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Firm Responses to an Interest Barrier: Empirical Evidence



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Abstract

This paper studies the effects of an interest barrier (IB) that was introduced in Finland to restrict the profit-shifting opportunities of multinational enterprises (MNEs). We employ Orbis database on 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 IB by decreasing their financial expenses. We also find that the most affected firms decreased their debt levels due to the reform. Our results suggest that the financial expense response is followed by a change in the use of transfer pricing as a method to shift profits between tax jurisdictions. We do not find evidence of total output changes among treated firms, suggesting that the IB did not affect the real activity of MNEs.

JEL Codes: H25, H26, G32

Keywords: Corporate income tax, Multinational firms, Capital structure, Profit shifting, Interest barrier

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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). These opportunities arise because the profits of each parent and subsidiary are subject to corporate income taxation in its host country in the current international tax system. Empirical evidence in turn shows that MNEs do also utilize these opportunities by engaging in various profit-shifting activities that have severe adverse effects (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 by giving advantage to MNEs.

In this paper we focus mostly on a particular profit-shifting channel, debt-shifting, which 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 can 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 other distortions following from profit-shifting activity, both the governments around the world and organizations have proposed and introduced several anti-tax avoidance measures. The OECD-designed Base Erosion and Profit Shifting (BEPS) package provides recommendations for actions that aim to reduce tax evasion and tax-planning strategies (OECD 2013a,b). The recommended measures include 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 introduced an interest barrier (IB) that restricts the deductibility of intra-MNE interest expenses from the beginning of 2014 onward. We study how the restriction affected the behavior of Finnish MNEs¹ and succeeded in decreasing profit-shifting. We employ a difference-in-differences

¹By Finnish MNE we mean a corporate group whose ultimate parent company is located in Finland. Swedish and Danish MNEs are defined in a corresponding manner. The group definition we employ is the one provided by Bureau van Dijk.

method to 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 MNEs 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 and their largely unchanged legislation during the time period.² 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 an IB in the absence of previous restrictions on the deductibility of interest expenses. The earlier empirical papers examining the effects of an IB (Buslei and Simmler 2012, Dressler and Scheuering 2012, Alberternst and Sureth-Sloane 2016) have been concentrated 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 the IB on financial expenses, debt levels and overall economic activity of firms. According to our results, Finnish MNEs decreased their financial expenses by 25-30% as a response to the introduction of the IB. This decrease could capture changes in both the debt levels and interest rates, but unfortunately, we are not able to observe interest rates in the data and thus, we cannot directly distinguish the changes in interest rates and debt levels. We do find evidence that the most affected MNEs decreased their debt levels after the reform, suggesting changes in the capital structure of these firms. For these firms we also observe an increase in EBITDA, suggesting that as a response to the IB they switched to use other profit-shifting measures. We find no evidence of real output changes among Finnish MNEs compared to Swedish and Danish MNEs. As the output levels of the treated companies are not affected, the IB does not seem to distort the overall economic activity of companies. Overall, the results suggest that an IB can be an efficient measure for governments to tackle debt-shifting, but it may simultaneously cause a switch from debt-shifting to transfer pricing.

The paper proceeds as follows. Section 2 reviews the related literature. Section 3 discusses the details of the Finnish reform and Section 4 provides 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.

²For a comparison between the Finnish and Swedish economies, see Korkman and Suvanto (2013).

2 Related Literature

This study contributes to several branches of literature. The literature on profit-shifting by MNEs has not only provided evidence on its occurrence, but also about various ways being used to shift profits (see e.g. Dharmapala 2014 and Egger and Stimmelmayer 2017). The three most common ways are transfer pricing, debt-shifting and the use of intangible assets. The literature on anti-tax avoidance measures acknowledges multiple such 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 firms³, and interest barriers (IB), which restrict the ratio of debt expenses to some profit-related measure.⁴ 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). However, economic literature has concentrated mostly on the effects of TCRs while the literature on IBs is scarce.

Maßbaum and Sureth (2009) study Belgian, Italian and German TCRs and find that their effects depend significantly on the details of the underlying tax system. However, several empirical studies have shown that companies respond to TCRs in line with their objectives and reduce internal debt levels. Blouin et al. (2014) investigate the impact of TCRs on the capital structure of the foreign affiliates of U.S. multinationals in 54 countries and show that they 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 response

³First, 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 or debt-equity bias. 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 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). 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). One way for MNEs to take advantage is by taking external debt from a favorable credit market and providing it as an internal debt to affiliates in less favorable markets.

⁴A typically used profit-related measure is earnings before interest, taxes, depreciation and amortization, EBITDA.

reduces the efficiency of TCRs that restrict only the use of intra-company debt.⁵ 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.⁶ In addition, these rules are shown to have adverse effects on foreign direct investments in high-tax countries (Buettner et al. 2014).

The scarce empirical literature on the effects of IBs has investigated the German case, where a TCR was replaced with an IB.⁷ Buslei and Simmler (2012), Dressler and Scheuering (2012) and Alberternst and Sureth-Sloane (2016) study the impacts of replacing the TCR by 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 reform by decreasing their debt-equity ratio or by splitting their assets to avoid the exemption limit, and that the reform 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 reform 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. 2001 and Huang and Ritter 2009). Buettner et al. (2009) investigate the effects of company taxation and capital market conditions on

⁵Compared to TCRs, substitution between internal and external debt may not play such a big role in case of IBs for firms with low profits. This is because IBs restrict the deductibility of interest expenses related to profits. Gresik et al. (2017) show theoretically that from a welfare perspective TCRs are under certain assumptions inferior to IBs, and argue that IBs are getting more popular due to inefficiency of TCRs. Note that 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.

⁶Hybrid instruments, which have elements of both debt and equity, can reduce the effectiveness of both TCRs and IBs (Barnes 2015). Action 2 in the OECD action plan tries to tackle the problems related to hybrid instruments (OECD 2015a).

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

⁸Under 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)

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 2013.⁹ An introduction of Finnish IB that was applied the first time in 2014 implied tax changes for numerous MNEs. The reform that restricts the deductibility of net interest expenses relative to the adjusted taxable result of business income was announced in a government proposal in November 2012.¹⁰ Due to the announcement the businesses might have anticipated and responded to it already before 2014. The provision applies to Finnish companies and partnerships and to foreign companies that are established permanently 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.¹¹

Figure 1 illustrates in more detail the structure of the Finnish interest barrier. It shows that if the first four conditions given in the figure (C1-C4) are fulfilled, the reform restricts the deductibility of intra-group interest expenses. The first condition (C1 in Figure 1) is that interest expenses exceed interest income of the firm. The next two conditions compare the net interest expenses of a firm to a euro-limit and a profit-related measure. The second condition (C2) states that in order for the deductibility to be restricted, the net interest expenses have to exceed €500,000.

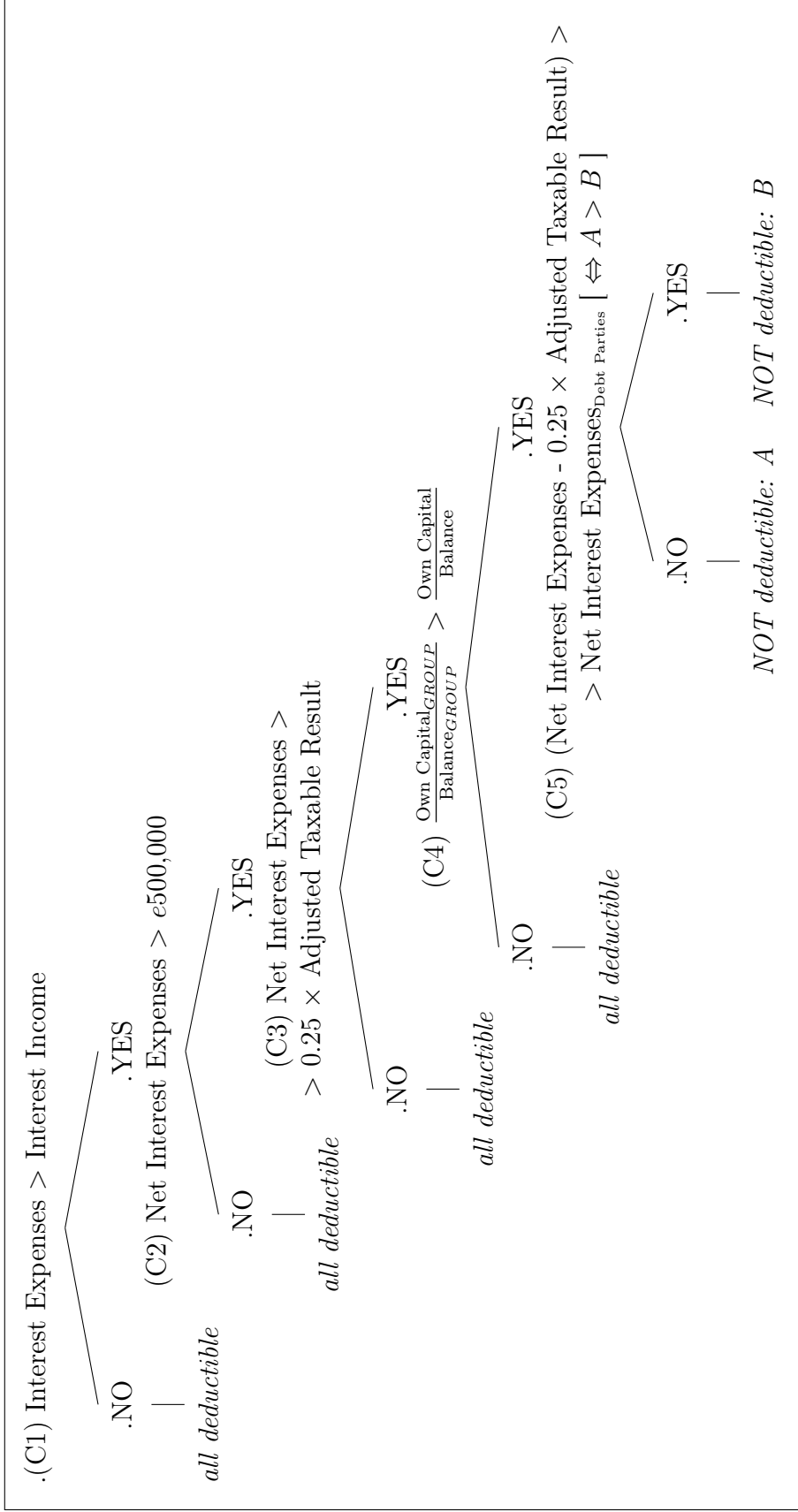
The third condition (C3) states that net interest expenses have to exceed 25% of the adjusted taxable result of business income.¹² According to the fourth condition (C4), interest

⁹In some special cases like in 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 was already restricted before 2014.

¹⁰The interest deduction limitation is part of the Business Income Tax Act (§18 a) and it was announced in the Government proposal (146/2012). For details, see the Business Income Tax Act (24.6.1968: §18 a; 28.12.1983; 30.12.2013), the Government proposals 146/2012 and 185/2013, the finance committee memorandum (31/2012) and the parliament reply (156/2012). The restriction was introduced for year 2013, but due to a one-year transition period it was applied for the first time in 2014. The government proposal (185/2013) estimated that the reform would lead to increase in corporate tax revenue of about 2% (according to the Budget Proposal 2014, the corporate income is budgeted to bring in a total of €3.861 billion in tax revenue in 2014, whereas the interest deductibility restriction is calculated to increase tax revenue from corporate income taxes by €80M).

¹¹The 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)

¹²The adjusted taxable result of business income refers to a company's taxable profit plus interest expenses



$A =$ Net Interest Expenses - $0.25 \times$ Adjusted Taxable Result; $B =$ Net Interest Expenses_{Debt Parties}

Figure 1: The structure of the Finnish IB

expenses are fully deductible as long as the equity ratio of the consolidated group does not exceed the equity ratio of the company. If this is not the case, the deductibility of interest expenses is restricted by the new provision.

Even if conditions C1-C4 are fulfilled, the 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 (C5).

In addition to the equity ratio rule (C4) explained above, the provision also includes another condition that might be considered as an escape clause. This 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.¹³

Let us next illustrate the changes in the incentives arising from the introduction of the Finnish IB. For now let us consider a case where neither of the two escape clauses are binding and the condition C5 is not met. The upper graphs of Figure 2 describe the deductibility of net interest expenses 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 results from the interest expenses reducing the taxable corporate income and thus, decreasing the corporate tax burden. Second, when the 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 a tax benefit amounting to corporate tax rate multiplied by 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

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).

¹³The ability of a company to benefit from non-deductible interest carried forward depends on whether the company makes profits in the future.

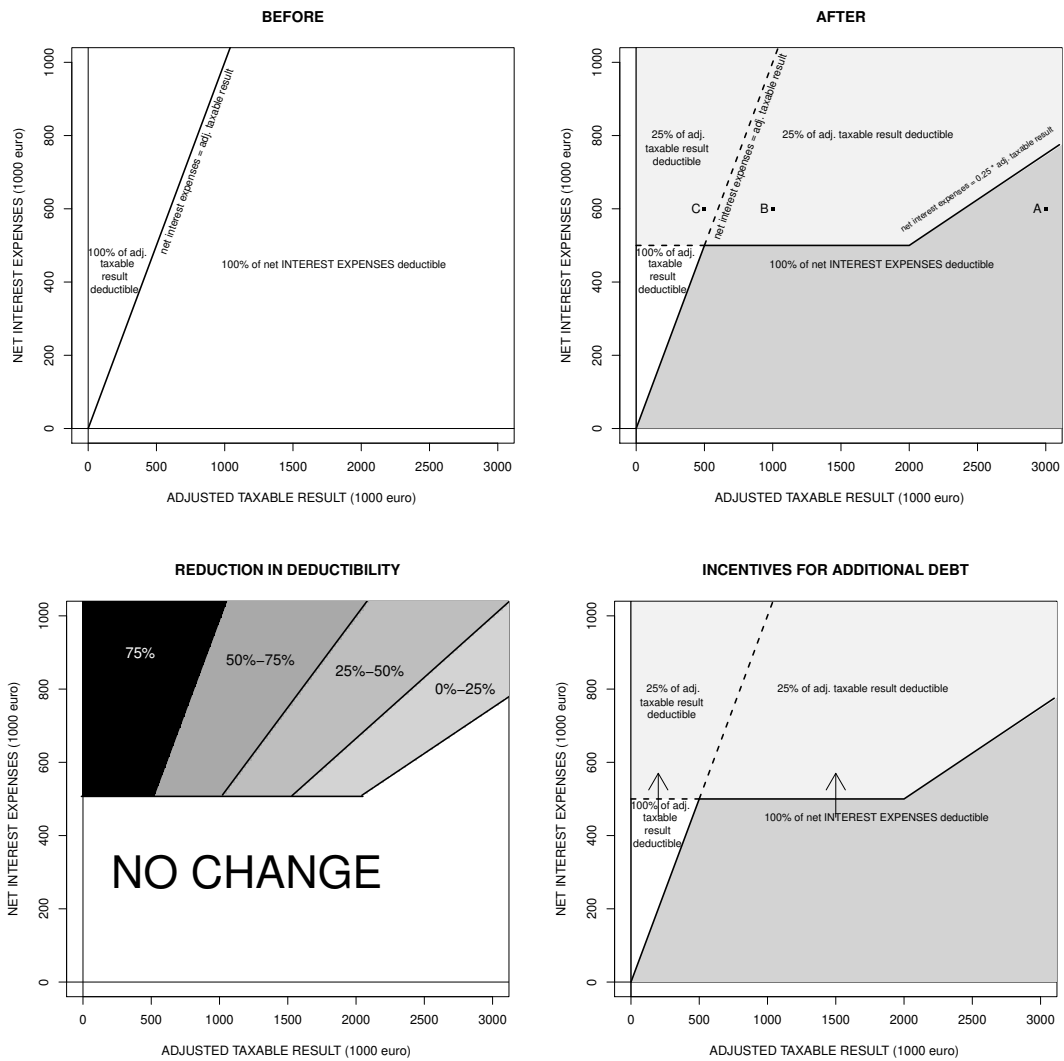


Figure 2: Before and after the reform incentives

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 (dark gray) area the reduction is at least 25% (50%), but less than 50% (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.¹⁴

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 rate¹⁵, 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 their behavior in response to the reform.

¹⁴We study the effects also with respect to the intensity of the treatment in Section 6.1.

¹⁵The Finnish corporate tax rate has been 26% from 2005 to 2011, 24.5% from 2012 to 2013 and 20% from 2014 on.

4 Predictions

Next, we present a stylized framework to illustrate the effects of interest barrier on the profit-shifting incentives of MNEs. We first consider a case where there are no restrictions on interest deductibility. After that we consider a change in MNE incentives following a restriction on the deductibility of interest expenses.

Consider two companies that belong to the same MNE, but are located in two different countries.¹⁶ A company h (e.g. parent) is located in a high-tax country H and a company l (subsidiary) is located in a low-tax country L . The corporate tax rate of country H exceeds that of country L ($\tau_H > \tau_L$). In the absence of debt-shifting the debt level of a firm is affected by tax rate and non-tax-related factors like chance of bankruptcy or the market-to-book ratio (see Hovakimian et al. 2004 and Huizinga et al. 2008). In the absence of interest deductibility restrictions a MNE may choose to use debt-shifting to maximize its group level net-of-tax profits. This goal may be achieved by changing either the internal debt level or the corresponding interest rate, or both. We write the net-of-tax profits of the MNE as $\Pi = (1 - \tau_H) \tilde{\pi}_H + (1 - \tau_L) \tilde{\pi}_L + (\tau_H - \tau_L)r^*D^* := \Pi_{noDS}$, where D^* is the optimal amount of internal debt and r^* is the corresponding interest rate.¹⁷ Let us now consider a case where debt-shifting is possible.¹⁸ Equation (1) gives the net-of-tax profits (Π_{DS}) when all interest expenses are fully deductible and company l issues an additional loan D with the corresponding interest rate r to company h to shift profits.

$$\Pi_{DS} = \Pi_{noDS} + (\tau_H - \tau_L)rD \quad (1)$$

Company h deducts its interest expenses rD from its pre-tax profits and company l receives the same amount in interest payments, and it becomes subject to the corporate tax rate τ_L . The company can affect its interest expenses by changing either the debt level D or the interest rate r or both. Independently of how the expenses are reduced, the net-of-tax profits of the MNE are higher than in the absence of debt-shifting ($\Pi_{DS} > \Pi_{noDS}$). Thus, if the interest expenses are fully deductible for corporate tax purposes in country H , the MNE

¹⁶Note that by considering only two companies our simple model excludes some margins that exploit complex organization structures. For instance, if a MNE redistributes debt within the group as a response to the IB, it may become able to circumvent the interest deductibility restriction in some cases. This is something our two company model is incapable for revealing.

¹⁷Here $\tilde{\pi}_H$ and $\tilde{\pi}_L$ refer to pre-tax profits of companies h and l in case no internal debt is used at all. Notations π_H and π_L are reserved to denote the pre-tax profits of companies h and l in case where internal debt might be used, but when no debt-shifting possibilities are considered. With the given notations we have $(1 - \tau_H) \tilde{\pi}_H + (1 - \tau_L) \tilde{\pi}_L + (\tau_H - \tau_L)r^*D^* = (1 - \tau_H) \pi_H + (1 - \tau_L) \pi_L$.

¹⁸ $(\tau_H - \tau_L)(r^*D^* + rD) = (\tau_H - \tau_L)\tilde{r}\tilde{D}$, where \tilde{D} stands for the overall internal debt level and \tilde{r} its average interest rate.

may increase its net-of-tax profits by showing additional profits in country L . As internal debts are also used to finance investments and production, the company profits π_H and π_L may be considered as functions of D . However, if debt-shifting is feasible, firms can increase their joint profit by increasing their interest expenses.

Now consider a case where the government in country H introduces a restriction on the deductibility of interest expenses, and a fraction a ($0 \leq a < 1$) of interest expenses rD remains tax deductible. The smaller the parameter a is, the stricter the restriction. Now the MNE net-of-tax profit is

$$\Pi_{IB} = \Pi_{noDS} + (a\tau_H - \tau_L)rD \quad (2)$$

A comparison between equations 1 and 2 shows that introducing an IB reduces the incentives for debt-shifting. Without an IB 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 IB 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 compared to a case without an IB. 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 IB makes debt-shifting less lucrative from the MNE's point of view and is therefore likely to reduce such activity.

Based on the simple framework above we formulate our empirically testable hypotheses. First, it is likely that the IB decreases the use of interest expenses in country H . Unfortunately, we do not directly observe interest expenses within MNE in the data but we observe aggregated financial expenses by firm, a variable including such expenses. Therefore, our first hypothesis is:

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.

We observe both long- and short-term debt levels in the data that enables us to examine these margins separately. Because short-term debts are more often used for everyday transactions, we expect to observe changes especially in the long-term debt levels of affected companies. However, MNEs could reorganize both debt types as a response to the reform. Therefore, our third and fourth hypotheses are:

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

H4: The short-term debt levels of affected companies decrease.

The IB cuts the incentives for profit-shifting via debt-shifting by increasing its costs. However, assuming that the MNEs willingness to avoid taxes remains, this increases incentives to employ other profit-shifting measures, e.g. transfer pricing activities. If this is the case, we would expect to see an increase in EBITDA due to the reform.¹⁹

H5: Affected companies replace debt-shifting by resorting increasingly on transfer pricing that would increase their EBITDA.

As a by-product, the IB may also make internal funding for investments more costly and increase the cost of capital as the company has to find funding elsewhere probably with at a higher price. This might lead to a decrease in investments and thus also affect the overall activity of a MNE that would lower the turnover of the affected companies.²⁰

H6: Real output in terms of turnover decreases among affected companies.

In addition to our primary hypotheses (H1 - H6), we can also examine other potential behavioral margins. 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 direct measure for taxable profits but we can examine changes in the amount of annual taxes paid by firms (H7) that is also very relevant for the policy maker as the main aim of introducing IB was to tackle tax avoidance and increase tax revenue.

H7: Taxes paid by affected companies increase.

In addition, we expect to observe a decrease in the financial revenues and taxes paid of firms belonging to Finnish MNEs but that are located abroad (H8 - H9).

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

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

¹⁹It 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.

²⁰We 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.

These hypotheses also serve as a robustness check for our main results because if we, for example, observe a decrease in the financial expenses and debt levels of Finnish firms we should observe a similar decrease in the financial revenues of other firms within the same MNEs. Therefore, testing these hypotheses are very important to make more strong interpretations of the results.

Finally, the fraction of interest expenses that is deductible after the reform affects the size of the incentive change. This is clearly visible from equation (2), the smaller the parameter a is, the more intense is change in its incentives. This leads to our last hypothesis (H10).

H10: Those firms that were the most affected by the reform respond the most.

5 Data and methods

5.1 Data

We use data from the ORBIS database provided by Bureau van Dijk Electronic Publishing (BvD). The data include firms' financial and productive activities from balance sheets and income statements as well as detailed information on firms' domestic and international ownership structure for over 130 million companies across the world. Studying the behavior of MNEs poses data challenges that concern also the ORBIS database. The data coverage of MNEs in all existing data sets is far from perfect. Further, existing data sources lack data of group activities of MNEs. For example, the allocation of profits, loans and interest payments within MNEs are impossible to observe completely from any of the existing data sets. Even though these problems are not completely solved by using the ORBIS database, we argue that it is the best available data source for the purposes of this study. An illustrative study about the representativeness of Orbis is provided by Kalemli-Ozcan et al. (2015). According to the study, the data coverage for Finnish, Swedish and Danish MNEs is at a more reasonable level than in many other countries. The data coverage for large companies is also much better than for small companies. As the IB by design affects large companies, poor coverage is less of a concern in the case of our study. Most importantly, there are no sharp discrete changes in coverage between countries in our treatment and control groups. Kalemli-Ozcan et al. (2015) also examined the data only up to year 2012. Given the gradual increase in the coverage their estimates are likely to overestimate the problems for the latest data versions.

To study the effects of the Finnish IB, 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 2015.²¹ The interest deductibility has been restricted

²¹The data include companies that have at least one foreign subsidiary. The corresponding numbers for

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.²²

5.2 Methods

We apply a standard difference-in-differences (DD) method to estimate the effects of the Finnish IB on several outcomes. We estimate the following equation

$$\begin{aligned} \text{Log}(Y_{it}) = & \theta \text{controls}_{it} + \beta_1 \text{treat}_i + \beta_2 \text{anticipation}_t + \beta_3 \text{after}_t \\ & + \beta_4 \text{treat}_i * \text{anticipation}_t + \beta_5 \text{treat}_i * \text{after}_t + \eta_i + \varepsilon_{it}, \end{aligned} \quad (3)$$

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 a firm belongs to the treatment group or not. The variable anticipation_t is a time dummy for the observation to be from year 2012 or 2013. The variable after_t is a time dummy which gets value one if an observation comes from year 2014 or 2015, and is 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.

Our main variable of interest in the analysis is the financial expenses of a firm. This financial expenses variable comes from the profit & loss account section of the Global Standard Format in the Orbis database. For Finnish companies it includes in addition to interest and other financial expenses also reductions in the value of investments held as non-current assets and reductions in the value of investments held as current assets (for more details,

years 2009-2011, which are employed in the derivation of the treatment and control groups, are 48,723 and 231,633 (see Table 1). Our data are collected between 10/2016-3/2017.

²²Sweden 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.

see Orbis User Guide). Also most of the other variables employed come from the Global Standard format. From our main variables of interest these include loans, long-term debt, EBITDA, operating revenue, taxation, financial revenue and number of employees. Variable for amortization & depletion comes from the Detailed Format in the Orbis database.

We recognize that none of the above variables directly measures the profit-shifting margins that the Finnish IB aimed to affect. This is common in the previous literature studying profit-shifting effects as it is usually hard to directly observe such measures from the data. However, with more aggregated outcomes from the ORBIS database and comparison between firms belonging to Finnish MNEs and similar firms from Swedish and Danish MNEs (that did not face major changes in their legislation), we can offer evidence of the effects of the IB with credible assumptions.

The main interest lies in coefficients β_4 and β_5 (the coefficients for the interaction terms $treat_i * anticipation_i$ and $treat_i * after_i$). Each of these coefficients show the impact of the introduction of the IB 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.²³ In all of our specifications, we include firm fixed-effects that allow for correlation between the firm component (η_i) and the regressors.

We construct our treatment group from those companies that are likely to be affected by the reform. More specifically, a company is in 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 2011. 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 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). The upper panel shows that only relatively few (2.7%) 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

²³The 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.

²⁴If 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 1,322 observations for Finnish MNEs in our data that exceed both of these limits in the pre-reform period from 2009 to 2011 ($1322 / 48723 = 2.7\%$). 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

all of these firms would have been affected by the reform.²⁵ For 690 firms, neither of the escape clauses is binding, yet both the euro limit and the profit-related limit are exceeded. These firms would have faced different tax treatment due to the reform and 396 of them belong to Finnish MNEs.²⁶ As our treatment group includes those companies that would have been affected by the reform at least once in years 2009-2011 (had the reform been in place), these 396 companies constitute the treatment group. From all these companies, only 20 are ultimate parents and the rest have subsidiary status. The control group is constructed using exactly the same criteria for Swedish and Danish MNEs.²⁷

To be able to study the internal transactions within MNEs, we would like to observe internal and external debts separately. Also, it would be important to be able to separate financial expenses due to internal debts from aggregated debts. However, data that would offer these information are not available for research. The Orbis database include information about the sum of internal and external debts and the aggregate financial expenses of firms. We use these measures as our main outcomes to measure the effects of the IB. 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. However, there are no large differences in financial expenses and debt-levels between treatment and control groups. The same holds for EBITDA. However, it seems that the firms in the treatment groups pay substantially less corporate taxes than the control group.

5.3 Descriptive evidence

In this section we show the time series of variables of main interest for the treatment and control groups. The aim is twofold. First, we want to show that the common time trend assumption holds, meaning that the variables develop similarly before the reform in both the treatment and control groups. Second, by examining these time series visually, it gives us descriptive evidence on the effects following the announcement and the implementation of the reform.

by zeros here when considering the treatment group.

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

²⁶Here 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.

²⁷The 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 2011 had the reform been applied to them. According to the lower panel of Table 1, there are 3,068 observations that exceed both the euro limit and the profit limit. For 1,467 (47.8%) of these observations neither of the escape clauses is binding. These observations come from 859 companies of Swedish and Danish MNEs. Of these 17 are ultimate parents and the rest have subsidiary status.

Table 1: Construction of treatment and control groups

<i>FINNISH MNEs</i> (<i>obs. 2009-2011</i>)	Obs. exceeding $\hat{A} \leq 500,000$ & 25% of adj.tax.result	Esc. clause 1 (equity) binding	Esc. clause 2 (industry) binding	Neither of esc. clauses binding	Number of companies
All (48,723)	1,322 (733 comp.) (2.7%)	454 (34.3%)	244 (18.5%)	690 (52.2%)	396 (54.0%)
Ultimate Parent (5,925)	203 (117 comp.) (3.4%)	161 (79.3%)	27 (13.3%)	32 (15.8%)	20 (17.1%)
Subsidiary (42,798)	1,119 (616 comp.) (2.6%)	293 (26.2%)	217 (19.4%)	658 (58.8%)	376 (61.0%)
<i>SE and DE MNEs</i> (<i>obs. 2009-2011</i>)	Obs. exceeding $\hat{A} \leq 500,000$ & 25% of adj.tax.result	Esc. clause 1 (equity) binding	Esc. clause 2 (industry) binding	Neither of esc. clauses binding	Number of companies
All (231,633)	3,068 (1,762 comp.) (1.3%)	942 (30.7%)	851 (27.72%)	1,467 (47.8%)	859 (48.8%)
Ultimate Parent (29,463)	423 (238 comp.) (1.4%)	357 (84.4%)	105 (24.8%)	29 (6.9%)	17 (7.1%)
Subsidiary (202,170)	2,645 (1,524 comp.) (1.3%)	585 (22.1%)	746 (28.2%)	1,438 (54.4%)	842 (55.2%)

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=989)									
mean	17.236	4.174	18.030	18.522	17.287	16.650	15.273	14.435	12.028
median	17.568	4.890	17.928	18.396	17.410	16.649	15.250	14.303	12.461
sd	2.408	2.612	1.574	1.539	1.928	2.121	1.823	1.697	2.739
Control (N=2,115)									
mean	16.733	3.320	17.954	18.460	17.186	16.408	15.092	14.310	12.671
median	17.114	3.784	17.737	18.264	17.293	16.694	15.015	14.104	12.869
sd	2.417	2.621	1.394	1.377	1.852	2.446	1.496	1.670	2.350

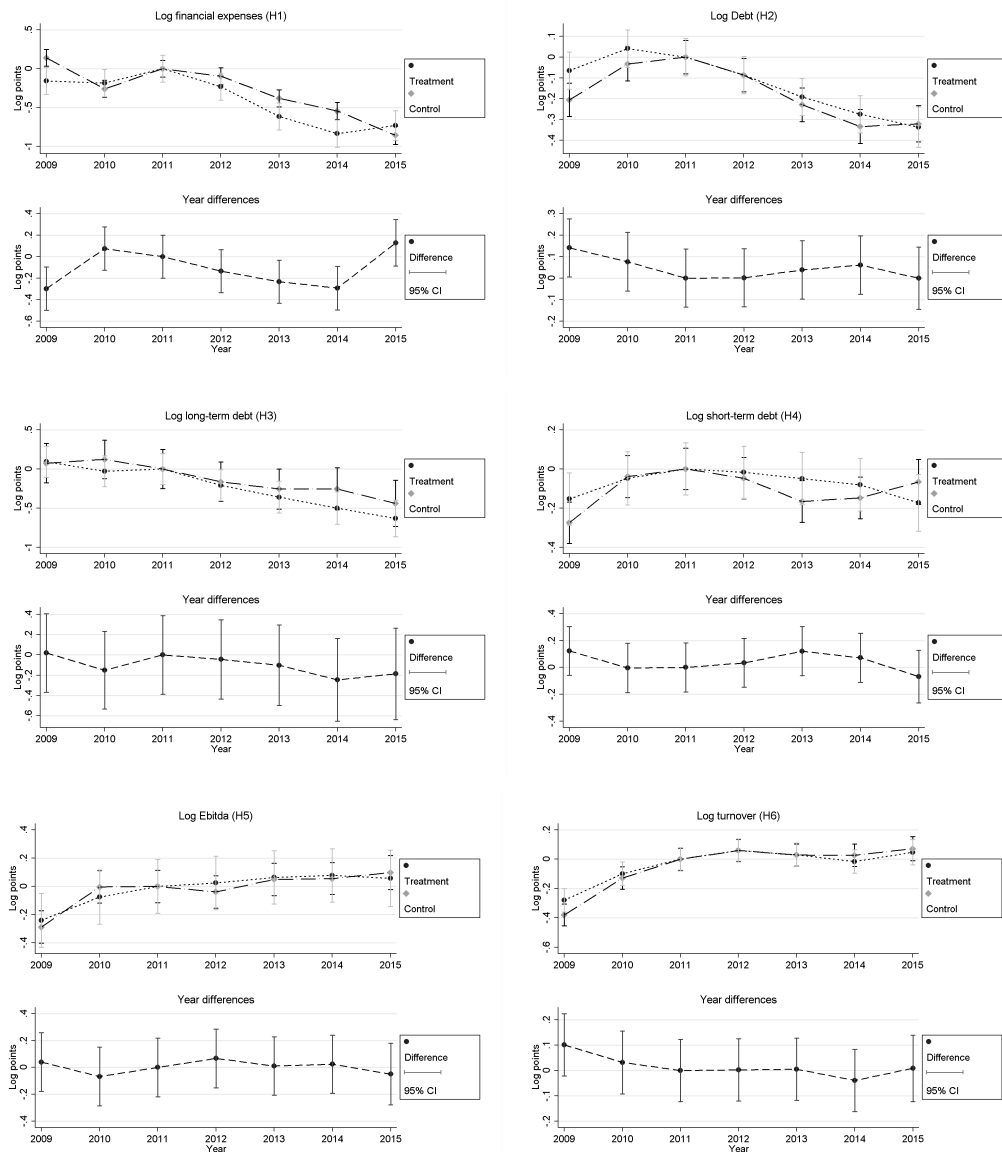


Figure 3: Development of logs of financial expenses, overall debt, long-term debt, short-term debt, EBITDA and turnover of companies of Finnish MNEs (Treatment) and of Swedish and Danish MNEs (Control)

Figure 3 depicts the time trends of the logarithm of financial expenses, overall debt, long-term debt, short-term debt, EBITDA and annual turnover for treatment and control groups. 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. 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. The figure shows that all variables develop rather similarly over time in both groups during the pre-reform period which supports our identification strategy.

The trends in financial expenses and long-term debt levels differ between the treatment and control groups after the IB is introduced as the values for the treatment group decrease compared to the control group.²⁸ However, the standard errors are large and the annual differences seem not to be statistically different from each other between countries. This is understandable as the Finnish IB affects only rather small number of large firms. None of the other variables depict clear changes in time trends after the announcement of the reform.

We are also able to use an alternative control group that consist of companies of Finnish MNEs that were not directly affected by the reform. More specifically, we use 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 this alternative control group. 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 main outcomes, financial expenses and long-term debts, from 2012 onward.²⁹ We form this alternative control group to show the robustness of our results. 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.

²⁸Note 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).

²⁹In 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.

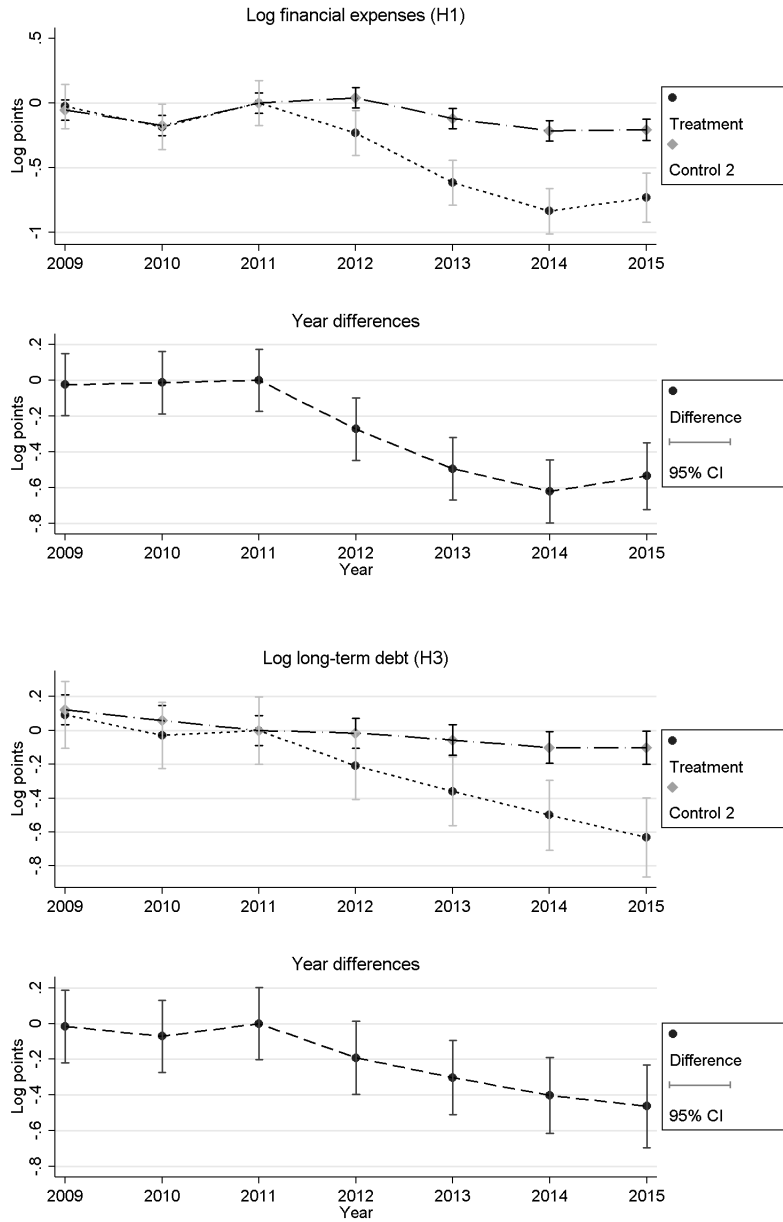


Figure 4: Development of logs of financial expenses and long-term debt of companies of Finnish MNEs (Treatment) and alternative control group of companies of Finnish MNEs that were not affected by the reform (Control 2)

6 Results

6.1 Baseline results

Table 3 shows our baseline results where the treatment group consists of both parent and subsidiary companies. Each column presents results for a model with a different dependent variable in logarithmic form. According to the first hypothesis, H1, the IB reduces financial expenses of treated companies. The first column in the table tests this hypothesis, showing two DD estimates (DD1 and DD2). DD1 stands for the anticipation effect that is the interaction of treatment and a dummy of pre-reform period (2012-2013) when firms knew that the new law is coming but it was not applied yet. The estimate for the anticipation effect is negative (-0.330) and statistically significant, showing that firms responded to the reform before it was implemented. This suggests that MNEs started to adjust their behavior towards the long-run optimum right after the reform was announced.

The effect of the IB is very similar for the years right after the law came into force (2014-2015). Following the introduction of the IB the financial expenses of the companies belonging to Finnish MNEs decreased by roughly a quarter compared to the control group. As we discussed in previous sections, 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 we do not observe within MNE debts or interest rates for loans in our data set, we focus on studying whether or not the level of debts of firms decrease due to the reform. A decrease in debt levels among Finnish MNEs compared to Danish and Swedish MNEs would imply a decrease in within MNE loans after the introduction of an IB in Finland.

The following three columns (H2-H4) in Table 3 show the DD results for overall debt levels, long-term debt levels and short-term debt levels, respectively. None of the estimates are statistically significant. The results suggest that other factors might play a role in the decreases in financial expenses. One way for MNEs is simply to decrease the interest rates of within-group loans that would mechanically decrease financial expenses, that would not affect the debt levels.

Table 3 also provides other than directly debt-related responses to the IB, as columns (H5-H6) are for EBITDA and turnover. As the IB makes debt-shifting less attractive, firms might respond by increasing transfer pricing as a way to shift profits. If there were such a change in profit-shifting, we should observe this as an increase in EBITDA. However, according to the results no such change happened. Therefore, our results do not support the hypothesis that firms reacted to the IB by resorting increasingly to transfer pricing as a mean of shifting profits. Of course, the firms may have also used other means to affect their tax liabilities. These include decisions concerning location of offices and intellectual

Table 3: Econometric results for all firms

VARIABLE (logs)	(H1)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)
	Financial Expenses	Overall Debt	Long-Term Debt	Short-Term Debt	EBITDA	Turnover	Corporate taxes
Anticipation (2012-13)	-0.025 (0.044)	-0.080** (0.035)	-0.272* (0.157)	-0.007 (0.045)	0.093** (0.040)	0.205*** (0.033)	-0.096 (0.080)
After (2014-15)	-0.469*** (0.065)	-0.252*** (0.047)	-0.394*** (0.123)	-0.015 (0.054)	0.166*** (0.051)	0.205*** (0.045)	-0.208* (0.111)
Anticip. x Treatment (DD1)	-0.330*** (0.079)	-0.051 (0.054)	-0.029 (0.171)	0.039 (0.071)	0.042 (0.074)	-0.038 (0.045)	0.104 (0.150)
After x Treatment (DD2)	-0.251** (0.117)	-0.036 (0.069)	-0.173 (0.165)	-0.027 (0.078)	-0.009 (0.092)	-0.060 (0.062)	0.044 (0.179)
Constant	14.125*** (0.068)	18.115*** (0.055)	16.599*** (0.123)	16.735*** (0.061)	14.892*** (0.090)	16.508*** (0.064)	12.425*** (0.115)
Observations	7,702	7,976	3,182	7,923	3,936	7,012	4,060
R-squared	0.058	0.052	0.021	0.016	0.015	0.054	0.004
# of firms	1,250	1,254	725	1,253	835	1,172	1,070

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. *** p<0.01, ** p<0.05, * p<0.1

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 IB might induce real responses. We use turnover to examine the overall activity of firms that would indicate changes in real responses. However, the results in column (H6) suggest no changes in turnover among treated Finnish firms, as the DD estimates remain statistically insignificant both pre- and post-reform periods. An obvious caveat in this analysis is that the real responses could materialize over the 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 IB affected the amount of corporate taxes reported 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. The DD point estimates are positive which suggests an increase in the amount of taxes but these none of the estimates are 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 evidence that the IB succeeded in reducing all possible profit-shifting channels. However, the positive DD estimates for corporate taxes together with DD estimates for EBITDA very close to zero indicate the change of firm behavior that is in line with the original goals of the reform.

As the amount of financial expenses decreased among treated firms, the amount of financial revenues should symmetrically decrease among other subsidiaries of MNEs (H8) that are part of treated MNEs (compared to the control group) if the reform succeeded to reduce intra-MNE tax avoidance by debt-shifting. In this context other subsidiaries 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

Table 4: Results for other subsidiaries in treated MNEs

	(H8)	(H9)
VARIABLE (logs)	Financial Revenue	Corporate Taxes
Anticipation (2012-13)	-0.112*	0.024
	(0.064)	(0.037)
After (2014-15)	-0.281***	0.135***
	(0.079)	(0.050)
Anticip. x Treatment (DD1)	-0.300***	-0.082
	(0.103)	(0.076)
After x Treatment (DD2)	-0.300**	-0.084
	(0.138)	(0.106)
Constant	10.286***	11.616***
	(0.046)	(0.028)
Observations	10,525	9,598
R-squared	0.012	0.004
# of firms	2,210	2,285

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

column (1)). This offers distinct evidence that the introduction of the Finnish IB prevents internal debt-shifting within MNEs. Also, the point estimates for both the anticipation and after period for corporate taxes are negative as expected, 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 during the time period may affect corporate tax revenues.³⁰

Finally, we study whether the responses to the Finnish IB differ according to the intensity of the treatment. We expect the response to be larger among those companies whose interest deductibility is restricted the most (H10). 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 at least by 75% due to the reform. However, the number of these firms is only 105 out of all 396 treated companies. We added a dummy variable to indicate the high-intensity treatment to separate the effect for this group from the overall response. The results for the treatment intensity are provided in Table 5. The results clearly show that only these most affected firms reduced their financial expenses. Interestingly, the level of overall debts also

³⁰We also study the possible differences in responses between parent companies and their subsidiaries (hypotheses H1 - H7). Table 8 in the Appendix collects these results. In the regressions we interact the DD variable with a dummy variable of whether or not a firm has a 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 no differences in their behavior for any of the other outcome variables.

Table 5: Econometric results for treatment intensity

VARIABLE (logs)	(H1)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)
	Financial Expenses	Overall Debt	Long-Term Debt	Short-Term Debt	EBITDA	Turnover	Corporate taxes
Anticipation (2012-13)	-0.025 (0.036)	-0.080*** (0.024)	-0.272*** (0.073)	-0.007 (0.033)	0.093** (0.038)	0.205*** (0.023)	-0.096 (0.073)
After (2014-15)	-0.469*** (0.038)	-0.252*** (0.026)	-0.394*** (0.084)	-0.015 (0.035)	0.166*** (0.039)	0.205*** (0.024)	-0.208*** (0.081)
Anticip. x Treatment (DD1)	-0.151 (0.110)	0.099 (0.075)	0.187 (0.195)	0.092 (0.101)	-0.141 (0.089)	-0.106 (0.065)	0.149 (0.201)
After x Treatment (DD2)	-0.010 (0.116)	0.086 (0.078)	-0.098 (0.219)	0.097 (0.105)	-0.130 (0.093)	-0.084 (0.067)	0.206 (0.214)
Anticip. x Tr. x High-Int.	-0.248** (0.123)	-0.206** (0.083)	-0.328 (0.223)	-0.073 (0.112)	0.370*** (0.115)	0.097 (0.073)	-0.081 (0.237)
After x Tr. x High-Int.	-0.333*** (0.129)	-0.167* (0.086)	-0.114 (0.247)	-0.171 (0.116)	0.255** (0.118)	0.035 (0.076)	-0.256 (0.250)
Constant	14.125*** (0.048)	18.115*** (0.031)	16.596*** (0.098)	16.736*** (0.043)	14.892*** (0.062)	16.509*** (0.031)	12.428*** (0.104)
Observations	7,702	7,976	3,182	7,923	3,936	7,012	4,060
R-squared	0.059	0.053	0.022	0.017	0.019	0.054	0.004
# of firms	1,250	1,254	725	1,253	835	1,172	1,070

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

decreases among these firms. Separating short- and long-run debts from the overall debt we do not find statistically significant estimates that is likely due to reduced power, following the split of the data in these regressions. Finally, we also observe an increase in the amount of EBITDA for these firms. This is also according to our hypothesis and indicates that the reform succeeded in blocking some parts of the debt-shifting motivated by tax reasons.³¹

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, we study the responses of companies that are located in Finland and are part of a MNE. 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 any 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. Therefore, this treatment group contain more firms than the one in our baseline estimations, and probably include some firms that we not actually affected by the reform. The control group contains a similarly constructed population of firms located in Sweden and Denmark. Note also that we also cannot offer the group-level clustered standard errors for the estimates.

Table 6 shows the results. The estimates are 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 general, the size of the point estimates presented in Table 6 are similar to our baseline estimates.

In Figure 4 we already compared the treatment group to an alternative comparison 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 7. The estimates are qualitatively very similar to those presented in our baseline estimations in Table 3. However, it is noticeable that the size of the responses are somewhat larger in financial expenses and all debt levels compared to the baseline estimates.

³¹We 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 6: Econometric results for the companies located in Finland

VARIABLE (logs)	(H1)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)
	Financial Expenses	Overall Debt	Long-Term Debt	Short-Term Debt	EBITDA	Turnover	Corporate taxes
Anticipation (2012-13)	-0.025 (0.037)	-0.081*** (0.026)	-0.085* (0.049)	-0.044 (0.036)	0.129*** (0.028)	0.123*** (0.019)	-0.207*** (0.059)
After (2014-15)	-0.526*** (0.046)	-0.251*** (0.036)	-0.166*** (0.061)	-0.112** (0.044)	0.210*** (0.033)	0.078*** (0.025)	-0.443*** (0.077)
Anticip. x Treatment (DD1)	-0.279*** (0.066)	-0.043 (0.046)	-0.166* (0.095)	0.064 (0.060)	0.074 (0.062)	0.011 (0.042)	0.124 (0.154)
After x Treatment (DD2)	-0.129 (0.100)	0.009 (0.061)	-0.259** (0.113)	0.161** (0.071)	-0.040 (0.075)	0.051 (0.051)	0.341* (0.178)
Constant	13.777*** (0.095)	17.933*** (0.059)	16.432*** (0.132)	16.185*** (0.064)	14.578*** (0.115)	15.516*** (0.097)	12.356*** (0.149)
Observations	9,581	9,830	3,909	9,732	5,670	8,967	5,052
R-squared	0.065	0.042	0.026	0.014	0.028	0.105	0.016
# of firms	1,488	1,488	866	1,483	1,163	1,416	1,277

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. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Econometric results for using 2nd control group from Finnish companies belonging to MNEs but not affected by the reform

VARIABLE (logs)	(H1)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)
	Financial Expenses	Overall Debt	Long-Term Debt	Short-Term Debt	EBITDA	Turnover	Corporate taxes
Anticipation (2012-13)	0.032 (0.033)	0.081*** (0.022)	-0.087** (0.037)	0.156*** (0.022)	0.104*** (0.026)	0.165*** (0.017)	0.042 (0.050)
After (2014-15)	-0.137*** (0.046)	0.029 (0.029)	-0.154*** (0.047)	0.160*** (0.029)	0.148*** (0.035)	0.156*** (0.023)	-0.017 (0.057)
Anticip. x Treatment (DD1)	-0.388*** (0.074)	-0.213*** (0.045)	-0.218*** (0.078)	-0.124** (0.058)	0.031 (0.067)	0.001 (0.034)	-0.035 (0.139)
After x Treatment (DD2)	-0.588*** (0.103)	-0.325*** (0.054)	-0.398*** (0.118)	-0.209*** (0.058)	0.009 (0.082)	-0.017 (0.048)	-0.140 (0.154)
Constant	11.137*** (0.048)	15.582*** (0.032)	13.762*** (0.059)	14.778*** (0.032)	12.968*** (0.043)	15.317*** (0.032)	10.603*** (0.065)
Observations	10,976	11,706	5,473	11,676	8,336	11,343	7,280
R-squared	0.032	0.042	0.028	0.035	0.015	0.069	0.002
# of firms	1,869	1,871	1,189	1,871	1,615	1,852	1,663

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

7 Conclusions

This paper has studied the responses of MNEs to the Finnish IB. This is the first study that evaluates the effects of IB in the case when there was no pre-reform restrictions on the deductibility of interest expenses. This is also the first study that evaluates the effects of interest barrier by using comparable MNEs from other similar countries as a control group. Employing the Orbis database with other Nordic MNEs serving as a control group for Finnish MNEs, we find evidence that the introduction of an interest barrier decreases the debt-shifting of 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. We also find that the response is heterogeneous and that only the most affected firms respond to the IB. These firms also decrease their debt levels. For the most affected firms, we also find an increase in transfer pricing following after the introduction of IB. Therefore, even though the introduction of this anti-tax avoidance measure restricted debt-shifting, the profit-shifting seems to take another form after the reform, at least to some extent. Regarding real responses in terms of the overall output of these firms, we do not find significant changes following the introduction of the IB.

It is worth noting that the firms may also have other means to avoid tax liabilities that are not described in this paper. These include, for example, decisions concerning the 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 about changes in the group structure and internal transactions of MNEs would be needed to observe whether companies react to the IB by using these measures. To our best knowledge, no comprehensive high-quality data with such information is available yet and thus, these responses are left for future research.

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Appendix

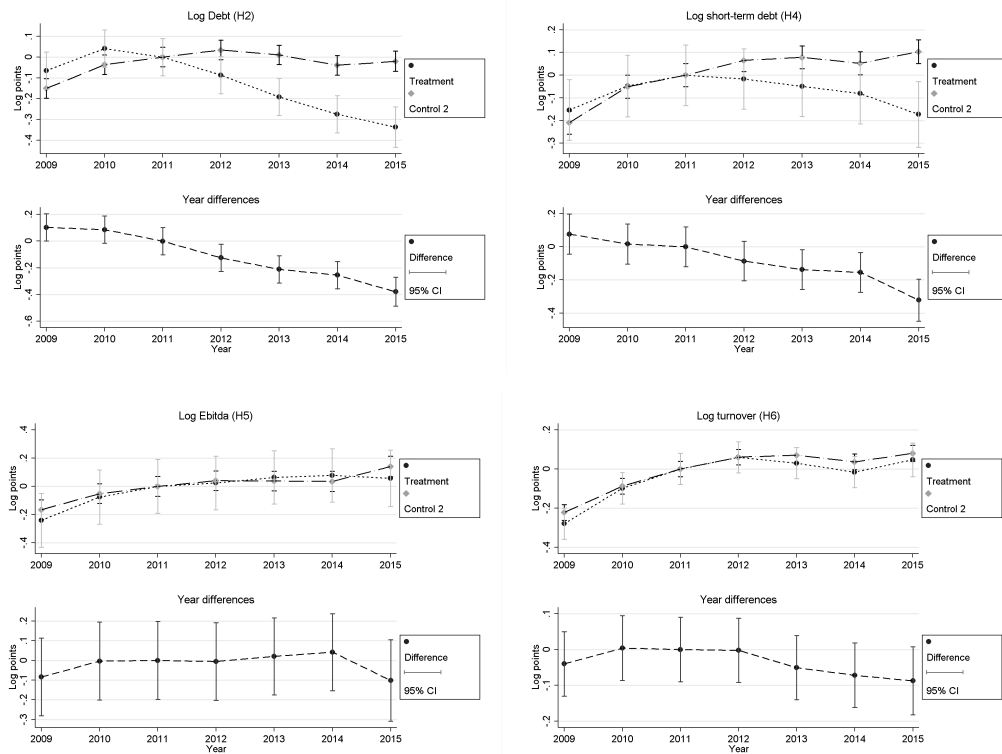


Figure 5: Development of logs of overall debt, short-term debt, EBITDA and turnover of companies of Finnish MNEs (Finns) and alternative control group of companies of Finnish MNEs that were not affected by the reform (Control 2nd)

Table 8: Econometric results for parents and subsidiaries

VARIABLE (logs)	(H1)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)
	Financial Expenses	Overall Debt	Long-Term Debt	Short-Term Debt	EBITDA	Turnover	Corporate taxes
Anticipation (2012-13)	-0.025 (0.043)	-0.080** (0.034)	-0.272* (0.164)	-0.007 (0.047)	0.093** (0.041)	0.205*** (0.033)	-0.096 (0.081)
After (2014-15)	-0.469*** (0.064)	-0.252*** (0.048)	-0.394*** (0.125)	-0.015 (0.056)	0.166*** (0.052)	0.205*** (0.045)	-0.208** (0.105)
Anticip. x Treatment (DD1)	-0.361*** (0.106)	-0.040 (0.071)	-0.095 (0.190)	0.107 (0.107)	0.024 (0.125)	-0.022 (0.053)	-0.102 (0.164)
After x Treatment (DD2)	-0.268* (0.154)	-0.065 (0.094)	-0.222 (0.195)	-0.034 (0.104)	-0.131 (0.163)	-0.064 (0.081)	-0.029 (0.230)
Anticip. x Tr. x Parent	0.063 (0.108)	-0.024 (0.070)	0.129 (0.136)	-0.142 (0.103)	0.031 (0.137)	-0.031 (0.059)	0.372* (0.226)
After x Tr. x Parent	0.035 (0.166)	0.058 (0.080)	0.091 (0.221)	0.012 (0.100)	0.193 (0.173)	0.006 (0.083)	0.126 (0.277)
Constant	14.125*** (0.082)	18.117*** (0.076)	16.603*** (0.139)	16.735*** (0.094)	14.895*** (0.112)	16.509*** (0.106)	12.424*** (0.141)
Observations	7,702	7,976	3,182	7,923	3,936	7,012	4,060
R-squared	0.058	0.052	0.021	0.017	0.016	0.054	0.005
# of firms	1,250	1,254	725	1,253	835	1,172	1,070

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. *** p<0.01, ** p<0.05, * p<0.1

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

	(H8)	(H9)
VARIABLE (logs)	Financial revenue	Corporate taxes
Anticipation (2012-13)	-0.112*	0.024
	(0.064)	(0.037)
After (2014-15)	-0.281***	0.135***
	(0.079)	(0.050)
Anticip. x Treatment (DD1)	-0.263**	-0.037
	(0.127)	(0.062)
After x Treatment (DD2)	-0.314**	-0.006
	(0.158)	(0.102)
Anticip. x Tr. x High-Int.	-0.083	-0.100
	(0.159)	(0.136)
After x Tr. x High-Int.	0.035	-0.178
	(0.241)	(0.193)
Constant	10.285***	11.617***
	(0.046)	(0.028)
Observations	10,525	9,598
R-squared	0.012	0.005
# of firms	2,210	2,285

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