Empl.)	0.395*** (0.006)	0.393*** (0.006)	0.398*** (0.009)	0.380*** (0.009)
Unemployment Rate	-0.012*** (0.001)	-0.011*** (0.001)	-0.012*** (0.002)	-0.010*** (0.002)
Corruption	0.000 (0.017)	-0.002 (0.017)	0.004 (0.023)	0.000 (0.029)
GDP Growth Rate	0.005*** (0.001)	0.006*** (0.001)	0.007*** (0.001)	0.005*** (0.002)
Log(GDP)	0.432** (0.189)	-0.109 (0.207)	0.484* (0.285)	-0.773** (0.319)
Log(GDP/capita)	-0.268 (0.174)	0.349* (0.195)	-0.141 (0.276)	0.914*** (0.292)
Year-Industry FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of Companies	103,714	103,714	66,331	51,877
No. of Observations	541,323	541,323	321,842	218,319
R <sup>2</sup> (within)	0.087	0.087	0.086	0.085

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. Dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *CIT* stands for a corporate income tax rate. *TP* measures the strictness of transfer pricing regulations. *TC* measures the strictness of interest deduction restrictions.  $\text{Log}(\text{Fixed Assets})$  and  $\text{Log}(\text{Cost of Empl.})$  are firm-level controls and represent natural logarithms of a company's fixed assets and employee costs respectively. *Unemployment Rate* stands for a country's rate of unemployment. *Corruption* represents a corruption index. *GDP Growth Rate* is a country's rate of GDP growth.  $\text{Log}(\text{GDP})$  denotes a natural logarithm of a country's gross domestic product.  $\text{Log}(\text{GDP/capita})$  stands for a natural logarithm of a country's GDP per capita. FE stands for fixed effects. IP represents a sample of IP-intensive firms as defined in section 5.3 and Non-IP includes a sample of all other companies.

Table 1, Column II reinvestigates the influence of transfer pricing regulations on a firm's profits. Consistent with Bartelsman and Beetsma (2003), Lohse and Riedel (2013), Saunders-Scott (2013), and Beer and Loeprick (2015), we find that an implementation of transfer pricing documentation rules in high-tax countries leads to an increase in firms' reported earnings before interest and taxes (Table 1, Column II). The coefficient on the interaction term between the corporate income tax rate and the transfer pricing rules is positive and statistically significant. It indicates that on average the negative tax rate sensitivity of EBIT shrinks by 0.1 percentage points every additional year that the transfer pricing regulation is in place. The effect size is comparable to the one reported by Beer and Loeprick (2015) who use the same measure for the strictness of transfer pricing regulations. This suggests a high effectiveness of strict transfer pricing regulations in limiting profit shifting behavior as put forward by Lohse and Riedel (2012) and Beer and Loeprick (2015). However, by not taking into account the possibility that firms might substitute profit shifting via debt for profit shifting via transfer pricing, the measured effect could be misleading in a tax policy context.

To test our hypotheses on potential substitution effects, we augment the regression by an indicator for interest deduction limitation rules as defined in Section 4.2 (Table I, Column III). In addition, to account for conditional effects, pairwise interactions and an interaction term between all three variables of interest are also included. In the presence of the triple interaction, the two-way interaction between the transfer pricing rules and CIT reflects the case where only formal transfer pricing rules exist, whereas interest deduction limitations do not. The coefficient on two-way interaction is positive and statistically significant, which suggests that in the absence of thin capitalization rules companies in high-tax countries seem to shift smaller volumes via the transfer pricing channel if transfer pricing rules exist. This confirms H 2a. Since this effect could include an absolute reduction in profit shifting activity, as well as a substitution with debt financing, we test whether the effect is mirrored in the debt equation. Table 2 illustrates the results for the corresponding debt regression as described in Section 5.1. The interaction between CIT and TP (Table 2 Column I) with debt ratio as a dependent variable illustrates the impact of transfer pricing regulations on the tax rate elasticity of the debt ratio. It is positive and significant at the 10% level. We conclude that the reduction of the tax rate sensitivity of EBIT following the introduction of transfer pricing regulations is accompanied by an increase in the debt ratio. We take this as an indication that firms to some extent substitute

debt shifting for transfer pricing shifting if the latter channel is restricted while the debt channel is not.

Table 2. Regression Results: Debt Ratio as a Dependent Variable

	Full Sample I	IP II	Non-IP III
CIT	0.209*** (0.039)	0.197*** (0.054)	0.225*** (0.059)
TP Doc	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)
CITxTP Doc	0.027* (0.015)	0.037* (0.020)	0.013 (0.023)
TC Rule	0.004*** (0.001)	0.004** (0.002)	0.004** (0.002)
CITxTC Rule	-0.034 (0.024)	-0.024 (0.033)	-0.058* (0.035)
TP DocxTC Rule	-0.000 (0.000)	-0.000 (0.001)	-0.001 (0.001)
CITxTP DocxTC Rule	-0.017* (0.009)	-0.022* (0.012)	-0.012 (0.013)
Log Profits	-0.004*** (0.000)	-0.005*** (0.001)	-0.002** (0.001)
Fixed Tangible Assets/Total Assets	-0.021*** (0.006)	-0.016** (0.007)	-0.027*** (0.009)
Log Cashflow	-0.010*** (0.001)	-0.009*** (0.001)	-0.012*** (0.001)
Inflation	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Year-Industry FE	Yes	Yes	Yes
# Companies	62,032	41,617	27,248
# Observations	249,137	158,947	89,740
R-squared (within)	0.016	0.017	0.020

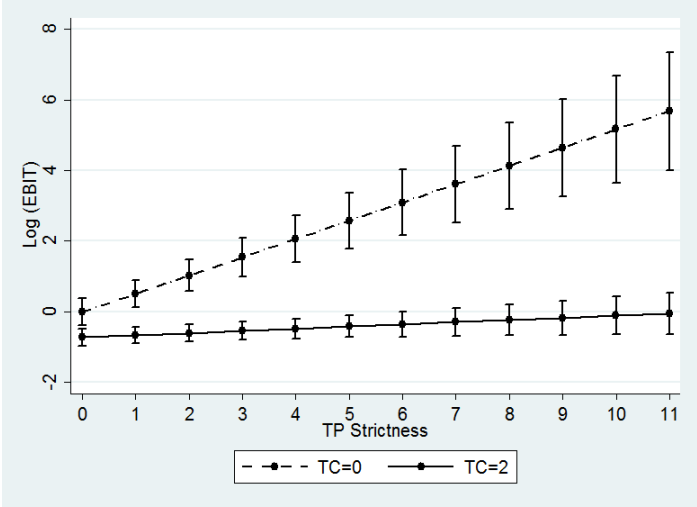
Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is *DebtRatio*, which is loans to total assets. *CIT* stands for a corporate income tax rate. *TP* measures the strictness of transfer pricing regulations. *TC* measures the strictness of interest deduction restrictions. Firm-level controls include Log(Profits), Log(Cashflow), and a ratio of fixed tangible assets to total assets. FE stands for fixed effects. IP represents a sample of IP-intensive firms as defined in section 5.3 and Non-IP includes a sample of all other companies.

To investigate potential substitutive behavior in the other direction (from debt shifting to transfer pricing shifting), Table 1, Column III also includes an interaction term between the corporate income tax rate (CIT) and the indicator for interest deduction limitations (TC) with log(EBIT) as the dependent variable. This reflects the case where only interest deduction restrictions exist but transfer pricing documentation rules do not apply.

The coefficient on these restrictions is negative and statistically significant which suggests that, in the absence of strict transfer pricing documentation rules, strict interest deduction restrictions lead to a further decrease in the negative tax sensitivity of EBIT by on average 0.36 percentage points, with each increase in the three-stage indicator for interest deduction restrictions. Since EBIT does not include interest payments, no technical relationship between thin capitalization and EBIT exists and we take the significant effect as an indication that firms substitute transfer pricing shifting for debt shifting if the latter is restricted. To substantiate this finding, Table 2, Column I shows the respective response to tighter thin capitalization rules as reflected in the tax rate sensitivity of the debt ratio. As expected, we find a negative sign, indicating a reduction of the debt ratio. The effect, however, is not significant in the full specification. If we later look at the subsample analysis, however, we observe a negative and significant response for firms with a low intangible intensity. It is plausible to assume that these firms relied more heavily on debt shifting prior to the reform (H1) and are thus greatly affected by the strengthening of thin capitalization rules.

Turning again to the EBIT specification (Table 1), the triple interaction of the CIT rate with the transfer pricing indicator and the interest deduction limitation indicator depicts the conditional reform effect if both profit shifting channels are restricted. It is also negative and highly significant (-0.228). This suggests that the positive impact determined for transfer pricing rules on the tax rate elasticity of EBIT (0.517) is much less pronounced if thin capitalization rules are strict. We consider this to be suggestive evidence that the initial effect measured for the introduction of transfer pricing regulations in absence of thin capitalization rules includes both a reduction in profit shifting behavior and a substitution of transfer pricing shifting with debt shifting. To give an example, three years after the introduction of formal transfer pricing documentation rules, the average marginal effect yields a tax rate sensitivity of -0.54 when the debt channel is restricted as opposed to 1.53 when substitution with debt shifting is possible because no restriction is imposed on that channel.

Figure 1. Average Marginal Effects of CIT on Log (EBIT): Full Sample



Hence, estimating the conditional effect helps to disentangle the impact of both decision margins (reducing profit shifting and substituting between channels). The overall tax rate elasticity of EBIT tests negative and increases only slightly with increasing strictness of transfer pricing regulations (Figure 1). It turns insignificant when transfer pricing regulations have been in place for seven years or more. This confirms hypothesis H3a, which stated that firms to some extent continue to substitute transfer pricing shifting for debt shifting if thin capitalization rules are strengthened and transfer pricing rules are strict as well. We further substantiate this finding by looking at the interactions in the debt equation. (Table 2, Column I) We observe that the positive impact of transfer pricing regulations on the tax sensitivity of the debt ratio determined for the case of an unrestricted debt channel (signaling substitution of transfer pricing shifting for debt shifting) is substantially mitigated if the debt channel is restricted (i.e. no substitution with debt shifting is further possible). This observation exactly mirrors the effect shown for the transfer pricing channel above.

*Subsample analysis for different IP intensities*

According to hypotheses H1 and H3b firms differ in terms of their scope to exploit leeways in trade mispricing. To test these hypotheses, we split the baseline sample into IP-intensive and non-IP-intensive companies. In line with Hypothesis 1, columns III and IV of Table 1 show that IP-intensive firms shift profits via transfer pricing manipulation in the absence of any anti-avoidance regulations. For this subgroup, we find a negative tax rate sensitivity of EBIT. For companies with a low IP intensity, an increase in the tax rate even has a weakly positive effect on EBIT. The results indicate that non-IP-intensive companies on average do not engage in profit shifting via transfer prices if both channels are unrestricted. Once strict interest deduction



limitation rules are in place, however, the negative and significant coefficient of the interaction term CITxTC reveals that non-IP-intensive firms now choose transfer pricing as their main profit shifting strategy (Table 1, Column V). The debt equation again mirrors this effect (Table 2, Column III): we observe a significant reduction of the tax rate sensitivity of the debt ratio following the introduction of interest deduction restrictions. Both results speak in favor of hypothesis H2b, namely that firms substitute shifting via the unrestricted channel for shifting via the restricted channel.

We also find support for this substitution hypothesis in the sample of firms with high IP intensity (Table 1, Column IV). If transfer pricing regulations become stricter, we observe a positive and significant coefficient for the interaction term CITxTP which confirms the expected reduction of profit shifting via this channel. In return, we learn from the debt equation that this subsample on average reports higher debt ratios when transfer pricing regulations are tightened (Table 2, Column II). Again, we conclude that firms react to the increase in channel specific shifting costs by switching to some extent to another profit shifting strategy (H2b).

Figure 2. Average Marginal Effects of CIT on Log (EBIT): IP-Intensive Firms

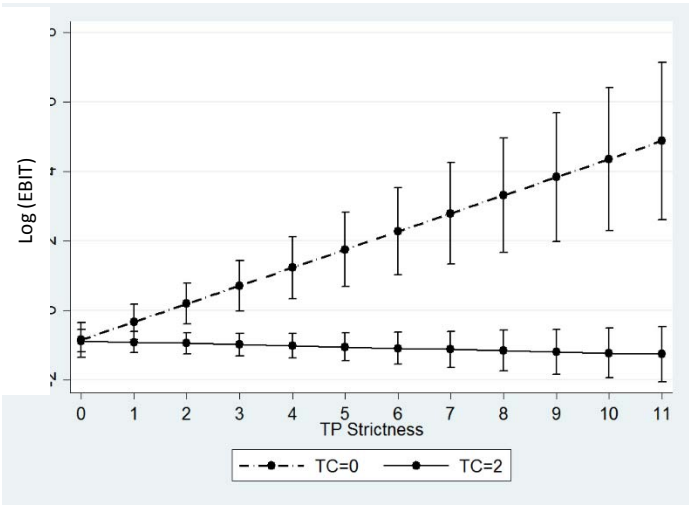
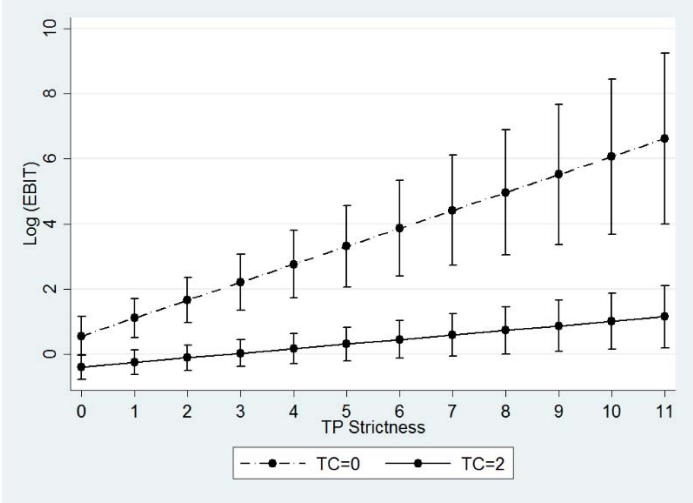


Figure 3. Average Marginal Effects of CIT on Log(EBIT): Non-IP-Intensive Firms



According to columns III and IV of Table 1, the coefficient on triple interaction is negative for both subsamples. Looking at the average marginal effects (Figures 2 and 3), we find that for IP-intensive firms the negative tax rate sensitivity given strict interest deduction restrictions is statistically significant for all levels up to seven years after the introduction of transfer pricing documentation rules (Figure 2). For non-IP-intensive firms, the negative tax rate sensitivity is only statistically significant in the first four years after transfer pricing documentation rules have been introduced if strict interest deduction restrictions exist (Figure 3). The size of the coefficient and its statistical significance declines with each additional year of the existence of transfer pricing documentation rules. These findings confirm our expectation from hypothesis H3b that, in a setting where both channels are restricted, IP-intensive firms have a wider scope for profit shifting via transfer pricing.

**6.1.3 Robustness Tests**

We conduct several robustness checks to test the sensitivity of our findings. Firstly, we replace the indicators for anti-avoidance rules with alternative measures (Table 3). Following Buettner et al. (2012), we use a non-linear transformation of the debt-to-equity ratio as an alternative indicator for interest deduction limitations (Table 3, Column I and II). If no thin capitalization rules exist, the indicator is equal to zero and in countries that apply an earnings stripping ratio this variable is set to missing.<sup>24</sup> Furthermore, following Lohse and Riedel (2013) we use an alternative measure for the strictness of transfer pricing regulations. This is a binary variable, which equals one if formal transfer pricing documentation rules exist in a country and zero

<sup>24</sup> Section 4.2 provides more details on the construction of this variable.

otherwise (Table 3, Column III and IV). Moreover, we additionally incorporate informal transfer pricing documentation rules using a variable that is set to one in all countries with an informal transfer pricing documentation requirement. We combine this measure with our main variable of interest to take into account the effect of time since implementation. Consequently, this variable increases by one each year after formal transfer pricing documentation rules have been introduced (Table 3, Column V and VI).

If we use the level of the debt-to-equity ratio as an indicator for interest deduction limitations, the results for the estimations according to equation 11 remain comparable to our baseline findings. One major difference is that the interaction between the interest deduction restrictions and the corporate income tax rate in column II of Table 3 still remains negative for non-IP-intensive firms but it is no longer statistically significant. While the interest deduction limitation strictness indicator underlying the baseline results considers both thin capitalization rules and earnings stripping rules, the indicator in the robustness check uses a transformation of the debt-to-equity ratio and therefore excludes countries with earnings stripping rules. Hence, the more significant coefficient in the baseline analysis could be driven by considering earning stripping countries as well. The negative triple interaction can be confirmed.

Using an alternative transfer pricing variable based on Lohse and Riedel (2013), most of our baseline results are confirmed. The only difference is that the tax rate sensitivity of IP-intensive firms is negative but no longer statistically significant once we use an alternative measure (see column III of Table 13). Moreover, the interaction between the tax rate and transfer pricing rules (in the regression with  $\text{Log}(EBIT)$  as a dependent variable) is no longer statistically significant for companies with a low IP intensity. However, these results have to be treated with caution, since the binary  $TP$  variable exhibits considerably less variation in our sample compared to our benchmark indicator for transfer pricing regulations. The transfer pricing variable which incorporates both informal transfer pricing documentation rules and the effect of time on the strictness of transfer pricing regulations (see columns V and VI of Table 13) shows no substantial difference compared to the baseline findings.

In addition to using alternative definitions of the anti-avoidance regulations, we also apply alternative definitions of IP intensity (Table 4). In the first variant (Table 4, Column I and II), we split the sample by taking into account a group's ratio of intangible assets to total assets. Under this definition companies active in R&D-intensive industries are (contrary to our main regression results) not automatically assumed to be IP-intensive. In the second alternative (Table 4, Column III and IV), we define IP intensity based on the level of intangible assets held

by an affiliate instead of the ratio of intangible assets to total assets. In a third alternative (Table 4, Column V and VI), we use the ratio of intangible assets to total fixed assets and additionally include all firms active in R&D-intensive industries in the sample of IP-intensive companies. The variations in the definition of IP intensity yield very similar results and confirm the baseline results presented in the main results section.

Table 3. Robustness Tests Using Alternative Definitions of Anti-Avoidance Legislation:  
 $\text{Log}(EBIT)$  as a Dependent Variable

TP Measure:	TP Doc Years		TP Doc Binary		TP Doc Years + TP Doc required in practice	
	$1/(1+\sigma)$		TC 3-stage		TC 3-stage	
TC Measure:	$\sigma = \text{TC D/E Ratio}$					
	IP	Non-IP	IP	Non-IP	IP	Non-IP
	I	II	III	IV	V	VI
<i>CIT</i>	-1.263*** (0.290)	0.256 (0.342)	-0.418 (0.255)	0.907*** (0.302)	-0.853*** (0.264)	0.572* (0.310)
<i>TP</i>	0.070*** (0.006)	0.075*** (0.008)	0.000 (0.000)	0.000 (0.000)	0.045*** (0.005)	0.039*** (0.007)
<i>CITxTP</i>	0.915*** (0.122)	0.974*** (0.147)	0.071*** (0.013)	0.024 (0.017)	0.400*** (0.085)	0.413*** (0.099)
<i>TC</i>	-0.042 (0.100)	0.055 (0.108)	0.000 (0.000)	0.000 (0.000)	0.020** (0.009)	0.050*** (0.012)
<i>CITxTC</i>	1.764 (1.194)	-1.622 (1.399)	0.532* (0.273)	0.584* (0.316)	0.002 (0.151)	-0.502*** (0.171)
<i>TPxTC</i>	-0.195*** (0.018)	-0.246*** (0.023)	0.028*** (0.010)	0.046*** (0.012)	-0.020*** (0.003)	-0.021*** (0.004)
<i>CITxTPxTC</i>	-2.684*** (0.402)	-2.278*** (0.491)	0.075 (0.152)	-0.361** (0.173)	-0.239*** (0.048)	-0.154*** (0.055)
<i>Log(Fixed Assets)</i>	0.077*** (0.004)	0.084*** (0.004)	0.000 (0.000)	0.000 (0.000)	0.079*** (0.004)	0.084*** (0.004)
<i>Log(Costs of Empl.)</i>	0.407*** (0.010)	0.388*** (0.010)	-0.042*** (0.009)	-0.010 (0.011)	0.398*** (0.009)	0.380*** (0.009)
<i>Unemployment Rate</i>	-0.011*** (0.002)	-0.012*** (0.002)	0.000 (0.000)	0.000 (0.000)	-0.013*** (0.002)	-0.011*** (0.002)
<i>Corruption</i>	0.024 (0.024)	0.015 (0.031)	-0.818*** (0.177)	-0.584*** (0.198)	0.009 (0.022)	0.002 (0.029)
<i>GDP Growth Rate</i>	0.008*** (0.002)	0.006*** (0.002)	0.079*** (0.004)	0.084*** (0.004)	0.008*** (0.001)	0.006*** (0.002)
<i>Log(GDP)</i>	-0.682** (0.324)	-2.137*** (0.364)	0.399*** (0.009)	0.381*** (0.009)	0.395 (0.286)	-0.827** (0.322)
<i>Log(GDP/capita)</i>	0.932*** (0.311)	2.055*** (0.331)	-0.011*** (0.002)	-0.009*** (0.002)	-0.087 (0.277)	0.933*** (0.297)
Year-Industry FE	Yes	Yes	0.026	-0.015	Yes	Yes
Firm FE	Yes	Yes	(0.022)	(0.028)	Yes	Yes
No. of Companies	Yes	Yes	0.007***	0.005***	66331	51877
No. of Observations	63267	49437	(0.001)	(0.002)	321842	218319
R <sup>2</sup> (within)	284982	195888	0.902***	0.117	0.086	0.085

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *CIT* stands for a corporate income tax rate. *TP* measures the strictness of transfer pricing regulations. *TC* measures the strictness of interest deduction restrictions. *Log(Fixed Assets)* and *Log(Cost of Empl.)* are firm-level controls and represent natural logarithms of a company's fixed assets and employee costs respectively. *Unemployment Rate* stands for a country's rate of unemployment. *Corruption* represents a corruption index. *GDP Growth Rate* is a country's rate of GDP growth. *Log(GDP)* denotes a natural logarithm of a country's gross domestic product. *Log(GDP/capita)* stands for a natural logarithm of a country's GDP per capita. FE stands for fixed effects. IP represents a sample of IP-intensive firms as defined in section 5.3 and Non-IP includes a sample of all other companies.

Table 4. Robustness Tests Using Alternative Definitions of IP Intensity:  $\text{Log}(EBIT)$  as a Dependent Variable

	IP <sub>2</sub>	Non-IP <sub>2</sub>	IP <sub>3</sub>	Non-IP <sub>3</sub>	IP <sub>4</sub>	Non-IP <sub>4</sub>
	I	II	III	IV	V	VI
CIT	-0.450* (0.270)	0.353 (0.285)	-0.525* (0.274)	0.046 (0.298)	-0.581** (0.261)	0.647** (0.298)
TP	0.050*** (0.006)	0.058*** (0.007)	0.052*** (0.007)	0.059*** (0.007)	0.054*** (0.006)	0.055*** (0.008)
CIT x TP	0.613*** (0.108)	0.431*** (0.116)	0.513*** (0.112)	0.528*** (0.120)	0.617*** (0.107)	0.379*** (0.118)
TC	0.007 (0.010)	0.044*** (0.010)	0.011 (0.010)	0.044*** (0.011)	0.008 (0.009)	0.043*** (0.011)
CIT x TC	-0.143 (0.152)	-0.531*** (0.159)	-0.044 (0.154)	-0.348** (0.166)	-0.073 (0.148)	-0.655*** (0.165)
TP x TC	-0.022*** (0.003)	-0.029*** (0.004)	-0.019*** (0.004)	-0.031*** (0.004)	-0.025*** (0.003)	-0.025*** (0.004)
CIT x TP x TC	-0.275*** (0.060)	-0.187*** (0.066)	-0.248*** (0.062)	-0.222*** (0.068)	-0.298*** (0.059)	-0.131* (0.068)
Log(Fixed Assets)	0.090*** (0.004)	0.076*** (0.003)	0.082*** (0.004)	0.078*** (0.004)	0.084*** (0.003)	0.079*** (0.004)
Log(Costs of Empl.)	0.399*** (0.009)	0.387*** (0.008)	0.405*** (0.010)	0.375*** (0.008)	0.401*** (0.008)	0.382*** (0.009)
Unemployment Rate	-0.011*** (0.002)	-0.012*** (0.002)	-0.010*** (0.002)	-0.015*** (0.002)	-0.012*** (0.002)	-0.010*** (0.002)
Corruption	0.002 (0.023)	-0.005 (0.027)	-0.008 (0.023)	0.006 (0.028)	-0.014 (0.022)	0.022 (0.028)
GDP Growth Rate	0.007*** (0.001)	0.006*** (0.002)	0.008*** (0.002)	0.005*** (0.002)	0.007*** (0.001)	0.006*** (0.002)
Log(GDP)	0.096 (0.287)	-0.288 (0.300)	0.292 (0.298)	-0.301 (0.316)	0.130 (0.279)	-0.275 (0.311)
Log(GDP/capita)	0.149 (0.274)	0.509* (0.278)	0.016 (0.290)	0.507* (0.288)	0.130 (0.266)	0.543* (0.287)
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Companies	52,985	50,728	66,842	68,459	60,389	43,324
No. of Observations	284,806	256,515	278,859	261,107	323,655	217,666
R <sup>2</sup> (within)	0.093	0.083	0.083	0.082	0.093	0.081

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *CIT* stands for a corporate income tax rate. *TP* measures the strictness of transfer pricing regulations. *TC* measures the strictness of interest deduction restrictions.  $\text{Log}(\text{Fixed Assets})$  and  $\text{Log}(\text{Cost of Empl.})$  are firm-level controls and represent natural logarithms of a company's fixed assets and employee costs respectively. *Unemployment Rate* stands for a country's rate of unemployment. *Corruption* represents a corruption index. *GDP Growth Rate* is a country's rate of GDP growth.  $\text{Log}(\text{GDP})$  denotes a natural logarithm of a country's gross domestic product.  $\text{Log}(\text{GDP/capita})$  stands for a natural logarithm of a country's GDP per capita. FE stands for fixed effects. IP represents a sample of IP-intensive firms and Non-IP includes a sample of all other companies.

## 6.2 Results 2: Quasi-Experimental Analysis of a French Tax Reform

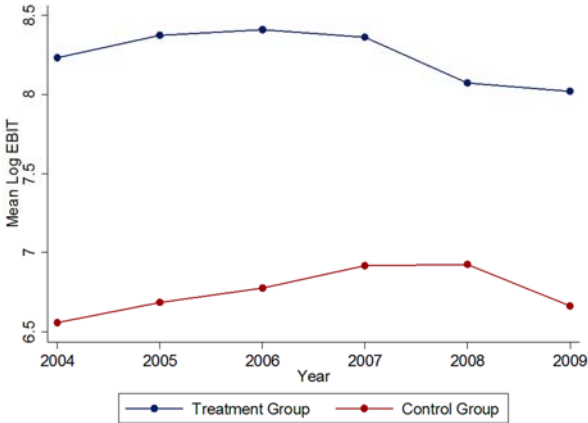
### 6.2.1 Baseline Findings

The empirical evidence presented in the previous section suggests that multinational enterprises are able to substitute profit shifting channels for one another. In order to validate this finding, we additionally study a reform setting in France using a difference-in-difference approach. As described in section 5.2, we divide the sample into treatment and control groups according to their level of exposure to the reform.

Figure 4 shows that the average EBIT of treatment and control groups followed a parallel trend during the three years prior to the introduction of the reform in 2007. The parallel trend assumption required for a difference-in-difference setting is confirmed for both the full sample (Panel A) and the subsample of IP-intensive firms (Panel B). Moreover, it is already obvious from this descriptive representation, that the average reported profits experience a sharp decline for treated firms in the post reform year that we do not find in the control sample.

Figure 4. Common Trend of EBIT in Treatment and Control Groups

Panel A. Full Sample



Panel B. IP-Intensive Firms

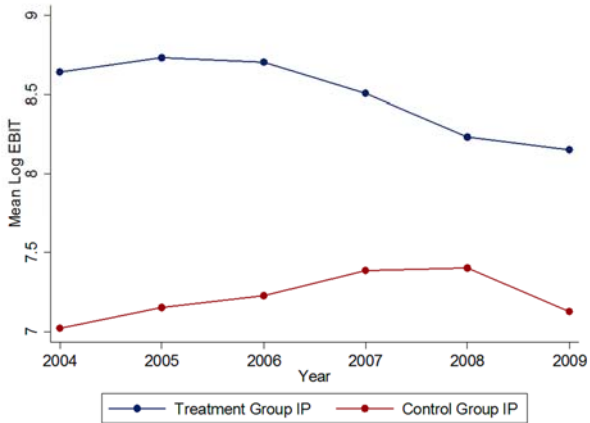


Table 6 summarizes the results of the difference-in-difference estimation. Column I presents the difference-in-difference regression results with both industry-year and firm fixed effects but without controlling for firm-level time-variant variables which will be included in column II. The coefficient on the difference-in-difference estimator is negative and significant at the level of 1%. It remains negative and statistically significant once we add fixed assets and employee compensation to the benchmark specification (see column II). This finding confirms or substitution hypotheses 2b and 3a along with our previous results, suggesting that firms facing a restriction on profit shifting via the debt channel use profit shifting via transfer prices more extensively.

In order to test the idea that treated firms differ in their potential use of transfer prices as a profit shifting strategy and therefore in their capacity to react to stricter thin capitalization rules by substituting their current strategy with transfer pricing shifting, we repeat the difference-in-difference regression separately for IP-intensive and non-IP-intensive companies (as defined in Section 5.1).

While France did not have formal transfer pricing documentation rules in the sample period 2004-2009, it nevertheless had transfer pricing regulations in place which were fairly strictly enforced. This suggests that, for companies not affected by thin capitalization rules before 2007, shifting high levels of profits via the debt channel might have been cheaper than excessively using transfer pricing manipulation. Consequently, the model suggests that both companies with a high and low intensity of intangible assets in the treatment group had incentives to make use of debt shifting prior to the reform. This is also implicitly ensured only including companies in the treatment group with high levels of interest paid. Thus, restricting the level of allowed debt shifting through the introduction of thin capitalization rules affects firms in the treatment group irrespective of their level of intangible intensity. However, the potential for substitution with the other channel is likely to be more pronounced for companies with a high intangible intensity suggesting that these companies are more able to substitute debt shifting with shifting via transfer pricing.

In fact, the results shown in columns III and IV of Table 6 indicate a negative and statistically significant coefficient on the difference-in-difference estimator for IP-intensive companies and an insignificant coefficient for non-IP-intensive firms. This finding supports hypothesis H3b, according to which companies with a high IP intensity have more leeway in substituting debt



shifting with transfer pricing shifting. In order to validate these results, we conduct a triple difference-in-difference estimation instead of splitting the sample into two parts. This is carried out by including an indicator variable for the intangibles intensity  $IP$  in the benchmark model. The coefficient on the triple difference estimator appears to be statistically significant and negative. Furthermore, with an F-value of 6.41 the joint coefficient is also highly significant.

Table 6. Main Results of Difference-In-Difference Estimation:  $\text{Log}(EBIT)$  as a Dependent Variable

	Full Sample		IP	Non-IP	Full
	I	II	III	IV	V
<i>After</i>	1.525 (0.966)	-0.868** (0.410)	-0.273*** (0.053)	-1.216** (0.523)	-0.891** (0.405)
<i>Treat*After</i>	-0.367*** (0.131)	-0.314** (0.126)	-0.573*** (0.157)	-0.097 (0.164)	-0.066 (0.166)
<i>After*IP</i>					0.056 (0.046)
<i>Treat*After*IP</i>					-0.497** (0.227)
<i>Controls</i>	No	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
No. of Companies	938	938	506	432	938
No. of Observations	5,628	5,628	3,036	2,592	5,628
R <sup>2</sup> (within)	0.072	0.124	0.165	0.104	0.125

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *After* is equal to zero for pre-reform years between 2004 and 2006 and takes on the value of one for the post-reform period between 2007 and 2009. *Treat* is a binary variable that is equal to one for all firms that are assigned to the treatment group and is equal to zero for all companies assigned to the control group. *Controls* includes  $\text{Log}(\text{Fixed Assets})$  and  $\text{Log}(\text{Costs of Empl.})$ , which represent natural logarithms of a company's fixed assets and the employee costs respectively. FE stands for fixed effects. IP represents a sample of IP-intensive firms as defined in section 5.3 and Non-IP includes a sample of all other companies.

### 6.2.2 Robustness Tests

As a robustness test, we check whether our benchmark results remain the same once we define the treatment group differently. The corresponding estimation outcomes are shown in Table 7. We begin by assigning only companies that have a tax incentive and a parent firm in an EU Member State or a country with a required treaty to the treatment group. The additional requirement of interest payments above 150,000 EUR is ignored. We label this alternative treatment definition  $Treat_2$  (Table 7, Column I). As a second alternative, we refer to the mean instead of the median interest payments in the three years prior to the reform to determine whether companies fulfil the requirement of interest payments above the exempt amount

(*Treat3*). Finally, we classify all companies with a parent in the EU or a treaty-exempt country with interest above 150,000 EUR as the treatment group (*Treat4*) instead and limit the sample to companies with a tax incentive (i.e. also the control group consists of firms with a debt shifting tax incentive) (Table 7, Column 3). According to columns I-III of Table 7, the alternative definitions of the treatment group and the sample yield highly significant negative coefficients for the difference-in-difference estimator on EBIT and confirm our baseline analysis. Moreover, we conduct a placebo test, in which we assume that the reform was implemented in 2006 instead of 2007. According to column IV of Table 7, the results of a placebo test turn out to be statistically insignificant, which further supports the validity of our main findings.

Table 7. Robustness Tests Using Alternative Definitions of Treatment and Control Groups as well as a Placebo Test:  $\text{Log}(EBIT)$  as a Dependent Variable

	Full Sample			
	I	II	III	IV
<i>After</i>	-0.866** (0.409)	-0.868** (0.410)	0.060 (0.132)	
<i>Treat2*After</i>	-0.104* (0.057)			
<i>Treat3*After</i>		-0.308** (0.120)		
<i>Treat4*After</i>			-0.315** (0.135)	
<i>After(Placebo)</i>				-0.184 (0.574)
<i>Treat*After(Placebo)</i>				-0.082 (0.133)
<i>Controls</i>	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of Companies	1,040	938	204	938
No. of Observations	6,240	5,628	1,224	3,752
R <sup>2</sup> (within)	0.115	0.124	0.115	0.158

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *After* is equal to zero for pre-reform years between 2004 and 2006 and takes on the value of one for the post-reform period between 2007 and 2009. *After(Placebo)* is equal to zero for 2004 and 2005 and takes on the value of one for 2006 and 2007. *Treat* is a binary variable that is equal to one for all firms that are assigned to the treatment group and is set to zero for all companies assigned to the control group. *Controls* includes  $\text{Log}(\text{Fixed Assets})$  and  $\text{Log}(\text{Costs of Empl.})$ , which represent natural logarithms of a company's fixed assets and employee costs respectively. FE stands for fixed effects.

In line with the analysis presented in section 6.1.3, we test the findings of this part of the paper using two alternative definitions of IP intensity. According to Table 8, the results remain almost

unchanged once IP-intensive firms are defined differently. The coefficient on the difference-in-difference estimator is negative and statistically significant in the case of IP-intensive firms, which demonstrates the robustness of our baseline findings.

Table 8. Robustness Tests Using Different Definitions for IP Intensity:  $\text{Log}(EBIT)$  as a Dependent Variable

	IP: intangible assets/total assets of a group > median of all groups		IP: intangible assets of a group > median of all groups	
	IP	Non-IP	IP	Non-IP
	I	II	III	IV
<i>After</i>	0.838*** (0.253)	0.108*** (0.040)	0.831*** (0.247)	0.110** (0.046)
<i>Treat*After</i>	-0.563*** (0.170)	-0.126 (0.181)	-0.529*** (0.177)	-0.039 (0.145)
<i>Controls</i>	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of Companies	427	385	434	378
No. of Observations	2,562	2,310	2,604	2,268
R <sup>2</sup> (within)	0.192	0.118	0.197	0.122

Notes: \*\*\*, \*\*, \* indicates significance at the 1%, 5%, and 10% level. Robust standard errors are reported in parentheses. Units of observation are firms. The dependent variable is  $\text{Log}(EBIT)$ , which denotes a natural logarithm of a firm's earnings before interest and taxes. *After* is equal to zero for pre-reform years between 2004 and 2006 and takes on the value of one for the post-reform period between 2007 and 2009. *Treat* is a binary variable that is equal to one for all firms that are assigned to the treatment group and is set to zero for all companies assigned to the control group. *Controls* includes  $\text{Log}(\text{Fixed Assets})$  and  $\text{Log}(\text{Costs of Empl.})$ , which represent natural logarithms of a company's fixed assets and employee costs respectively. FE stands for fixed effects. IP represents a sample of IP-intensive firms and Non-IP includes a sample of all other companies.

## 7 Conclusion

The issue of base erosion and profit shifting has been on the international policy agenda for several years now. The recent initiatives to fight BEPS are, however, not yet mirrored by a thorough understanding of how the introduction or the tightening of anti-avoidance legislation affects firms' profit shifting strategies. Understanding the profit shifting mechanisms has a high relevance for understanding, explaining and predicting profit shifting behavior in a changing institutional environment (Shackelford and Shevlin, 2001).

Due to the nature of firm internal decision making processes that it is difficult to answer this question with archival data. Nonetheless, recent studies by, e.g. Hopland et al (2017), de Simone (2016), and Kim et al. (2015) show that specific research designs, reform settings and estimation techniques make it possible draw indirect inferences on the formation of profit strategies also from archival data.

Against this background, the objective of this paper was to further elucidate how profit shifting strategies are developed, in particular with respect to firms' reaction to anti-avoidance legislation. Our main line of questioning was whether firms substitute different profit shifting strategies with one another if the channel specific costs change due to anti-avoidance legislation. This type of substitution could explain why studies looking at the effect of profit shifting strategies separately find evidence of a strong effectiveness of anti-avoidance legislation but little or no effect on investment responses.

Our identification strategy includes two empirical approaches and focuses on the potential interdependency between transfer pricing shifting and debt shifting. Firstly, we use firm-level panel data from 2004 to 2012 on European companies from the Amadeus database. Secondly, we exploit a tax reform in France that came into force in 2007 as a quasi-experimental setting. This reform tightened thin capitalization rules for one group of French firms that had previously been exempt (in particular firms with European shareholders) while the regulations remained unchanged for the remaining French firms. In both approaches, we take into account that the potential to substitute, in particular, profit shifting via transfer prices for debt shifting depends on firms' flexibility to deviate from arm's length prices which is closely related to the specificity of intra-group transactions, i.e. the relevance of intangible assets (Dischinger and Riedel, 2011).

Our results confirm existing evidence that tightening transfer pricing regulations reduces the tax sensitivity of earnings before interest and taxes (EBIT) substantially. Our results show, however, that this reduction includes both a reduction in profit shifting activity and a substitution with debt shifting. Moreover, we find that firms using debt shifting rely more heavily on tax optimization of transfer prices when thin capitalization rules are strengthened. If transfer pricing regulations are also strict, the conditional reform effects show that the substitutive response is more pronounced for a subsample of firms with a high share of intangible property (IP). The difference-in-difference approach for the French tax reform illustrates an increase in profit shifting based on transfer prices for treated firms facing new restriction on debt shifting. Again, the effect is stronger for IP intensive firms.

As for policy recommendations, our results show that disregarding the conditional effect might provide biased conclusions about the effectiveness of transfer pricing regulations and interest deduction restrictions. Taking into account that firms jointly optimize profit shifting strategies for both channels and therefore substitute between channels if the respective costs change might

also explain why it is difficult to empirically establish negative side effects of anti-avoidance rules.

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## Appendix

Table A1. Country Statistics

Country	Full Sample		IP		Non-IP	
	Obs.	%	Obs.	%	Obs.	%
Austria	9,017	1.67	6,129	1.88	2,888	1.34
Belgium	24,799	4.58	12,040	3.70	12,759	5.91
Bosnia-Herzegovina	1,177	0.22	634	0.19	543	0.25
Bulgaria	3,625	0.67	1,882	0.58	1,743	0.81
Croatia	5,525	1.02	3,044	0.94	2,481	1.15
Czech Republic	22,997	4.25	12,333	3.79	10,664	4.94
Denmark	10,766	1.99	4,956	1.52	5,810	2.69
Estonia	4,502	0.83	1,841	0.57	2,661	1.23
Finland	11,011	2.03	7,089	2.18	3,922	1.82
France	99,863	18.45	70,775	21.74	29,088	13.48
Germany	35,339	6.53	24,395	7.49	10,944	5.07
Hungary	2,850	0.53	1,938	0.60	912	0.42
Iceland	106	0.02	37	0.01	69	0.03
Ireland	581	0.11	229	0.07	352	0.16
Italy	54,878	10.14	45,782	14.07	9,096	4.21
Latvia	102	0.02	57	0.02	45	0.02
Luxembourg	2,160	0.40	1,112	0.34	1,048	0.49
Malta	6	0.00	5	0.00	1	0.00
Montenegro	15	0.00	9	0.00	6	0.00
Netherlands	8,437	1.56	3,456	1.06	4,981	2.31
Norway	21,620	3.99	15,117	4.64	6,503	3.01
Poland	20,952	3.87	11,751	3.61	9,201	4.26
Portugal	9,086	1.68	4,686	1.44	4,400	2.04
Romania	20,764	3.84	10,595	3.26	10,169	4.71
Serbia	6,248	1.15	2,909	0.89	3,339	1.55
Slovak Republic	5,675	1.05	3,311	1.02	2,364	1.10
Slovenia	3,310	0.61	2,298	0.71	1,012	0.47
Spain	55,495	10.25	34,309	10.54	21,186	9.82
Sweden	24,177	4.47	9,515	2.92	14,662	6.79
Switzerland	15	0.00	7	0.00	6	0.00
Ukraine	7,084	1.31	2,552	0.78	4,532	2.10
UK	69,141	12.77	30,701	9.43	38,440	17.81
Total	541,323	100	325,494	100	215,827	100

Notes: This table shows a distribution of observations across countries in the full sample, as well as the sample of IP-intensive firms, and the sample of non-IP firms. IP intensity is defined in section 5.3.

Table A2. An Overview of Transfer Pricing Documentation Requirements

Country	Formal	Informal
Austria	No	All Sample Years
Belgium	No	All Sample Years
Bosnia-Herzegovina	No	Since 2008
Bulgaria	No	Since 2006
Croatia	Since 2005	
Czech Republic	No	All Sample Years
Denmark	Since 2006	All Sample Years
Estonia	Since 2007	
Finland	Since 2007	All Sample Years
France	Since 2010	All Sample Years
Germany	Since 2003	All Sample Years
Hungary	Since 2010	All Sample Years
Iceland	No	
Ireland	Since 2011	
Italy	Since 2010	All Sample Years
Latvia	No	Since 2007
Luxembourg	No	Since 2005
Malta	No	
Montenegro	No	All Sample Years
Netherlands	Since 2002	
Norway	Since 2008	All Sample Years
Poland	Since 2001	
Portugal	Since 2002	
Romania	Since 2007	All Sample Years
Serbia	No	All Sample Years
Slovak Republic	Since 2009	All Sample Years
Slovenia	Since 2005	
Spain	Since 2009	All Sample Years
Sweden	Since 2007	All Sample Years
Switzerland	No	All Sample Years
Ukraine	No	
UK	Since 2008	All Sample Years

Notes: Formal refers to transfer pricing documentation requirements that are explicitly stated in national law. Informal refers to transfer pricing documentation requirements that are not explicitly mentioned in national law but are required in practice.

Table A3. An Overview of Debt-To-Equity Ratios under Thin Capitalization Rules

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium	0	0	0	0	0	0	0	0	5
Bulgaria	2	2	2	3	3	3	3	3	3
Croatia	4	4	4	4	4	4	4	4	4
Czech Republic	4	4	4	4	2	4	4	4	4
Denmark	4	4	4	4	4	4	4	4	4
France	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Germany	1.5	1.5	1.5	1.5	-	-	-	-	-
Hungary	3	3	3	3	3	3	3	3	3
Italy	5	4	4	4	-	-	-	-	-
Latvia	4	4	4	4	4	4	4	4	4
Lithuania	4	4	4	4	2	4	4	4	4
Netherlands	3	3	3	3	3	3	3	3	3
Poland	3	3	3	3	3	3	3	3	3
Portugal	2	2	2	2	2	2	2	2	2
Romania	1	3	3	3	3	3	3	3	3
Serbia	4	4	4	4	4	4	4	4	4
Slovenia	0	8	8	8	6	6	6	5	4
Spain	3	3	3	3	3	3	3	3	-

Table A4. Special Requirements Regarding Interest Deduction Limitations

Country	Rules
Belgium	7:1 debt-to-equity ratio if interest is tax-exempt or taxed at a reduced rate at the level of a lender.
France	2004-2006: applicable only to payments to non-EU parent companies that are not resident in one of the treaty-exempted countries.
Luxembourg	85:15 debt-to-equity ratio if debt is used for the funding of participations or real estate located in Luxembourg.
Portugal	2006-2012: applicable only to payments to non-EU parent companies. Before: an exemption is possible if debt-to-equity ratio is considered to be at arm's length.
Spain	2004-2011: applicable only to payments to non-EU parent companies.
Sweden	No deduction of interest paid on intra-group debt relating to the intra-group acquisition of shares if there are no justifying business or commercial reasons and the income is not subject to tax of at least 10%.
Ukraine	Interest deductible up to a firm's own interest income and 50% of other income if paid to a foreign company.
UK	Included in transfer pricing regulations; generally a 1:1 ratio is used as a guideline.

Table A5. Three-Stage Indicator of Interest Deduction Restrictions

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012
Austria	0	0	0	0	0	0	0	0	0
Belgium	1	1	1	1	1	1	1	1	1
Bosnia-Herzegovina	0	0	0	0	0	0	0	0	0
Bulgaria	2	2	2	2	2	2	2	2	2
Croatia	0	1	1	1	1	1	1	1	1
Czech Republic	1	1	1	1	2	1	1	1	1
Denmark	1	1	1	1	1	1	1	1	1
Estonia	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0
France	1	1	1	2	2	2	2	2	2
Germany	2	2	2	2	2	2	2	2	2
Hungary	2	2	2	2	2	2	2	2	2
Iceland	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0
Italy	1	1	1	1	2	2	2	2	2
Latvia	1	1	1	1	1	1	1	1	1
Luxembourg	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0
Montenegro	0	0	0	0	0	0	0	0	0
Netherlands	2	2	2	2	2	2	2	2	2
Norway	0	0	0	0	0	0	0	0	0
Poland	2	2	2	2	2	2	2	2	2
Portugal	1	1	1	1	1	1	1	1	1
Romania	2	2	2	2	2	2	2	2	2
Serbia	1	1	1	1	1	1	1	1	1
Slovak Republic	0	0	0	0	0	0	0	0	0
Slovenia	0	1	1	1	1	1	1	1	1
Spain	1	1	1	1	1	1	1	1	2
Sweden	0	0	0	0	0	1	1	1	1
Switzerland	2	2	2	2	2	2	2	2	2
Ukraine	1	1	1	1	1	1	1	1	1
UK	1	1	1	1	1	1	1	1	1

Notes: The three-stage variable measures the strictness of interest deduction restrictions. It is denoted as follows: 0: no specific interest deduction restrictions; 1: a special rule or a thin capitalization rule with broad exceptions or debt-to-equity ratio above 3; 2: thin capitalization rules without broad exception and debt-to-equity ratio of 3 or lower or earnings stripping rules.

Table A6. Descriptive Statistics: Panel-Data Analysis

	Full Sample				IP				Non-IP			
	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max
<i>EBIT</i>	541,323	4,605.62	0.00	9,535,506	325,494	5,127.08	0.00	6,219,053	215,829	3,819.23	0.00	9,535,506
<i>Fixed Assets</i>	541,323	25,631.88	0.00	5.06E+07	325,494	28,875.49	0.00	5.06E+07	215,829	20,740.31	0.00	3.52E+07
<i>Costs of Empl.</i>	541,323	7,689.78	0.00	7,336,624	325,494	8,792.55	0.00	7,336,624	215,829	6,026.75	0.00	6,041,358
<i>Interest Paid</i>	375,573	1,480.30	0.00	1.94E+08	238,004	1,755.68	0.00	1.94E+08	137,569	1,003.81	0.00	6,567,206
<i>Sales</i>	375,573	78,082.02	0.00	1.15E+08	238,004	80,777.43	0.00	5.00E+07	137,569	73,418.77	0.00	1.15E+08
<i>Net PPE/Assets</i>	375,573	0.18	0.00	79.64	238,004	0.17	0.00	79.64	137,569	0.19	0.00	1.96
<i>EBITDA/Assets</i>	375,573	0.17	0.00	585.70	238,004	0.16	0.00	329.39	137,569	0.16	0	585.70
<i>Intangibles</i>	541,323	2,665.22	0.00	1.80E+07	325,494	3,722.45	0.00	1.80E+07	215,829	1,055.35	0.00	3,762,855
<i>Intangibles/Assets</i>	541,323	0.01	0.00	0.99	325,494	0.02	0.00	0.99	215,829	0.00	0.00	0.00
<i>CIT</i>	541,323	0.29	0.09	0.40	325,494	0.30	0.09	0.40	215,829	0.28	0.09	0.40
<i>TP Doc Years</i>	541,323	1.53	0.00	11.00	325,494	1.46	0.00	11.00	215,829	1.63	0.00	11.00
<i>TP Doc Binary</i>	541,323	0.49	0.00	1.00	325,494	0.49	0.00	1.00	215,829	0.51	0.00	1.00
<i>TP Doc Years + Doc Required in Practice</i>	541,323	2.51	0.00	12.00	325,494	2.45	0.00	12.00	215,829	2.6	0.00	12.00
<i>TC 3-stage</i>	541,323	1.24	0.00	2.00	325,494	1.28	0.00	2.00	215,829	1.18	0.00	2.00
<i>TC 1/ (1+ <math>\sigma</math>)</i>	375,573	0.18	0.00	0.50	238,004	0.21	0.00	0.50	137,569	0.16	0.00	0.50
<i>Corruption</i>	541,323	1.18	-1.03	2.56	325,494	1.15	-1.03	2.56	215,829	1.23	-1.03	2.56
<i>Unemployment Rate</i>	541,323	8.57	2.30	31.80	325,494	8.63	2.30	31.80	215,829	8.45	2.30	31.80
<i>Inflation</i>	541,323	2.74	-1.71	25.20	325,494	2.61	-1.71	25.20	215,829	2.94	-1.71	25.20
<i>GDP</i>	541,323	1.09E+12	1.81E+09	2.55E+12	325,494	1.15E+12	2.18E+09	2.55E+12	215,829	9.88E+11	1.81E+09	2.55E+12
<i>GDP/capita</i>	541,323	25,751.01	1421.18	70,569.24	325,494	26,021.74	1,421.18	70,569.24	215,829	25,342.54	1,421.18	70,569.24
<i>GDP Growth Rate</i>	541,323	1.47	-14.80	12.10	325,494	1.37	-14.80	12.10	215,829	1.63	-14.80	12.10
<i>Growth Options</i>	375,573	0.06	-0.99	140.86	238,004	0.06	-0.99	140.86	137,569	0.06	-0.99	23.57

Notes: The number of observations is 541,323 in the regressions with  $\text{Log}(\text{EBIT})$  as a dependent variable (see section 6.1.1) and 375,573 in the regressions with  $\text{Log}(\text{Interest Paid})$  as a dependent variable (see section 6.1.2). *EBIT* denotes earnings before interest and taxes. *Fixed Assets* represents total fixed assets. *Cost of Empl.* stands for employee costs. *Interest Paid* denotes a firm's interest payments. *Sales* stands for a company's total turnover. *Net PPE/Assets* is a ratio of a company's net property, plant, and equipment to total assets. *EBITDA/Assets* is a ratio of earnings before interest, taxes, depreciation, and amortization to total assets. *Intangibles* shows total intangible assets of a company. *Intangibles/Assets* represents a ratio of the MNE's intangibles to total assets. *CIT* stands for a corporate income tax rate. *TP*-variables measure the strictness of transfer pricing regulations. *TC*-variables measure the strictness of interest deduction limitations. *Corruption* represents a corruption index. *Unemployment Rate* stands for a country's rate of unemployment. *Inflation* denotes a country's rate of inflation. *GDP* denotes a natural logarithm of a country's gross domestic product. *GDP/capita* stands for a natural logarithm of a country's GDP per capita. *GDP Growth Rate* is a country's rate of GDP growth. *Growth Options* denotes the median annual sales growth per industry and country. IP represents a sample of IP-intensive firms as defined in section 5.3 and Non-IP includes a sample of all other companies.

Table A/. Descriptive Statistics: Difference-In-Difference Estimation

## Panel A. Full Sample

	Obs.	Mean	Median	Std. Dev.	Min	Max
Treatment Group						
<i>EBIT</i>	120	8,377.94	3,373.41	11,857.69	156.30	53,744.78
<i>Costs of Empl.</i>	120	15,506.77	9,793.83	20,690.72	851.26	110,785
<i>Fixed Assets</i>	120	55,012	11,621.67	136,975.80	78.09	704,268.70
Control Group						
<i>EBIT</i>	5,508	11,893.03	718.48	106,761.80	0.19	3,232,000
<i>Costs of Empl.</i>	5,508	16,833.22	2,011.11	73,509.92	0.33	1,769,000
<i>Fixed Assets</i>	5,508	39,757.99	1,007.44	265,506.80	0.00	4,920,454
All Firms						
<i>EBIT</i>	5,628	11,818.08	745.51	105,632.60	0.19	3,232,000
<i>Costs of Empl.</i>	5,628	16,804.94	2,075.49	72,784.34	0.33	1,769,000
<i>Fixed Assets</i>	5,628	40,083.24	1,039.74	263,423.90	0.00	4,920,454

## Panel B. IP-Intensive Firms

	Obs.	Mean	Median	Std. Dev.	Min	Max
Treatment Group						
<i>EBIT</i>	60	10,025.57	4,050.25	13,793.34	209.69	53,744.78
<i>Costs of Empl.</i>	60	21,617.45	11,612.07	26,851.96	851.26	110,785
<i>Fixed Assets</i>	60	81,250.91	16,460.96	186,250.40	321.64	704,268.70
Control Group						
<i>EBIT</i>	2,976	15,668.66	1,274.36	135,135.90	0.50	3,232,000
<i>Costs of Empl.</i>	2,976	21,241.59	3,739.15	59,276.42	2.78	641,069
<i>Fixed Assets</i>	2,976	56,932.31	2,097.93	332,521.40	0.00	4,920,454
All Firms						
<i>EBIT</i>	3,036	15,557.14	1,337.52	133,809.60	0.50	3,232,000
<i>Costs of Empl.</i>	3,036	21,249.02	3,869.67	58,806.89	2.78	641,069
<i>Fixed Assets</i>	3,036	57,412.92	2,166.21	330,258.10	0.00	4,920,454

Notes: *EBIT* stands for earnings before interest and taxes. *Cost of Empl.* stands for employee costs. *Fixed Assets* represents total fixed assets. IP-intensive firms are defined in section 5.3