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Firm Responses to an Interest Barrier: Empirical Evidence

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Firm Responses to an Interest Barrier: Empirical Evidence

*Jarkko Harju, Ilpo Kauppinen and Olli Ropponen**

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Abstract

This paper studies the effects of an interest barrier that was introduced in Finland to restrict the profit-shifting opportunities of multinational enterprises (MNEs). We employ full population data of Finnish, Swedish and Danish MNEs and a difference-in-differences methodology, where Swedish and Danish MNEs serve as a control group. We find that Finnish MNEs responded to the interest barrier by decreasing their financial expenses. Subsidiaries decreased also their long-term debt levels. We do not find evidence of debtshifting being replaced by transfer pricing. Neither do we find evidence of changes in output, suggesting that the interest barrier did not create distortions by affecting the real activity of MNEs.

JEL Codes: H25, H26, G32

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1 Introduction

It is widely recognized that cross-country differences in corporate tax rates and tax bases create opportunities for multinational enterprises (MNEs) to reduce their tax burden (see e.g. Hines 1999, Devereux 2006, Dharmapala 2016). A critical feature of the current international tax system is that the profits of each parent and subsidiary are subject to corporate income taxation in its host country. This provides an incentive for MNEs to alter the profit allocation between the parent company and the subsidiaries in different countries. Substantial empirical evidence shows that MNEs do indeed utilize these opportunities by engaging in various profit-shifting activities (Huizinga and Laeven 2008, Buettner and Wamser 2013, Heckemeyer and Overesch 2013, Dharmapala 2014). According to the OECD (2015c), profit-shifting decreases global corporate income tax revenue by 4-10%. In addition, it has distributional effects as high-tax-rate and broad-tax-base countries lose tax revenues to low-tax countries. Profit-shifting also distorts competition between MNEs and domestic companies by giving an advantage to the former. One channel for profit-shifting is via debt-shifting. This channel exploits the fact that interest expenses are deductible for corporate tax purposes in most countries (see e.g. Huizinga et al. 2008). A parent company in a high-tax country may show its profits in a low-tax country by borrowing from its low-tax country subsidiary. Deducting the interest expenses in a high-tax country and paying taxes on the corresponding interest income in a low-tax country, the MNE effectively shifts its tax liability to the low-tax country and reduces its overall tax burden.

As a response to diminished corporate tax revenues and to other adverse distortions, governments around the world have introduced several anti-tax avoidance measures to protect their tax bases. The OECD has designed its Base Erosion and Profit Shifting (BEPS) package to reduce the room for tax evasion and tax-planning strategies that exploit gaps in the international tax system (OECD 2013a,b). The package provides recommendations for actions that would equip governments with the instruments needed to tackle profit-shifting. One of the recommendations focuses on limiting base erosion especially in cases involving interest deductions and other financial payments (OECD 2015b). The European Commission (EC) has also taken an active role in the fight against profit-shifting by including limitations in deductibility of interest and other financial expenses both in the Anti-Tax Avoidance Directive (ATAD) and in the directive on Common Consolidated Corporate Tax Base (CCCTB). (EC 2016a,b,c)

In line with both the OECD recommendations and EC directives, Finland restricted the deductibility of intra-MNE interest expenses from the beginning of 2014

onwards. In this paper, we study how this interest barrier (IB) affected the behavior of Finnish MNEs and succeeded in decreasing profit shifting. We employ a difference-in-differences method to full population data of Finnish, Swedish and Danish MNEs from the Orbis database. The Finnish MNEs are treated with the IB, whereas the Swedish and Danish MNEs serve as a control group. We argue that Swedish and Danish companies form a suitable control group, as the companies in the control and treatment groups show similar pre-reform trends in a number of variables. Furthermore, the economic structures and institutions are relatively similar in the three countries.[1] In addition, we use an alternative control group of companies of Finnish MNEs to show the robustness of our results.

Our paper is the first to study the effects of IB in case where no pre-reform restrictions on the deductibility of interest expenses exist. The earlier empirical literature of an IB relies exclusively on the German reform, where a thin-capitalization rule (TCR) was replaced by an IB. Our study is also the first to study the effects of IB by using comparable MNEs from other countries as a control group.

We examine the effects of IB on financial expenses, debt levels and overall economic activity of firms. Our results show that the introduction of the interest barrier decreased the financial expenses of Finnish MNEs by 25-30%. This result is of importance as it captures the joint changes in debt levels and their interest rates. We also find a decrease in long-term debt levels. We do not find evidence of MNEs increasing the use of other profit-shifting measures like transfer pricing in response to the interest barrier. Neither do we find evidence of changes in real output among Finnish MNEs compared to Swedish and Danish MNEs. As the output levels of the treated companies are not affected, the interest barrier does not seem to distort the overall activity of companies. The results suggest that an interest barrier can be an efficient measure in tackling profit-shifting.

The paper proceeds as follows. The following section reviews the related literature. Section 3 discusses the details of the Finnish reform and Section 4 provides theoretical predictions of the effects of the reform. Section 5 describes the methodology and the data. The results of the econometric analyses are provided in Section 6 and Section 7 concludes.

2   Related Literature

This study contributes to the literature on profit-shifting by MNEs. The literature has provided evidence of the occurrence of profit-shifting and acknowledges various

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[1]For a comparison between the Finnish and Swedish economies, see Korkman and Suvanto (2013).

ways to shift profits (see e.g. Dharmapala 2014 and Egger and Stimmelmayr 2017). The three most common ways are transfer pricing, debt-shifting and the use of intangible assets. The literature also acknowledges multiple anti-tax avoidance measures for tackling debt-shifting (see Webber 2010 for a survey). Typical measures include thin-capitalization rules (TCRs), which restrict the debt-to-equity ratios of firms[2], and interest barriers (IB), which restrict the ratio of debt expenses to some profit-related measure.[3] Even if there has been a shift from the former to the latter, both types of restrictions are applied in several countries (Merlo and Wamser 2014).

There is a large empirical literature on the effects of TCRs. Maßbaum and Sureth (2009) study Belgian, Italian and German rules and find that their effects depend significantly on the details of the underlying tax system. However, several empirical studies on the effects of TCRs have shown that companies respond to these rules in line with their objectives and reduce internal debt levels. Blouin et al. (2014) investigate the impact of thin-capitalization rules on the capital structure of the foreign affiliates of U.S. multinationals in 54 countries and show that these restrictions reduce an affiliate's debt-to-asset ratio. Buettner et al. (2012) analyze the impact of TCRs using a firm-level panel data set on the OECD country affiliates of German multinationals. They find that TCRs reduce the incentive to use internal loans for tax-planning but lead to higher external debt. A reduction in leverage is also observed in a number of other studies (Weichenrieder and Windischbauer 2008, Overesch and Wamser 2010 and Wamser 2014). In line with Buettner et al. (2012), Wamser (2014) also provides evidence that internal debt might be easily substituted by external debt. This may reduce the efficiency of TCRs that only restrict the use of intra-company debt. The use of hybrid instruments further deteriorates the performance of TCRs by providing a way to circumvent the restriction by manipulating the label of the funding from debt to equity.[4] In addition, these rules are shown to have adverse effects on foreign direct investments in high-tax countries (Buettner et al. 2014).[5]

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[2]It is worth noting that debt-to-equity ratio restrictions (not only on internal debt, but in general) may also have other objectives, like reducing systemic risk. Second, internal debt arrangements also exist for purposes other than tax planning, and being able to substitute external debt with internal debt offers MNEs several advantages relative to domestic firms (see Desai et al. 2004 and Egger et al. 2014). MNEs are, for instance, able to issue external debt in a favorable credit market to affiliates in less favorable markets.

[3]A typically used profit-related measure is earnings before interest, taxes, depreciation and amortization, EBITDA.

[4]Hybrid instruments, which have elements of both debt and equity, are considered to be problematic for both TCRs and IBs by reducing their effectiveness (Barnes 2015). Action 2 in the OECD action plan tries to tackle the problems related to hybrid instruments. (OECD 2015a)

[5]Debt-equity tax bias relates to the fact that debt is deducted in corporate taxation in many countries, whereas equity is not, leading to tax favoritism of debt compared to equity. This bias results in excess debt, which has been observed not only to exacerbate tax avoidance opportunities

A recent evolution of the anti-tax avoidance measures targeted to reducing the scope for debt-shifting has been towards IBs. By restricting the deductibility of interest expenses related to profits, they are often tighter for firms with low profits than the TCRs. Therefore, compared to TCRs, substitution between internal and external debt may not play such a big role in the case of IBs. Gresik et al. (2017) show theoretically that from a welfare perspective TCRs are under certain assumptions inferior to IBs.[6] They also discuss about the use of IBs emerging because of the perception that TCRs are inefficient. The effects of IBs have previously been studied in a German context.[7] Buslei and Simmler (2012), Dressler and Scheuering (2012) and Alberternst and Sureth-Sloane (2016) study the impacts of the introduction of an interest barrier (IB) that constituted an upper bound for the deductibility of debt expenses in Germany from 2008 onwards.[8] Buslei and Simmler (2012) show that firms responded to the IB by decreasing their debt-equity ratio or by splitting their assets to avoid the exemption limit, and the IB increased the tax base for firms that did not respond. Dressler and Scheuering (2012) find that firms reacted to the reform by reducing their debt-to-asset ratio and net interest payments. They also find unintended effects that are contrary to the purpose of the IB as domestic companies also reduced their debt-to-asset ratios. Furthermore, companies mostly reduced their external, not internal, debt. Alberternst and Sureth-Sloane (2016) find that affected companies reduced their leverage by as much as 4.7 percentage points more than non-affected companies.

Our study also contributes to the broader question of the relationship between taxes and the financing structure of companies. It has been found that a higher marginal tax rate is associated with a higher debt ratio (MacKieMason 1990, Givoly et al. 1992, Graham 1996, Sarkar and Zapatero 2003 and Stöckl and Winner 2013). However, some studies have also found evidence of a negative relationship between the marginal tax rate and the debt ratio (Barclay and Smith 1995, Ayers et al.

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via debt-shifting, but also via increasing systemic risk by increasing riskiness and therefore the probabilities of company bankruptcies. The welfare impacts of debt-equity tax bias may be large, perhaps more than 0.25% of GDP (see de Mooij 2011 and Fatica et al. 2012). Another way to tackle the problem of systemic risk is by decreasing tax rates, as these are observed to reduce the leverage of companies (see e.g. Miniaci et al. 2014 and Dwenger and Steiner 2014).

[6]They use the term earnings stripping rule instead of IB and the safe harbor rule to denote a deductibility restriction that is related to the limit for debt-equity ratio.

[7]A review of empirical evidence of German TCRs and IBs is provided by Ruf and Schindler (2015).

[8]In this reform Germany replaced its TCR by IB. Under the new rules net interest expenses are always fully deductible only if these do not exceed both 30% of EBITDA and €3M. Otherwise deductibility is restricted, unless at least one of the conditions called "escape clauses" holds. Figure 1 in Dressler and Scheuering (2012) provides an illustrative description of how the escape clauses work. For example, the deductibility of interest expenses is not restricted if the company's equity ratio does not exceed the equity ratio of the whole group. This restriction is independent of the creditor. (Buslei and Simmler 2012)

2001 and Huang and Ritter 2009). Buettner et al. (2009) investigate the effects of company taxation and capital market conditions on the financial structure of MNE's foreign affiliates and find that a higher local tax rate is positively associated with internal debt. Buettner et al. (2011) find that local tax rates have a positive effect on both internal and external debt. Feld et al. (2013) provide a meta-analysis of capital structure choices and company taxation.

3　The Finnish Reform

Interest expenses related to business income were largely deductible in Finland until 2013. The Finnish reform of 2014 constitutes a restriction on the deductibility of net interest expenses relative to the adjusted taxable result of business income, i.e. the taxable profits adjusted for tax purposes.[9] However, even if the reform was introduced for 2014 the MNEs may anticipate it already before. The government proposal (146/2012) announced the forthcoming reform in November 2012 and therefore there may occur a response already from that year on.

The provision applies to Finnish companies and partnerships and to foreign companies permanently established in Finland. It is applied at the level of individual companies and concerns only the interest expenses of intra-group loans and loans between related parties.[10]

The law aims to limit the scope for intra-company debt-shifting.[11] The government proposal (185/2013) estimated that the reform would lead to increase in corporate tax revenue of about 2%.[12]

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[9]In line with the objectives of the BEPS project, Finland introduced an interest barrier to protect its tax base in the beginning of 2014. The restriction was introduced in 2013, but due to a one-year transition period it was applied for the first time in 2014. The interest deduction limitation is part of the Business Income Tax Act (§ 18 a). Even though interest expenses have been largely deductible, in some special cases such as in the presence of tax evasion (see the Act on Assessment Procedure 18.12.1995/1558; § 28) or transfer pricing (see the Act on Assessment Procedure 18.12.1995/1558; § 31), the deductibility of interest expenses may already have been restricted before 2014.

[10]The related party definition used in provision § 18 a in the Business Income Tax Act is connected to the actual control (based e.g. on share ownership, voting power) defined in the Act on Assessment Procedure (18.12.1995/1558, § 31 Transfer pricing adjustment).

[11]The details and the underlying reasons are given in the Business Income Tax Act (24.6.1968: § 18 a; 28.12.983; 30.12.2013) and in Government proposals 146/2012 and 185/2013. The Government proposal (146/2012) also suggests that the Tax Administration should monitor the effects of the introduction of the interest deduction restrictions. The finance committee memorandum (31/2012) and the parliament reply (156/2012) state that the Ministry of Finance and the Tax Administration should monitor the effects of the tax changes on the finance structures of companies and on changes in interest expense deductions and examine potential new tax planning issues arising.

[12]The corporate income is budgeted to bring in a total of €3.861 billion in tax revenue in 2014 (Budget Proposal 2014). The interest deductibility restriction is calculated to increase tax revenue

Figure 1 illustrates the somewhat complicated structure of the Finnish interest barrier by employing five questions (Q1-Q5). If the answers to the first four questions are positive, the deductibility restriction is applied. The first question (Q1) asks whether the interest expenses exceed the interest income of the firm. As long as interest expenses do not exceed interest income, all interest expenses are deductible. If interest expenses do exceed interest income, net interest expenses are still fully deductible as long as they do not exceed €500,000 (Q2).

If net interest expenses exceed the limit of €500,000, net interest expenses are still deductible if they are at most 25% of the adjusted taxable result of business income[13] (Q3).

Even if all the answers to Q1-Q3 are positive, interest expenses are still fully deductible as long as the equity ratio of the consolidated group does not exceed the equity ratio of the company (Q4; escape clause 1). If this is not the case, the deductibility of interest expenses will be restricted by the new provision.

Question Q5 considers the amount of net interest expenses that are not deductible. Non-deductibility is restricted to the amount of net interest expenses arising from the related parties. More specifically, all net interest expenses exceeding 25% of the adjusted taxable result of business income will be non-deductible as long as they do not exceed the net intra-group interest expenses of the debt parties. If they exceed net intra-group interest expenses, the exceeding part will remain deductible.
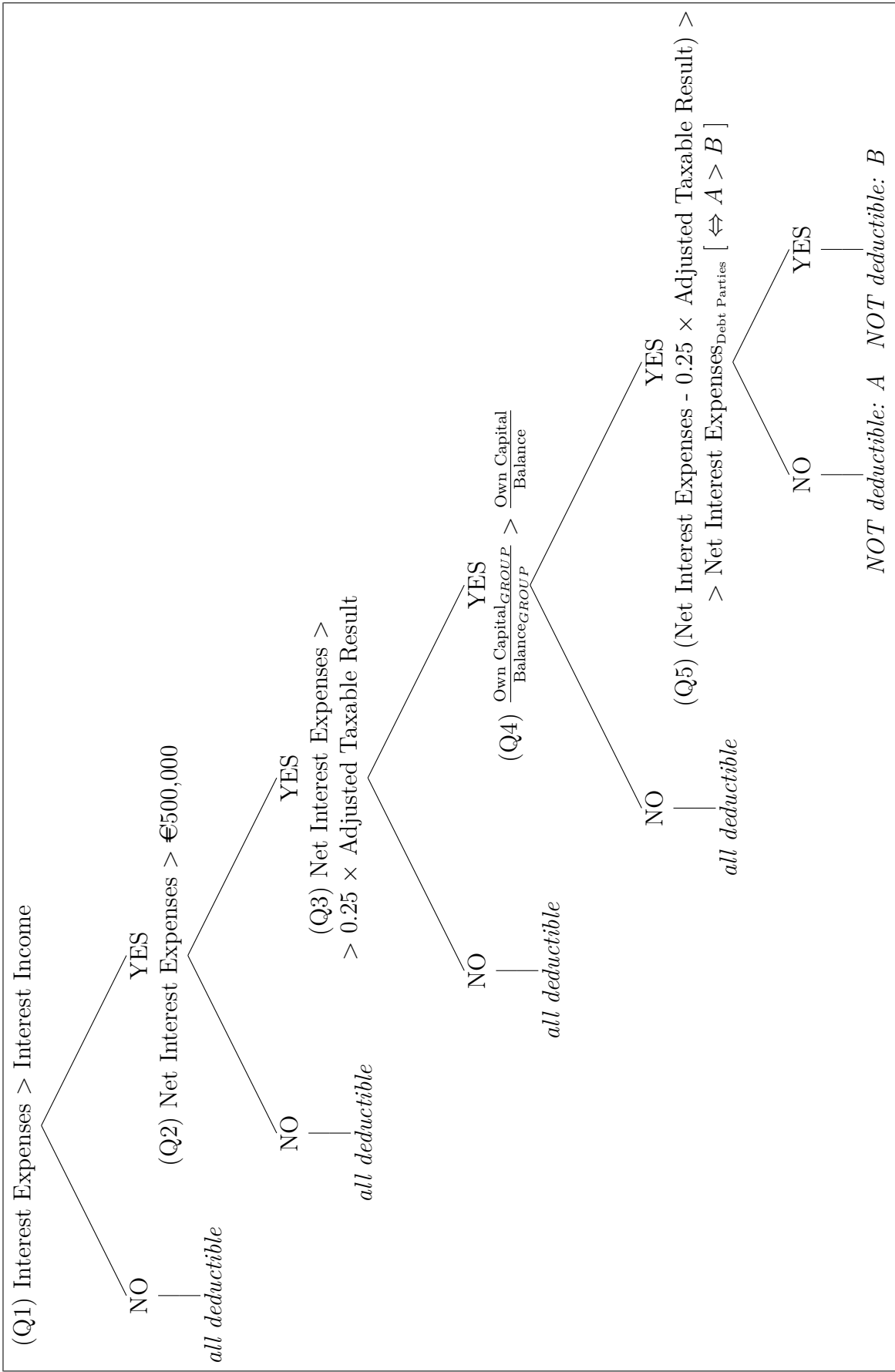
In addition to the equity ratio rule explained above, the provision also includes a second escape clause (escape clause 2; not shown in figure) which states that the restriction is not applied to credit institutions, insurance companies, pension institutions and in some cases to their consolidated corporations. The provision also states that non-deductible interest may be carried forward and may therefore be deducted in future years.[14]

Let us next illustrate the changes in the incentives arising from the introduction of the Finnish IB. For now let us consider the case where neither of the two escape clauses are binding and the answer to Q5 is "NO". The upper graphs of Figure 2

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from corporate income taxes by €80M, which is roughly 2% of the total corporate income tax in the budget (Government proposals 146/2012 and 185/2013). The Finnish corporate tax rate has been 26% from 2005 to 2011, 24.5% form 2012 to 2013 and 20% from 2014 on.

[13]The adjusted taxable result of business income refers to a company's taxable profit plus interest expenses and depreciations deducted for tax purposes (EBITD). The Finnish group contribution (given is added and received is deducted) is also taken into account when calculating the adjusted taxable result. Technically the adjusted taxable result is calculated here by adding amortizations to and subtracting net group subsidies from EBITDA (Earnings Before Interest Taxes Depreciation and Amortization).

[14]The ability of a company to benefit from non-deductible interest carried forward depends on whether the company makes profits in the future.

Figure 1: The structure of the Finnish IB

(Q1) Interest Expenses > Interest Income

NO — *all deductible*

YES — (Q2) Net Interest Expenses > €500,000

NO — *all deductible*

YES — (Q3) Net Interest Expenses > 0.25 × Adjusted Taxable Result

NO — *all deductible*

YES — (Q4) $\frac{\text{Own Capital}_{GROUP}}{\text{Balance}_{GROUP}} > \frac{\text{Own Capital}}{\text{Balance}}$

NO — *all deductible*

YES — (Q5) (Net Interest Expenses - 0.25 × Adjusted Taxable Result) > Net Interest Expenses$_{\text{Debt Parties}}$ [$\Leftrightarrow A > B$]

NO — *all deductible*

YES — *NOT deductible: A   NOT deductible: B*

NOT deductible$_{DebtParties}$

A = Net Interest Expenses - 0.25 × Adjusted Taxable Result; B = Net Interest Expenses$_{DebtParties}$

BEFORE

NET INTEREST EXPENSES (1000 euro)

net interest expenses = adj. taxable result

100% of adj. taxable result deductible

100% of net INTEREST EXPENSES deductible

ADJUSTED TAXABLE RESULT (1000 euro)

AFTER

NET INTEREST EXPENSES (1000 euro)

net interest expenses = adj. taxable result

25% of adj. taxable result deductible

25% of adj. taxable result deductible

net interest expenses = 0.25 * adj. taxable result

100% of adj. taxable result deductible

100% of net INTEREST EXPENSES deductible

C■   B■   A■

ADJUSTED TAXABLE RESULT (1000 euro)

REDUCTION IN DEDUCTIBILITY

NET INTEREST EXPENSES (1000 euro)

75%   50%–75%   25%–50%   0%–25%

NO CHANGE

ADJUSTED TAXABLE RESULT (1000 euro)

INCENTIVES FOR ADDITIONAL DEBT

NET INTEREST EXPENSES (1000 euro)

25% of adj. taxable result deductible

25% of adj. taxable result deductible

100% of adj. taxable result deductible

100% of net INTEREST EXPENSES deductible

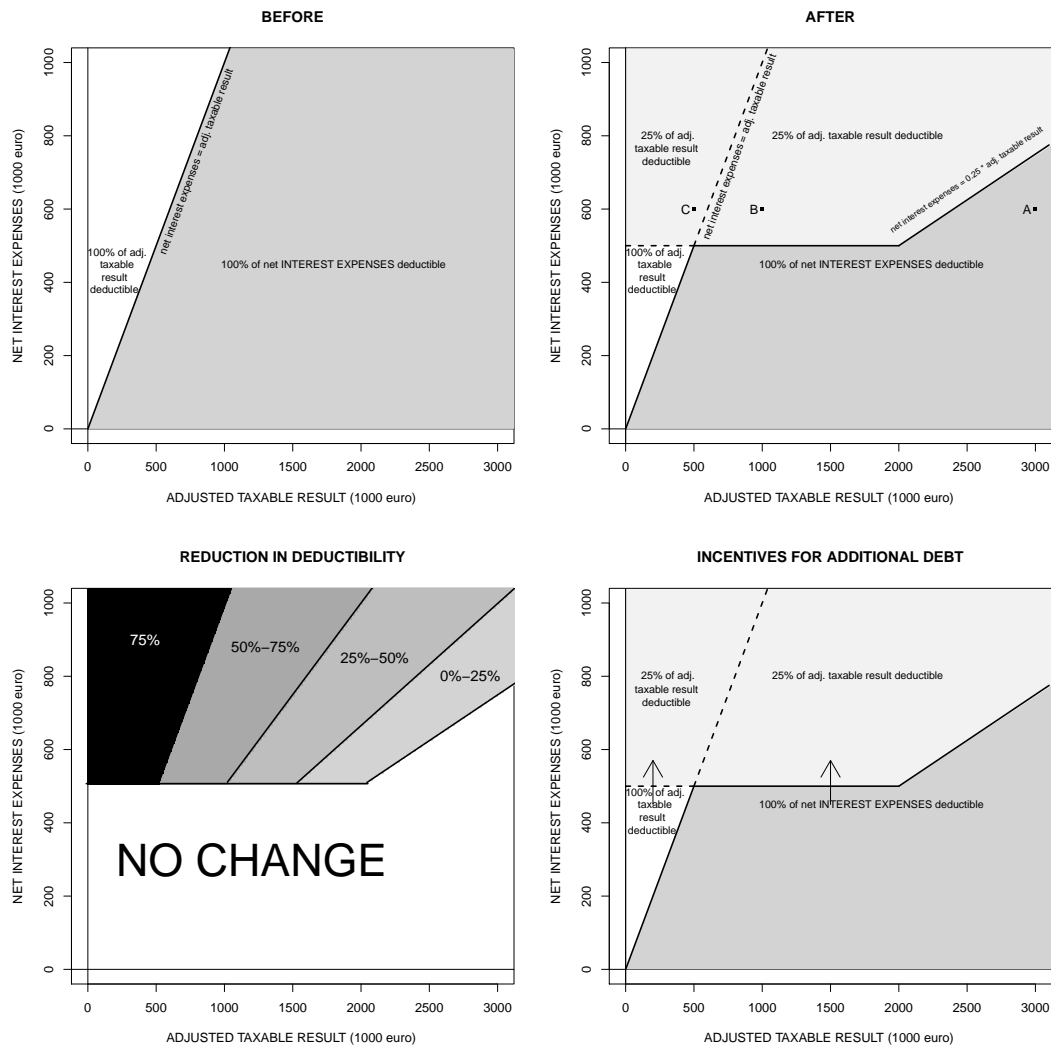ADJUSTED TAXABLE RESULT (1000 euro)

Figure 2: Before and after the reform incentives

describe this case before and after the reform. Before the reform (upper left graph of Figure 2), there are two cases. First, net interest expenses are fully deductible in cases where the adjusted taxable result exceeds net interest expenses (shaded area). The tax benefit of a firm increases as deductible interest expenses lower taxable corporate income and thus also decrease the corporate tax burden. Second, in cases where net interest expenses exceed the adjusted taxable result, all of the adjusted taxable result can be deducted. These cases result in zero taxation for the company and the amount of the benefit is the corporate tax rate times the adjusted taxable result.

The upper right-hand graph illustrates the deductibility of interest expenses after the reform. The tax treatment of companies whose net interest expenses are at most €500,000 remains unaffected. For these companies the amount of the deduction is the minimum of the adjusted taxable result and net interest expenses. The implications

of the reform for companies whose net interest expenses exceed €500,000 depend on the relative magnitudes of the net interest expenses and the adjusted taxable result. In some cases the reform has an effect on company interest deductibility, whereas in others there are no changes. For a company with net interest expenses over €500,000, but still in the dark gray shaded area (e.g. a company with an adjusted taxable result of €3M and net interest expenses of €600,000; point A in the graph), the reform does not change the deductibility, because its net interest expenses do not exceed one quarter of the adjusted taxable result. For a company with an adjusted taxable result of €1M and net interest expenses of €600,000 (point B), the reform decreases the deduction by more than one half (from pre-reform €600,000 to post-reform €250,000). Companies with little income and net interest payments above €500,000 are affected the most. For instance, a company with an adjusted taxable result of €500,000 and net interest expenses of €600,000 (point C) is allowed to deduct only €125,000 after the reform, which is only a quarter of what it was before the reform (€500,000).

The lower left-hand graph of Figure 2 illustrates the magnitudes of the reductions in the deductibility of interest expenses. For a company with net interest expenses less than €500,000 or less than 25% of its adjusted taxable result, there are no changes in the deductibility (white area). For companies in the light gray area, the interest deduction is reduced, but by less than 25%. For the gray area the reduction is at least 25%, but less than 50%. For the dark gray area, the reduction is between 50% and 75%. The biggest reduction is 75% (black area). The pattern is clear: of those companies that face a reduction in their deductibility at all, the reduction is typically higher the smaller the adjusted taxable result is. Thus the IB affects most those companies with relatively little profits, but a lot of net interest expenses.[15]

The lower right-hand graph illustrates cases where a company considers increasing its net interest expenses by a small amount. It shows that companies with low profits have the sharpest incentives not to increase their debt level. Consider a company with net interest expenses of €500,000 and an adjusted taxable result of €500,000, whose net interest expenses are fully deductible. Suppose next what happens when it borrows an additional €1 after the reform. Because net interest expenses exceed €500,000, the maximum amount that can be deducted is only 1/4 of the adjusted taxable result, resulting in a deduction of €125,000 (€375,000 less than without the additional loan of €1). With a 20% corporate income tax rate, the change corresponds to the marginal cost of the additional €1 loan being €75,000 (which is 7.5 million per cent of the additional loan). Thus, in some cases the interest deductibility restriction provides a very sharp incentive for companies to change

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[15]We study the effects also with respect to the intensity of the treatment in Section 6.1.

their behavior in response to the reform.

4   Theoretical predictions

In the following simple theoretical framework we assume that MNEs maximize their joint group level net-of-tax profits. In the absence of interest deductibility restrictions the MNE may choose to use debt-shifting to achieve its objective. This may be done by changing either the internal debt level or the corresponding interest rate, or both. Below we first consider a case where there are no restrictions on interest deductibility. Following this case we consider the changes in MNE incentives arising when the government introduces a restriction on the deductibility of interest expenses.

Let us consider two companies that belong to the same MNE, but are located in two different countries. A domestic company h (e.g. parent) is located in a high-tax country H and a foreign company l (subsidiary) is located in a low-tax country L. The corporate tax rate of country H exceeds that of country L ($\tau_H > \tau_L$). Equation (1) gives the net-of-tax profits (Π_{DS}) in a case where all interest expenses are fully deductible and company l issues a loan of size D with an interest rate r to company h.

$$
\begin{aligned}
\Pi_{DS} = (\pi_H - T_H) + (\pi_L - T_L) &= \pi_H - \tau_H(\pi_H - rD) + \pi_L - \tau_L(\pi_L + rD) = \\
&= (1 - \tau_H)\,\pi_H + \tau_H rD + (1 - \tau_L)\,\pi_L - \tau_L rD = \\
&= (1 - \tau_H)\,\pi_H + (1 - \tau_L)\,\pi_L + (\tau_H - \tau_L)rD = \Pi_{noDS} + (\tau_H - \tau_L)\,rD
\end{aligned}
\tag{1}
$$

Company h deducts its interest expenses rD from its pre-tax profit π_H and company l receives rD in interest payments, which becomes subject to the corporate tax rate τ_L. T_H and T_L are the taxes paid in countries H and L respectively. Here the company has two ways to affect its interest expenses, by changing either the debt level D or its interest rate r (or both). However, independently of which of these two ways is used, the net-of-tax profits of the MNE become higher than without debt-shifting ($\Pi_{DS} > \Pi_{noDS}$).[16] Thus, if the interest expenses are fully deductible for corporate tax purposes in country H, the MNE may increase its net-of-tax profits by showing additional profits in country L. It should also be noted that internal debts are not only used for profit-shifting purposes but can be (and also typically are) used to finance investments and production. In such a case company profits π_H

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[16]In case the companies act independently, the net-of-tax profits of the MNE, Π, are

$$
\Pi = (1 - \tau_H)\,\pi_H + (1 - \tau_L)\,\pi_L := \Pi_{noDS}.
$$

and π_L could be functions of D. In any case, if debt-shifting is feasible, companies can increase their joint profit by increasing their interest expenses (rD).

Let us next consider what happens when the government introduces a restriction on the deductibility of interest expenses (IB) in country H. More specifically, let a fraction a $(0 \leq a < 1)$ of interest expenses rD be deductible for tax purposes. Note that the smaller the parameter a is the tighter the restriction is. In this case the MNE net-of-tax profit is

$$\begin{aligned} \Pi_{IB} = (\pi_H - T_H) + (\pi_L - T_L) &= \pi_H - \tau_H(\pi_H - arD) + \pi_L - \tau_L(\pi_L + rD) = \\ &= (1 - \tau_H)\,\pi_H + \tau_H arD + (1 - \tau_L)\,\pi_L - \tau_L rD = \\ &= (1 - \tau_H)\,\pi_H + (1 - \tau_L)\,\pi_L + (a\tau_H - \tau_L)rD = \Pi_{noDS} + (a\tau_H - \tau_L)\,rD \end{aligned}$$
(2)

A comparison of equations 1 and 2 shows that introducing an IB reduces the incentives for debt-shifting. Without an interest barrier a one-unit increase in interest expenses (rD) from the high-tax country to low-tax country increases the net-of-tax profits of the MNE by $\tau_H - \tau_L$. With an interest barrier the corresponding change in the net-of-tax profits following from one-unit debt-shifting is $a\tau_H - \tau_L$, which is always smaller than without an interest barrier ($a\tau_H - \tau_L < \tau_H - \tau_L$). It should be noted that there is no incentive to use debt-shifting if $\tau_L > a\tau_H$. Even when this is not the case, an interest barrier makes debt-shifting less lucrative from the MNE's point of view and is therefore likely to reduce such activity. Thus, according to our simple model the hypothesis regarding interest expenses is that they will decrease among companies that are affected by the IB. Let us formulate this as our first hypothesis:[17]

H1:   The financial expenses of affected companies decrease

As discussed above, financial expenses depend on the debt level D and the interest rate r. Therefore, the MNE may reduce its financial expenses by changing one of these components or alternatively partly reduce internal debt levels and interest rates. As there are restrictions on how high an interest rate can be, the debt response is also likely to occur. Our second testable hypothesis reads as follows:

H2:   The debt levels of affected companies decrease

Because short-term debts are more often used for everyday transactions, we consider that especially long-term debt levels will change. Our third and fourth hypothesis

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[17]We formulate this hypothesis for the financial expenses (instead of interest expenses), because these are what we see in our data and what we will test empirically in Section 6.

considers the reactions in long-term and short-term debt levels following the introduction of an interest barrier.

H3:   The long-term debt levels of affected companies decrease

H4:   The short-term debt levels of affected companies do not change

The interest barrier cuts the incentives for profit-shifting via debt-shifting by increasing its costs. However, the possibilities to employ other profit-shifting channels are mostly not changed. So affected companies may have an incentive to increase transfer pricing activities.[18] Empirically this would be seen in EBITDA.

H5:   Debt-shifting by affected companies is replaced by transfer pricing

As a by-product, the IB may also make internal funding for investment more costly and increase the cost of capital as the company has to find funding from third party at a higher price. This might lead to decreased investment and affect for instance the turnover of the company.[19] This is our last primary hypothesis.

H6:   Real output decreases among affected companies

In addition to our primary hypotheses (H1 - H6), the theoretical model also provides other predictions (H7 - H10). First, as long as treated companies do not replace debt-shifting completely by transfer pricing and other debt-shifting methods, both the profits and taxes paid by the companies should increase. The data do not have a measure for taxable profits but we can examine changes in the amount of annual taxes paid by firms (H7).

H7:   Taxes paid by affected companies increase

Further, changes should occur in other companies of affected MNEs. We expect the financial revenues and taxes paid by these companies to decrease (H8 - H9).

H8:   The financial revenues of non-affected companies in affected MNEs decrease

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[18]It is worth noting that the extent to which debt-shifting is replaced by transfer pricing is probably not one-to-one, but depends on different things. A key determinant is the pre-reform relative price of each of the profit-shifting channels for the company. If the company has exercised profit-shifting only via transfer pricing before the reform (because it is more lucrative for the company), it is not likely to change the behavior. However, those companies that have exercised debt-shifting before the reform are more likely to have been provided with the incentives to change their behavior, because of the increased price of this activity.

[19]We do agree that materialization of the turnover reductions following the reduced investments might take a longer time than the time span of our data. Therefore, observing no changes in the turnover does not provide exhaustive evidence on there not being any real responses.

H9:   The taxes of non-affected companies in affected MNEs decrease

Our model also shows that fraction*a* in equation 2, the fraction of interest expenses that is deductible after the reform, matters for the incentives. The smaller the parameter *a* for a given company, the more intensively the reform changes its incentives. This consideration lead to our final hypothesis (H10).

H10:   The intensity of the reform matters for company responses

5   Methods and data

5.1   Difference-in-Differences

We apply a standard difference-in-differences (DD) method to estimate the effects of the Finnish interest barrier on several behavioral margins of companies. The definitions and constructions of the treatment and control groups are discussed in the next subsection.

We estimate the following equation
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$$Log(Y_{it}) = \theta controls_{it} + \beta_1 treat_i + \beta_2 anticipation_t + \beta_3 after_t +$$
$$+\beta_4 treat_i * anticipation_t + \beta_5 treat_i * after_t + \eta_i + \varepsilon_{it}, \qquad (3)$$

where Y refers to the dependent variable of interest for firm i at time t. The dependent variables are all in a logarithmic form to deal with the skewed outcomes. The variable $treat_i$ is a dummy variable which indicates whether an observation belongs to the treatment group or not. It gets value one if the firm belongs to the treatment group and is zero otherwise. The variable $anticipation_t$ is a time dummy for the observation to be from years 2012 and 2013. The variable $after_t$ is a time dummy which gets value one if an observation comes from some year after 2014 and zero otherwise. In some specifications we also replace $anticipation_t$ and $after_t$ by year dummies to investigate the yearly responses. In the baseline analysis, $controls_{it}$ include the number of employees and sales in natural logarithmic form. η_i is a firm-specific constant term and ε_{it} is an i.i.d. error term.

The main interest lies in coefficients β_4 and β_5 (the coefficients for the interaction terms $treat_i * anticipation_t$ and $treat_i * after_t$). Each of these coefficients shows the impact of the introduction of the interest barrier on treated firms relative to the control group (average treatment effect for the treated, ATT), if the DD assumptions hold. The main assumption of the DD method is the *common time trend assumption*, which means that the variable of interest would behave similarly in the treatment

and control groups over time if the policy change had not been introduced.[20] In our baseline analysis, we use a firm fixed-effect strategy that allows for correlation between the firm component (η_i) and the regressors.

5.2 Defining the treatment and control groups

Our data come from the ORBIS database produced by Bureau van Dijk. The database provides data on firms' financial and productive factors from balance sheets and income statements as well as detailed information on firms' domestic and international ownership structure for companies across the world. [21] To study the effects of the Finnish interest barrier, we collected 113,687 observations on Finnish MNEs and their subsidiaries and 540,477 observations on Swedish and Danish MNEs and their subsidiaries between the years 2009 and 2015.[22] The interest deductibility has been restricted in Sweden and Denmark for this whole period. These restrictions have also remained largely unchanged in both countries, making their MNEs appropriate for our control group.[23]

We construct our treatment group from those companies that are likely to be affected by the reform. More specifically, a company belongs to the treatment group if it belongs to a Finnish MNE and its deductibility of interest expenses would have been affected by the Finnish IB in at least one year between 2009 and 2013. The control group is constructed according to the same criterion from the companies of Swedish and Danish MNEs. The construction of both the treatment group and

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[20]The method also requires that there is no self-selection to the groups and no differences in transitory shocks during the examination. Additionally, one has to assume that the error term is not correlated with the regressors and there is no perfect multicollinearity between regressors .

[21]The ORBIS database is discussed in more detail in Kalemli-Ozcan et al. (2015).

[22]The data include companies that have at least one foreign subsidiary. The corresponding numbers for years 2009-2013, which are employed in the derivation of the treatment and control groups, are 81,205 and 386,055 (see Table 1). Our data are collected between 10/2016-3/2017.

[23]Sweden introduced interest deduction rules for internal loans that were associated with internal acquisitions in 2009. In 2013 these rules were extended to apply to interest expenses on all debts within a specially defined group. Regarding our empirical results provided in the following section the tightening of the Swedish interest limitation rule implies that our estimates become the lower bounds for the effect. The Danish interest deductibility limitation is composed of three sets of rules: thin-capitalization rules, the interest ceiling rule and the EBIT rule. The thin-capitalization rule works to disallow gross interest costs and capital losses on related company debt to the extent the overall debt-to-equity ratio exceeds a given ratio (safe harbor). In relation to financing costs that remain after the thin-capitalization limitation, there is an interest ceiling rule that limits the deductibility further by introducing an upper bound via fixed relation to the company assets. The EBIT rule, which is applied after the thin-capitalization rule and the interest ceiling rule, limits the tax deductibility of net financing costs and is determined via fixed relation to EBIT. The last of the three rules was introduced in 2007. Therefore, the interest deductibility restrictions have been remained largely unchanged in Sweden and Denmark between 2009 and 2015. Note also that we use other control groups than Swedish and Danish MNEs to study the robustness of our results in Section 6.2.

Table 1: Construction of treatment and control groups

FINNISH MNEs (obs. 2009-2013)	**Obs. exceeding €500,000 & 25% of adj.tax.result**	**Esc. clause 1 (equity) binding**	**Esc. clause 2 (industry) binding**	**Neither of esc. clauses binding**	**Number of companies**
All (81,205)	2,289 (948 comp.) (2.8%)	809 (35.3%)	428 (18.7%)	1,164 (50.9%)	520 (54.9%)
Ultimate Parent (9,875)	376 (156 comp.) (3.8%)	298 (79.3%)	49 (13.0%)	59 (15.7%)	25 (16.0%)
Subsidiary (71,330)	1,913 (792 comp.) (2.7%)	511 (26.7%)	379 (19.8%)	1,105 (57.8%)	495 (62.5%)
SE and DE MNEs (obs. 2009-2013)	**Obs. exceeding €500,000 & 25% of adj.tax.result**	**Esc. clause 1 (equity) binding**	**Esc. clause 2 (industry) binding**	**Neither of esc. clauses binding**	**Number of companies**
All (386,055)	5,657 (2,407 comp.) (1.5%)	1,772 (31.3%)	1,539 (27.2%)	2,715 (48.0%)	1,205 (50.0%)
Ultimate Parent (49,105)	807 (353 comp.) (1.6%)	676 (83.8%)	210 (26.0%)	63 (7.8%)	30 (8.5%)
Subsidiary (336,950)	4,850 (2,054 comp.) (1.4%)	1,096 (22.6%)	1,329 (27.4%)	2,652 (54.7%)	1,175 (57.2%)

Table 2: Descriptive statistics in log euros, Treatment and control groups 2009-2011

	Turnover	Employees	Total Assets	Debt Overall	Debt Long-Term	Debt Short-Term	Financial Expenses	Ebitda	Corporate taxes
Treatment (N=1,214)									
mean	17.213	4.135	17.957	18.417	17.267	16.384	15.274	14.225	12.092
median	17.545	4.875	17.811	18.288	17.382	16.415	15.285	14.171	12.466
sd	2.418	2.604	1.619	1.579	1.927	2.264	1.856	1.856	2.731
Control (N=2,753)									
mean	16.771	3.437	17.910	18.386	17.190	16.341	15.166	14.130	12.834
median	17.194	3.932	17.694	18.176	17.283	16.547	15.054	13.980	13.005
sd	2.544	2.615	1.498	1.488	1.899	2.538	1.655	1.852	2.363

the control group is illustrated in Table 1. The upper panel of the table describes it for companies that belong to Finnish MNEs (treatment group) and the lower panel for companies in Swedish and Danish MNEs (control group). Let us consider the upper panel. It shows that only relatively few (2.8%) of all the observations from Finnish MNEs exceed both the euro and the profit limits.[24] Due to the escape clauses (equity ratio, industry), not all of these observations would have been affected by the reform.[25] For 1,164 observations, neither of the escape clauses is binding, yet both the euro limit and the profit-related limit are exceeded. These are the observations that would have faced different tax treatment due to the reform.[26] These observations come from 520 companies that belong to Finnish MNEs. As our treatment group includes those companies that would have been affected by the reform at least once in years 2009-2013 (had the reform been in place), these 520 companies are our treatment group. Of these 520 companies, 25 are ultimate parents and the rest have subsidiary status. The control group is constructed in exactly the same way as the treatment group.[27]

The descriptive statistics for the treatment and control groups are provided for years 2009-2011 in Table 2. According to the table, Finnish firms that were affected by the reform (treatment) are larger in terms of annual turnover and employees than the firms in the control group. Regarding debt levels we would like to observe the internal debts, but unfortunately we can only see the sum of internal and external debts. Similarly, regarding financial expenses we cannot distinguish those arising due to internal debts from the ones arising due to external debts. According to the table there are no large differences in these variables between treatment and control groups. The same holds for EBITDA. However, it seems that the firms in

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[24]If neither of the escape clauses is binding, there would have been a change in deductibility for those observations whose net interest expenses exceed both €500,000 and 25% of adjusted profits. There are 2,289 observations for Finnish MNEs in our data that exceed both of these limits in the pre-reform period from 2009 to 2013 (2289 / 81205 = 2.8%). Note that here we do not take into account the carry-forward property of the deductions. Note also that because a lot of observations, especially on amortizations and net group support (variable Extr. and Other P/L), are missing (although these are more likely to be really zeros than missing) and we do not want to compress the number of observations, we have replaced the missing values by zeros here when considering the treatment group.

[25]The first escape clause compares the equity ratio of the company to the corresponding ratio for the whole group. The ratio is calculated as follows: Ratio = (Total Asset - Debt)/Total Asset.

[26]Here it is also worth noting that the restriction stands for net interest expenses between companies with interconnections (MNEs). Our data allow us to observe only the overall net interest expenses.

[27]The control group consists of companies of Swedish and Danish MNEs that would have been affected by the Finnish reform at least once between 2009 and 2013 had the reform been applied to them. According to the lower panel of Table 1, there are 5,657 observations that exceed both the euro limit and the profit limit. For 2,715 (48.0%) of these observations neither of the escape clauses is binding. These observations come from 1,205 companies of Swedish and Danish MNEs. Of these 30 are ultimate parents and the rest have subsidiary status.

the treatment groups pay substantially less corporate taxes than the control group.

5.3   Descriptive analysis

In this section we depict time series of central variables for firms in the treatment and control groups. The aim is twofold. First, we want to show that the common time trend assumption holds as the variables show similar pre-reform trends in both the treatment and control groups. Second, examining a time series visually gives us descriptive evidence on the effects following the announcement and the implementation of the reform.

Figure 3 depicts the time trends of the natural logarithm of financial expenses, overall debt, long-term debt, short-term debt, EBITDA and annual turnover for treatment and control group observations. In the upper panel of each graph we show the development of a given variable separately for the two groups. In the lower panel we show the *development of the difference* between the groups. 95% confidence intervals are depicted in both panels. The annual *differences* are calculated from coefficients of year indicators in a firm fixed-effect regression where the dependent variable is the corresponding time series variable. It seems that all the selected variables develop rather similarly over time in both groups. Debt levels in particular show almost identical pre-reform time trends.

The trends in financial expenses and long-term debt levels differ between the treatment and control groups after the policy is introduced as the values for the treatment group decrease compared to the control group.[28] The time trend for short-term debt does not show as clear a time trend as that for long-term debt. EBITDA and turnover also show rather similar pre-reform time trends. To conclude, the pre-reform trends among companies of Finnish MNEs and those of other Nordic MNEs are quite similar. However, as can be seen from the depicted confidence intervals, the standard errors are large. This is understandable as the Finnish interest barrier affects rather large firms and thus the number of observation is relatively small.

We are also able to use an alternative control group that consist of companies of Finnish MNEs that were not affected by the reform. More specifically, we use

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[28]Note that there is no difference between treatment and control groups in financial expenses in 2015. We observe from the data that the financial expenses of Swedish MNEs especially decrease compared to Finnish MNEs in 2015. The behavior of Swedish MNEs is likely to be a response to conflicting interpretations of interest deductibility rules between Swedish Tax Agency and MNEs. This induced several appeals to the Administrative Court as the Swedish Tax Agency denied large amounts of interest deductibility of MNEs in 2015 (see, e.g. PwC 2016 and Bloomberg 2017). One potential reason for different interpretations arises from the question about whether the Swedish interest deduction limitation rules were contrary to EC law. This has also produced an intense debate of the applicability of the restrictions on interest deductibility in Sweden (see, e.g. EY 2014).
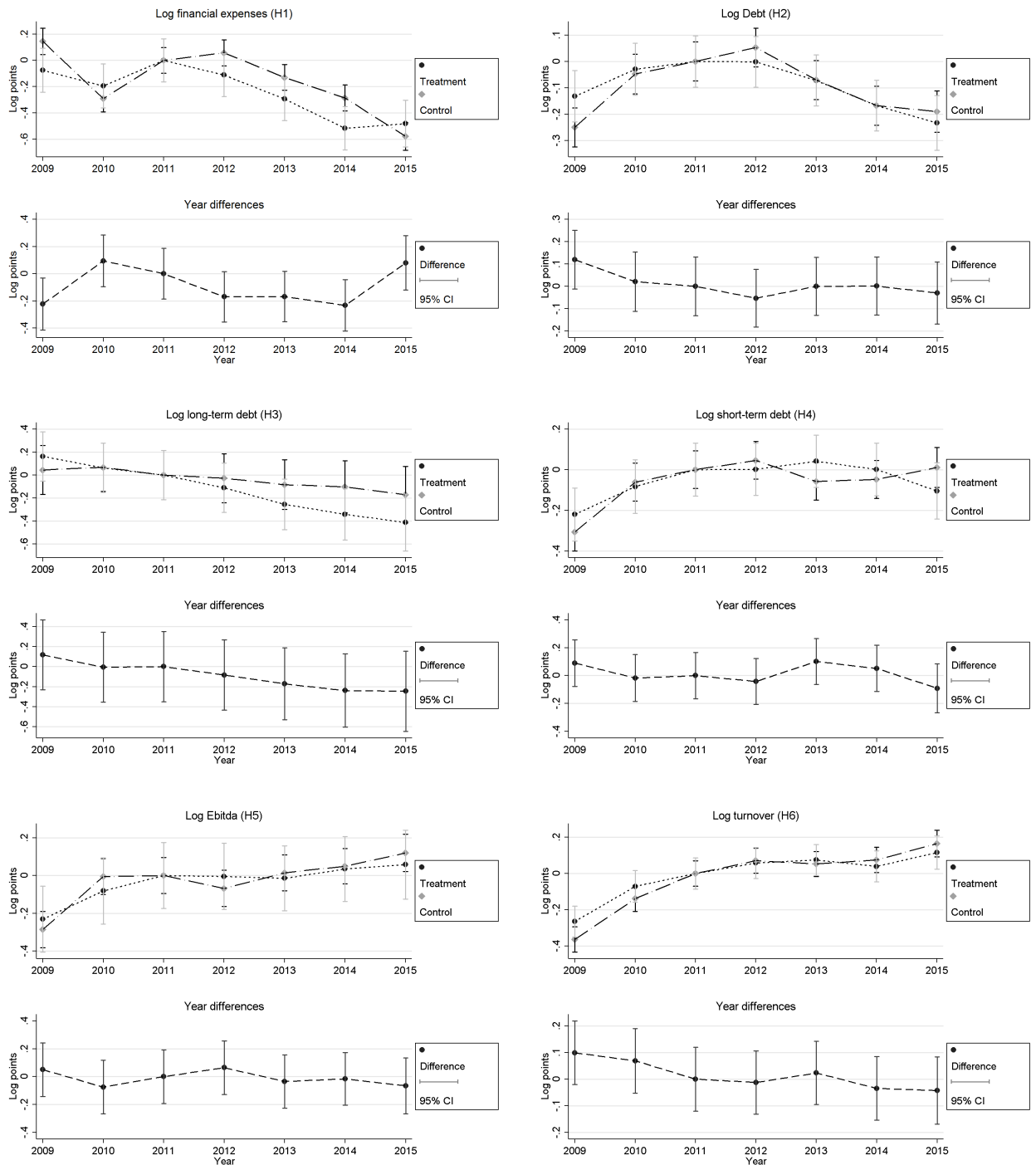
Figure 3: Development of logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA and turnover of companies of Finnish MNEs (Treatment) and of Swedish and Danish MNEs (Control)

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all companies of Finnish MNEs that had net interest expenses less than 25% of the adjusted taxable result of business income and less than 500,000 euros of net interest expenses prior to the reform as an alternative comparison group. Figure 4 shows the development of financial expenses and long-term debts for the treatment group and the alternative control group (Control 2). The main message from the Figure is very similar to the baseline comparison presented in Figure 3: the pre-reform trends follow each other very closely and the trends start to diverge for both outcomes from 2012 onwards.[29] This offers us an opportunity to use alternative control group to study the effects of the introduction of an IB in Finland and also gives us further evidence that the reform clearly affected the behavior of treated MNEs. In Section 6.2 we also estimate the effects of the reform on all our main hypotheses (H1-H7) using this alternative control group and show that the results are very well in line with our baseline results.
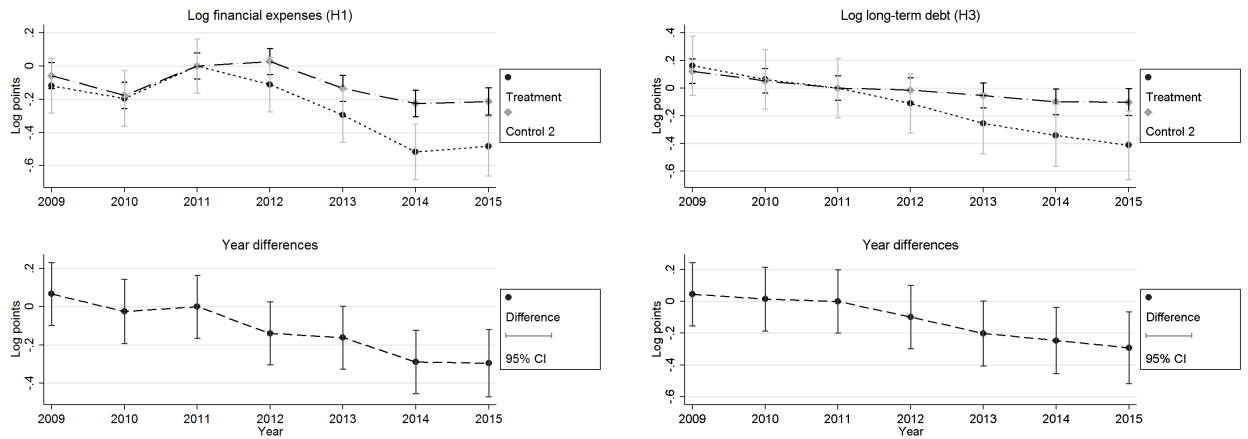

Figure 4: Development of logs of financial expenses and long-term debt of companies of Finnish MNEs (Treatment) and alternative control group of companies of Finnish MNEs that were not affected by the reform (Control 2)

6   Results

This section presents our econometric results. Section 6.1 first presents our main results and then studies the effects in more detail by studying whether the results differ by the intensity of the treatment (IB). Section 6.2 provides robustness checks for our results.

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[29]In Figure 5 in the Appendix we also present the development of overall debt, short-term debt, EBITDA and annual turnover over time to show that the pre-trends are very similar also in these variables across the groups.

6.1 Main Results

Table 3 shows the estimation results obtained by fitting the DD model described in Section 5 to a full sample of firms where parent companies and subsidiaries are pooled together. Each column presents results for a model with a different dependent variable, each of these being in logarithmic form. According to the first hypothesis, H1, financial expenses are predicted to decrease among treated companies after the interest barrier is introduced. The first column in the table tests this hypothesis. The regression considers two DD estimates (DD 1 and DD 2).[30] The first of these stands for the anticipation effect (2012-2013), which took place immediately after the law was announced, but before it was applied. The DD coefficient for the anticipation effect is negative (-0.302) and highly statistically significant and shows that there is a response to the interest barrier already before 2014 when it was first applied. This is likely to arise due to MNEs starting to change their behavior towards the long-run optimum right after the reform was announced, instead of waiting an additional year or two. An underlying issue might thus relate to debt decisions inside the MNEs being made in discrete intervals, instead of being updated in short time periods. Fama and Fresch (2002) also observe that MNEs adjust their debts slowly.

The effect of the interest barrier on financial expenses is very similar for the years after the law came into force (2014-2015). Following the introduction of the interest barrier the financial expenses of the companies belonging to Finnish MNEs decreased by roughly a quarter compared to the control group. The results, which are in line with our hypothesis H1, are also observed in Figure 3. The reduction in financial expenses might arise from changes in debt levels (D), their interest rates (r) or in financial expenses other than interest expenses. As interest rates and other financial expenses are unobserved, we next study debt levels.

The following three columns in Table 3 stand for the DD results for overall debt levels, long-term debt levels and short-term debt levels, respectively. For none of the debt levels do we find statistically significant changes. The results suggest that factors other than debt levels might play a role in the decreases in financial expenses. One way for MNEs is to affect the interest rates of within-group loans that would mechanically decrease financial expenses, but won't affect the debt levels. Regarding the results for debt it is also worth noting the large standard errors in the results regarding long-term debt, which follow from the large number of missing observations in this variable.

Table 3 considers also other than directly debt-related responses to the interest barrier. The following two columns in the table stand for the DD results for EBITDA

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[30]Because we employ a fixed-effects model, there is no separate constant for the treatment variable.

Table 3: Econometric results for all firms

VARIABLE (logs)	(H1) Financial Expenses	(H2) Overall Debt	(H3) Long-Term Debt	(H4) Short-Term Debt	(H5) EBITDA	(H6) Turnover	(H7) Corporate taxes
Anticipation (2012-13)	0.198***	0.086**	-0.090	0.111***	0.063*	0.221***	-0.183***
	(0.045)	(0.037)	(0.129)	(0.038)	(0.035)	(0.030)	(0.068)
After (2014-15)	-0.180***	-0.083*	-0.165	0.093**	0.171***	0.273***	-0.297***
	(0.067)	(0.047)	(0.108)	(0.047)	(0.044)	(0.046)	(0.092)
Anticip. x Treatment (DD1)	-0.302***	-0.071	-0.156	0.007	0.016	-0.048	0.227
	(0.078)	(0.062)	(0.147)	(0.066)	(0.068)	(0.045)	(0.138)
After x Treatment (DD2)	-0.227**	-0.056	-0.272	-0.034	-0.037	-0.093	0.149
	(0.112)	(0.073)	(0.170)	(0.074)	(0.082)	(0.064)	(0.149)
Employees	0.099***	0.124***	0.056*	0.140***	0.062***	0.127***	0.041*
	(0.018)	(0.014)	(0.032)	(0.015)	(0.019)	(0.014)	(0.022)
Constant	13.875***	17.952***	16.353***	16.573***	14.955***	16.443***	12.468***
	(0.063)	(0.049)	(0.120)	(0.054)	(0.076)	(0.056)	(0.092)
Observations	10,256	10,685	4,145	10,620	5,228	9,325	5,443
R-squared	0.028	0.033	0.010	0.022	0.013	0.059	0.007
# of firms	1,719	1,725	988	1,724	1,123	1,602	1,453

Note: Dependent variables are logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA, turnover and corporate taxes. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Clustered firm-group-level standard errors in parenthesis. The results are obtained estimating equation (3) for each outcome.

and turnover. As the interest barrier makes debt-shifting less attractive, firms might resort increasingly to transfer pricing to shift profits. If there were such a change in profit-shifting, which would change it from debt-shifting towards transfer pricing, we should observe this by considering the changes in EBITDA. However, according to the results no such change happened. Therefore, our results do not support the hypothesis that firms reacted to the interest barrier by resorting increasingly to transfer pricing as a means of shifting profits. Of course, the firms may have also other means to affect their tax liabilities. These include decisions concerning location of offices and intellectual property, group structure and use of holding companies. The changes in EBITDA could track also other than transfer pricing margins, but detailed information on changes in the group structure and internal transactions of MNEs would be needed to observe whether companies react to the IB by increasing the use of other methods. To our best knowledge, no such data is available.

In addition to profit-shifting responses, the interest barrier might have real responses. An indication of such responses might be observed in turnover. However, the results for turnover do not support the existence of real responses, as all the DD estimates remain statistically insignificant in the second last column.

A potential caveat is that the real responses could materialize over longer time period. However, our results show that treated firms responded to the IB already before the reform, but their turnover did not change, suggesting no real responses within observed 4 years since the IB was first discussed.

We can further investigate this by studying whether or not the interest barrier affected the amount of corporate taxes reported to Finland by Finnish MNEs (H7). If the reform affected the profit-shifting margin only, we should observe an increase in the level of corporate taxes among treated firms after the reform. The last column of Table 3 shows the results. It seems that the DD point estimates are positive which would suggest an increase in the amount of taxes as in our hypothesis, but these estimates are clearly not statistically significant. On one hand, the reduction in the corporate tax rate in 2014 suggests that the point estimate would be a lower bound and may therefore become statistically non-significant. On the other hand, the tax rate reduction might reduce incentive for debt-shifting. Therefore, we cannot provide firm evidence that the interest barrier succeeded in reducing all the profit-shifting channels of Finnish MNEs. However, the positive DD estimates for corporate taxes together with DD estimates for EBITDA very close to zero suggest behavior in line with the original goals of the reform.

As the amount of financial expenses decreases among treated MNEs, the amount of financial revenues should also symmetrically decrease among other subsidiaries of MNEs that are part of treated MNEs (compared to the control group) if intra-MNE

Table 4: Results for other subsidiaries in treated MNEs

VARIABLE (logs)	(H8) Financial Revenue	(H9) Corporate Taxes
Anticipation (2012-13)	-0.113**	0.052
	(0.057)	(0.034)
After (2014-15)	-0.295***	0.154***
	(0.071)	(0.047)
Anticip. x Treatment (DD1)	-0.268***	-0.111
	(0.099)	(0.071)
After x Treatment (DD2)	-0.306**	-0.125
	(0.129)	(0.099)
Employees	0.044***	0.019*
	(0.015)	(0.010)
Constant	10.218***	11.579***
	(0.042)	(0.026)
Observations	11,721	10,806
R-squared	0.012	0.004
# of firms	2,474	2,560

Note: Dependent variables are logs of financial revenue and corporate taxes. The results are obtained estimating equation (3) for both outcomes. Clustered firm-group-level standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

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tax avoidance by debt-shifting was blocked by the Finnish reform (H8). By other subsidiaries we mean firms that belong to the treated MNEs but are not located in Finland. To offer credible estimates we use firms that belong to the control MNEs but that are not located in Denmark or Sweden as a comparison group. The decrease in financial revenue would also imply a decrease in profits among these other subsidiaries. We test both of these hypotheses in columns (1) and (2) of Table 4. However, as mentioned before, we do not have a direct measure of corporate profits so we use corporate taxes as a proxy for this (H9). We observe a clear decrease in financial revenue among other firms belonging to the treated MNEs compared to the control group (in column (1)). This offers distinct evidence that the introduction of the Finnish interest barrier prevents internal debt-shifting within MNEs. Also, as expected the point estimates for both the anticipation and after period for corporate taxes are negative, although these estimates are not statistically significant. This may be because of other issues affecting the corporate taxes. For example changes in corporate tax rates may affect corporate tax revenues.

We also study the possible differences in responses to the interest barrier between parent companies and their subsidiaries regarding hypothesis H1 - H7. In these regressions, provided in Table 7 in the Appendix we interact the DD variable with a dummy variable for having parent status. The results show that a decrease in financial expenses (H1) takes place both for parent companies and for subsidiaries. Separating parents from their subsidiaries in the table reveals that there is a long-term debt response to the reform among subsidiaries, something which was masked in Table 3. The result provides support for hypothesis H3 by showing that the long-term debt levels of subsidiaries of Finnish MNEs decrease after the reform. For parents the coefficient is positive yet statistically not significant. Yet, the results provide some evidence pointing towards parents being able to manipulate with the interest rate instead of debt levels. Regarding other hypotheses tested in Table 7, the estimates seem to be consistently statistically insignificantly different from zero as they are in the baseline results.

Finally, we study whether the responses to the Finnish IB differ according to the intensity of the treatment. Our hypothesis (H10) arising from the theoretical model is that the response is larger among those companies whose interest deductibility is restricted the most.

The intensity of the reform was illustrated in the lower left-hand side graph of Figure 2 in Section 3. As suggested by the graph, we consider a company to have an intense treatment if its deductibility of net interest expenses was reduced by 75% due to the reform. The number of these firms is only 121 out of all 520 treated companies. The treatment and control groups are constructed as in the previous section. For

the regressions we added a dummy variable to indicate the high-intensity treatment to separate the effect for them from the overall response. The results for treatment intensity are provided in Table 8 in the Appendix. The results support hypothesis H10 for financial expenses.[31] The reduction in financial expenses is greater among those companies for which treatment was the most intensive. For other variables we do not find differences with respect to intensity of treatment. This may be either because there are no differences or due to reduced power following from the splitting of data in these regressions. Despite of reduced power, we still find some evidence on the intensity of treatment affecting the firm behavior.[32]

6.2   Robustness Checks

As already discussed in Section 3, the Finnish IB applies not only to Finnish companies but also to foreign companies permanently established in Finland. As a robustness check for our main results, in this section we study those companies that are located in Finland and are part of a MNE. In this robustness check, the treatment group is constructed according to the same criteria as for the main results, but now this group contains all companies that are located in Finland and are part of a multinational group. Therefore, this group is formed independently of the MNEs' parent country and without restricting the sample according to escape clause 1, which we are not able to apply without information on the entire MNE's aggregated equity ratio. Note also that we cannot calculate the group-level clustered standard errors. The control group contains a similarly constructed population of Swedish and Danish firms.

Table 5 shows the results. The estimates are well in line with the baseline results presented in Table 3. These results also show a decrease in the level of financial expenses and long-term debts. In addition, the results show a statistically significant increase in the level of corporate taxes among Finnish firms that belong to MNEs. In general the size of the estimates presented in Table 5 are very similar to our baseline estimates. Regarding the results in Section 6.1, it is worth noting that because we were considering both control group companies located in Finland and treatment group companies located outside Finland, the results in that section need to be considered as conservative lower-bound estimates of the effects.

In Figure 4 we already compared the treatment group to an alternative compar-

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[31]For other variables in Table 8 we do not find evidence of differences according to whether a company received a high-intensity treatment or not.

[32]We also examine financial revenue and corporate taxes by treatment intensity among other subsidiaries belonging to treated MNEs. The results are presented in Table 9 in the Appendix. We find no heterogeneity in responses in this respect.

Table 5: Econometric results for the companies located in Finland

VARIABLE (logs)	(H1) Financial Expenses	(H2) Overall Debt	(H3) Long-Term Debt	(H4) Short-Term Debt	(H5) EBITDA	(H6) Turnover	(H7) Corporate taxes
Anticipation (2012-13)	0.215***	0.077***	-0.025	0.049	0.115***	0.163***	-0.260***
	(0.038)	(0.029)	(0.044)	(0.033)	(0.027)	(0.019)	(0.053)
After (2014-15)	-0.193***	-0.068*	-0.081	-0.025	0.242***	0.165***	-0.436***
	(0.047)	(0.037)	(0.055)	(0.041)	(0.031)	(0.025)	(0.069)
Anticip. x Treatment (DD1)	-0.348***	-0.131***	-0.171**	-0.012	-0.010	-0.022	0.268*
	(0.066)	(0.046)	(0.087)	(0.054)	(0.059)	(0.041)	(0.141)
After x Treatment (DD2)	-0.241**	-0.128**	-0.266***	0.033	-0.082	-0.002	0.368**
	(0.096)	(0.062)	(0.101)	(0.066)	(0.069)	(0.049)	(0.156)
log(Employees)	0.225***	0.177***	0.124***	0.191***	0.113***	0.279***	0.068
	(0.035)	(0.022)	(0.039)	(0.022)	(0.031)	(0.030)	(0.042)
Constant	13.432***	17.689***	16.257***	16.058***	14.525***	15.472***	12.370***
	(0.086)	(0.055)	(0.113)	(0.058)	(0.090)	(0.082)	(0.123)
Observations	12,433	12,863	5,079	12,702	7,365	11,580	6,528
R-squared	0.035	0.026	0.017	0.015	0.029	0.104	0.015
# of firms	2,016	2,016	1,150	2,009	1,568	1,909	1,699

Note: Dependent variables are logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA, turnover and corporate taxes. Clustered firm-group-level standard errors in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ The results are obtained estimating equation (3) for each outcome.

Table 6: Econometric results for using 2nd control group from Finnish companies belonging to MNEs but not affected by the reform

VARIABLE (logs)	(H1) Financial Expenses	(H2) Overall Debt	(H3) Long-Term Debt	(H4) Short-Term Debt	(H5) EBITDA	(H6) Turnover	(H7) Corporate taxes
Anticipation (2012-13)	0.020	0.077***	-0.084**	0.151***	0.104***	0.165***	0.035
	(0.033)	(0.022)	(0.037)	(0.022)	(0.026)	(0.017)	(0.050)
After (2014-15)	-0.145***	0.025	-0.152***	0.155***	0.147***	0.156***	-0.023
	(0.046)	(0.029)	(0.047)	(0.029)	(0.035)	(0.024)	(0.057)
Anticip. x Treatment (DD1)	-0.123*	-0.061	-0.164**	-0.032	-0.025	0.008	0.008
	(0.072)	(0.053)	(0.083)	(0.058)	(0.063)	(0.037)	(0.132)
After x Treatment (DD2)	-0.265***	-0.172***	-0.281**	-0.104*	-0.013	0.020	-0.122
	(0.097)	(0.061)	(0.140)	(0.062)	(0.077)	(0.051)	(0.132)
log(Employees)	0.084***	0.099***	0.071***	0.110***	0.065***	0.113***	0.054***
	(0.013)	(0.010)	(0.021)	(0.010)	(0.013)	(0.010)	(0.018)
Constant	11.218***	15.672***	13.783***	14.835***	13.028***	15.341***	10.637***
	(0.047)	(0.030)	(0.071)	(0.032)	(0.042)	(0.033)	(0.065)
Observations	11,541	12,311	5,681	12,276	8,557	11,859	7,572
R-squared	0.019	0.034	0.023	0.035	0.014	0.073	0.003
# of firms	1,978	1,980	1,249	1,980	1,671	1,953	1,749

Note: Dependent variables are logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA, turnover and corporate taxes. *** p<0.01, ** p<0.05, * p<0.1

equation (3) for each outcome. Clustered firm-group-level standard errors in parenthesis. The results are obtained estimating

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ison group of companies that belong to Finnish MNEs but that were not affected by the reform. As a further robustness check we estimate the effects of the reform on all our main outcomes (H1-H7) using this alternative control group instead of the control group used in the baseline analysis. The results are presented in Table 6. The results are very similar to those presented in our baseline estimations in Table 3. Also, it is noticeable that the size of the estimates are very similar to baseline estimates which gives us confidence to conclude that the introduction of an IB has clear behavioral effects on MNEs.

7 Conclusions

We have studied the responses to the Finnish interest barrier. This is the first study that evaluates the effects of interest barrier in case where no pre-reform restrictions on the deductibility of interest expenses exist. This is also the first study that evaluates the effects of interest barrier by using comparable MNEs from other countries as a control group. Employing the Orbis database with other Nordic MNEs serving as a control group for Finnish MNEs, we find evidence of profit-shifting by MNEs. More specifically, we find that the Finnish interest barrier, which restricts the deductibility of financial expenses, decreases these expenses among Finnish MNEs by 25-30% compared to the control group. Subsidiaries reduced their long-term debt levels, whereas for parent companies we do not find any changes in their debt levels.

In addition to debt-related responses we also study other responses. We do not find evidence of increased transfer pricing following from the debt-shifting becoming more expensive. Nor do we find evidence of real responses following the introduction of the interest barrier. Therefore, the restriction does not seem to have adverse effects, yet succeeds in its task of decreasing the financial expenses. In summary, our study provides evidence supporting the positive view about the performance of this particular anti-tax avoidance measure.

However, the firms may also have other means to affect their tax liabilities. These include decisions concerning location of offices and intellectual property, group structure and use of holding companies. The changes in EBITDA could track also other than transfer pricing margins, but detailed information on changes in the group structure and internal transactions of MNEs would be needed to observe whether companies react to the IB by increasing the use of other methods. To our best knowledge, no comprehensive high-quality data with such information is available and studying whether firms react to IBs in these other ways is left for future research.

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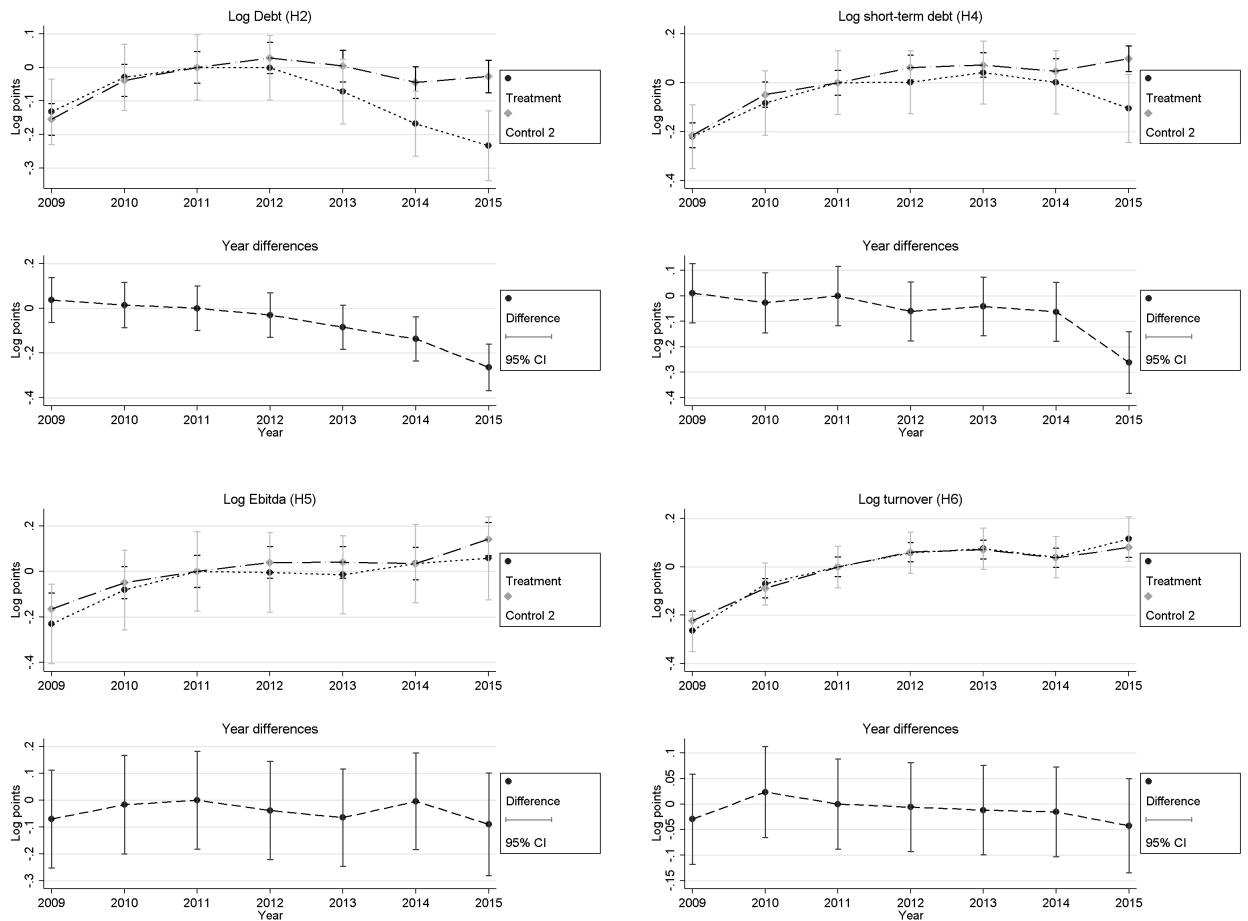
Appendix

Figure 5: Development of logs of overall debt, short-term debt, EBITDA and turnover of companies of Finnish MNEs (Finns) and alternative control group of companies of Finnish MNEs that were not affected by the reform (Control 2nd)

Table 7: Econometric results for parents and subsidiaries

VARIABLE (logs)	(H1) Financial Expenses	(H2) Overall Debt	(H3) Long-Term Debt	(H4) Short-Term Debt	(H5) EBITDA	(H6) Turnover	(H7) Corporate taxes
Anticipation (2012-13)	0.198***	0.086***	-0.090	0.111***	0.063*	0.221***	-0.183***
	(0.045)	(0.037)	(0.123)	(0.038)	(0.035)	(0.030)	(0.066)
After (2014-15)	-0.180***	-0.084*	-0.166	0.093**	0.171***	0.273***	-0.297***
	(0.067)	(0.046)	(0.104)	(0.047)	(0.045)	(0.046)	(0.091)
Anticip. x Treatment (DD1)	-0.314***	-0.066	-0.215	0.062	0.011	-0.033	0.052
	(0.109)	(0.071)	(0.172)	(0.096)	(0.116)	(0.054)	(0.176)
After x Treatment (DD2)	-0.251*	-0.114	-0.463**	-0.048	-0.125	-0.117	0.029
	(0.143)	(0.080)	(0.208)	(0.103)	(0.156)	(0.080)	(0.206)
Anticip. x Tr. x Parent	0.025	-0.012	0.113	-0.113	0.011	-0.028	0.310
	(0.116)	(0.079)	(0.161)	(0.101)	(0.135)	(0.059)	(0.214)
After x Tr. x Parent	0.048	0.116	0.366	0.029	0.138	0.046	0.212
	(0.153)	(0.087)	(0.265)	(0.104)	(0.167)	(0.090)	(0.243)
log(Employees)	0.099***	0.123***	0.053**	0.139***	0.062***	0.126***	0.042*
	(0.018)	(0.014)	(0.030)	(0.014)	(0.019)	(0.015)	(0.022)
Constant	13.876***	17.955***	16.365***	16.575***	14.955***	16.445***	12.469***
	(0.082)	(0.068)	(0.138)	(0.086)	(0.102)	(0.109)	(0.118)
Observations	10,256	10,685	4,156	10,620	5,228	9,325	5,443
R-squared	0.028	0.033	0.011	0.022	0.014	0.060	0.008
# of firms	1,719	1,725	988	1,724	1,123	1,602	1,453

Note: Dependent variables are logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA, turnover and corporate taxes. The results are obtained estimating equation (3) for each outcome. Clustered firm-group-level standard errors in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: Econometric results for treatment intensity

VARIABLE (logs)	(H1) Financial Expenses	(H2) Overall Debt	(H3) Long-Term Debt	(H4) Short-Term Debt	(H5) EBITDA	(H6) Turnover	(H7) Corporate taxes
Anticipation (2012-13)	0.198***	0.086***	-0.090	0.111***	0.062*	0.221***	-0.183***
	(0.033)	(0.023)	(0.064)	(0.029)	(0.032)	(0.021)	(0.063)
After (2014-15)	-0.180***	-0.083***	-0.165**	0.093***	0.171***	0.273***	-0.297***
	(0.035)	(0.024)	(0.073)	(0.031)	(0.033)	(0.022)	(0.067)
Anticip. x Treatment (DD1)	-0.137	-0.055	-0.168	-0.047	-0.066	-0.121*	0.244
	(0.107)	(0.076)	(0.191)	(0.096)	(0.080)	(0.065)	(0.182)
After x Treatment (DD2)	-0.080	-0.060	-0.458**	-0.010	-0.054	-0.090	0.238
	(0.113)	(0.079)	(0.220)	(0.101)	(0.084)	(0.068)	(0.189)
Anticip. x Tr. x High-Int.	-0.222*	-0.021	0.019	0.071	0.162	0.101	-0.029
	(0.117)	(0.083)	(0.212)	(0.106)	(0.103)	(0.073)	(0.211)
After x Tr. x High-Int.	-0.196	0.005	0.249	-0.031	0.041	-0.003	-0.136
	(0.124)	(0.086)	(0.241)	(0.110)	(0.105)	(0.076)	(0.219)
Employees	0.099***	0.124***	0.058**	0.139***	0.061***	0.126***	0.041*
	(0.012)	(0.008)	(0.023)	(0.010)	(0.013)	(0.007)	(0.022)
Constant	13.875***	17.952***	16.347***	16.574***	14.957***	16.444***	12.469***
	(0.044)	(0.029)	(0.084)	(0.037)	(0.054)	(0.029)	(0.087)
Observations	10,256	10,685	4,156	10,620	5,228	9,325	5,443
R-squared	0.028	0.033	0.011	0.022	0.014	0.060	0.007
# of firms	1,719	1,725	988	1,724	1,123	1,602	1,453

Note: Dependent variables are logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA, turnover and corporate taxes. The results are obtained estimating equation (3) for each outcome with treatment intensity dummies. Clustered firm-group-level standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Econometric results for treatment intensity: other subsidiaries of treated MNEs

VARIABLE (logs)	(H8) Financial revenue	(H9) Corporate taxes
Anticipation (2012-13)	-0.113**	0.052
	(0.057)	(0.034)
After (2014-15)	-0.295***	0.154***
	(0.071)	(0.047)
Anticip. x Treatment (DD1)	-0.232**	-0.088
	(0.117)	(0.061)
After x Treatment (DD2)	-0.324**	-0.060
	(0.145)	(0.102)
Anticip. x Tr. x High-Int.	-0.091	-0.057
	(0.165)	(0.139)
After x Tr. x High-Int.	0.045	-0.153
	(0.235)	(0.186)
Employees	0.044***	0.019*
	(0.015)	(0.010)
Constant	10.218***	11.580***
	(0.042)	(0.026)
Observations	11,721	10,806
R-squared	0.013	0.004
# of firms	2,474	2,560

Note: Dependent variables are logs of financial revenue and corporate taxes. The results are obtained estimating equation (3) for each outcome with treatment intensity dummies. Clustered firm-group-level standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

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