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The Importance of Escape Clauses: Firm Response to Thin Capitalization Rules

Abstract

Escape clauses, where small firms are exempt from particular tax rules, is a crucial feature of a number of corporate tax schemes, but creates incentives to avoid taxation by manipulating the measures that determine inclusion. We evaluate the impact of thin capitalization rules, which commonly feature such escape clauses across the world, by exploiting the introduction of these rules in Norway in 2014. Combining difference-in-differences, regression discontinuity and bunching estimates, we show that what appears to be a strong response in the capital structure among exposed firms primarily reflect within-group reallocation of debt to avoid exposure to the rules. We observe sharp bunching among both new and existing subsidiaries at both thresholds for rule inclusion, and find that internal corporate group debt is offloaded to these bunching subsidiaries in order to avoid additional tax costs. As a result, significant and large effects on firm-level capital structure in response to the thin capitalization rules is driven by reshuffling of capital within corporate groups with little real effects. Re-estimating the difference-in-difference specification at the corporate group level confirms this finding, questioning the extent to which thin capitalization rules affect the real economy due to the presence of escape clauses.

JEL-Codes: H250, H260, G300.

Keywords: thin capitalization rules, capital structure, escape clauses, difference-in-differences, bunching.

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1 Introduction

Strategic use of internal debt within multinational corporations to avoid taxes (debt shifting) has been a major concern among policymakers in the latest decades. To mitigate such behavior, many countries have introduced different versions of thin capitalization rules (TCR) that impose an upper limit on interest deductions. This limit removes the incentive to overleverage firms in high-tax countries by equalizing after-tax prices of debt and equity. However, to prevent adverse effects on small firms, TCRs generally also include several escape clauses or thresholds, below which the rules do not apply. Such escape clauses are also common features of many size dependent regulations such as VAT registration, thresholds for accounting obligations and thresholds for transfer pricing reporting, all of which introduce incentives for bunching below the threshold to avoid additional costs.

This paper analyzes the importance of the escape clauses in thin capitalization rules directly to understand how they allow corporate groups to avoid thin-cap rules. Escape clauses has not previously been analyzed explicitly in the young literature evaluating TCRs, despite being very common features of these rules across the world. Using difference-in-differences and the introduction of a thin capitalization rule in Norway in 2014, we first show that firms exposed to the rule before the introduction respond with a large and significant reduction in their debt-to-asset ratio, suggesting that the regulation has a large impact on firms' financing decisions. To understand how firms adjust to the escape clauses explicitly, we use a bunching and regression discontinuity framework to analyze behavior around the thresholds for inclusion in the scheme. We find that firms bunch at the thresholds, and that this response is accompanied by substantial shifts from external to internal debt among bunching firms. Results indicate an excess mass of new firms in the region right below the threshold, suggesting that corporate groups establish new firms to act as bunchers and reduce total corporate group exposure. For non-bunching firms above the threshold, we find effects in the opposite direction; a reduction in internal debt and increase in external

debt, suggesting that the rule induce coordination of adjustment within corporate groups to avoid exposure to the rule in both bunching and non-bunching firms. In particular, results indicate that non-bunching firms offload internal debt onto bunching corporate members, largely avoiding the impact of the thin capitalization rule.

Our findings highlight that escape clauses intended to ease the administrative burden of new regulation can have important costs by allowing firms and corporate groups to exploit the escape clauses to avoid taxes. Because these escape clauses are extremely common in thin capitalization rules across the world (see table A2 for an overview within the OECD) this is relevant for a large number of countries who have recently implemented such rule sets. Furthermore, our findings may inform other policies that also feature escape clauses based on firm size.

This paper primarily contributes to the literature on evaluations of thin capitalization rules introduced in many countries during the last decade. For long, the most popular rule has been the so-called safe harbor rule, in which deductions are removed above a cutoff in the debt-to-equity-ratio. Because the safe harbor type of regulation was prevalent for a long time the TCR literature is dominated by studies on corporate group subsidiaries facing potential tax costs above a debt-to-equity ratio. Buettner et al. (2012) and Blouin et al. (2014) analyze German and American subsidiaries, respectively, and find that this type of TCR induce firms to reduce the internal debt-to-assets ratio. Similarly, studies on subsidiaries operating in Germany have found that safe harbor rules reduce the incentive to use internal debt (Buettner et al., 2016; Overesch and Wamser, 2010), but also some indications of firms successfully avoiding exposure to the rule by e.g. substitution of debt type (Wamser, 2014; Weichenrieder et al., 2008). de Mooij and Hebous (2017) investigate whether thin capitalization rules successfully reduce the overall group level debt bias. They conclude that regulations punishing internal debt does not induce a drop in the consolidated debt-to-asset-ratio, implying that many variants of TCRs have limited effect on preventing overleveraged firms. This is in line with the findings in this paper.

In recent years many countries (examples include Germany, Finland and Norway) have switched to limiting deductions relative to a percentage share of the firms' EBITDA (or EBIT), frequently referred to as the earnings stripping rule (Ruf and Schindler, 2015; Andresen and Kvamme, 2019). Only a handful of studies have evaluated earnings stripping rules, with mixed results. Harju et al. (2017) study firms in Finnish multinational corporations and find that they respond by decreasing financial costs, but not debt levels. This is at odds with studies of the German case, which estimates reductions in debt-to-assets ratios (Buslei and Simmler, 2012; Alberternst and Sureth, 2015). In the US, the Tax Cuts and Jobs Act of 2017 introduce a similar rule and Carrizosa et al. (2020) find that public firms responds by reducing the debt-to-assets ratio.

In contrast to these studies we rely on bunching and regression discontinuity methods in combination with differences-in-differences, allowing us to explicitly analyze the impact of the escape clauses commonly found in these rule sets. This is novel, despite the common presence of escape clauses that induces strong incentives to bunch. We also fill a gap in the literature by linking effects on the firm and corporate group level.

Second, we connect with a growing number of papers using the bunching approach in a firm setting. This includes a literature on size dependent regulations which often incentivize bunching below thresholds to avoid tax costs or other administrative costs. For example, several papers across several countries analyze the impact of a VAT reporting threshold and show that firms curb sales to bunch below the threshold and avoid additional taxes (Harju et al., 2016; Liu et al., 2021; Onji, 2009; Muthitacharoen et al., 2021; Boonzaaier et al., 2019). Other policies that have been studied in this literature includes a country-specific threshold for employees in France and thresholds for accounting obligations in Armenia (Asatryan and Peichl, 2017; Askenazy et al., 2022). This paper is most closely related to Bachas and Soto (2018) who use the bunching framework in a setting with Costa Rican firms facing a shift in average corporate taxes at particular values of revenue to estimate the elasticity of taxable income. Other notable studies that have applied a bunching framework in a firm setting

include Coles and Smith (2019); Devereux et al. (2014); Chen et al. (2021).

The paper proceeds as follows. Section 2 describes the institutional setting , while section 3 describe the data and sample selection. Our two empirical strategies are described in section section 4, and section 5 provides our reduced form results and robustness checks. Section 6 concludes.

2 Institutional setting

Norway employs a corporate income tax with a rate of 22 percent, slightly above the OECD average (20.6 % in 2020), but close to neighboring countries.[1] As with most corporate income tax schemes, interest costs are deductible, while there is no allowance for the user cost of equity. This bias is counteracted in the personal income tax scheme with a more lenient taxation of dividends compared to interest income.[2] For a shareholder originating in Norway, these two systems could neutralize the financing decision entirely. However, for a small open country as Norway, it is normally assumed that the rate of return requirement on corporate equity before personal taxes is determined by international investors on the world capital markets (Lindhe and Södersten, 2012).

In line with many other European countries, Norway responded to the OECD Base Erosion and Profit Shifting (BEPS) initiative by introducing restrictions on interest deductions for firms to reduce the problem of profit shifting.[3] One of the channels for such practices has long been recognized as debt shifting, where corporate groups inflate interest costs in high tax countries and transfer revenue to low tax countries through internal lending, taking advantage of the tax differential. The rules apply for all firms with both 1) net interest cost above NOK 5 million (approximately 500,000 euro) and 2) net interest cost above 30

[1] From the years 1992-2013 the rate was held constant at 28 percent, before gradually being lowered down to 22 percent in 2019. These tax cuts should decrease the incentive to overleverage, and happened during our sample period, but should not affect our results as they apply to all firms.

[2] Individuals are only liable to a tax above a rate-of-return allowance for dividends. The dividends tax was increased during the sample period in order to counteract the lowered corporate income tax and keep the taxation of labor earnings and capital gains roughly similar.

[3] An overview of these rules across OECD countries can be found in table A2

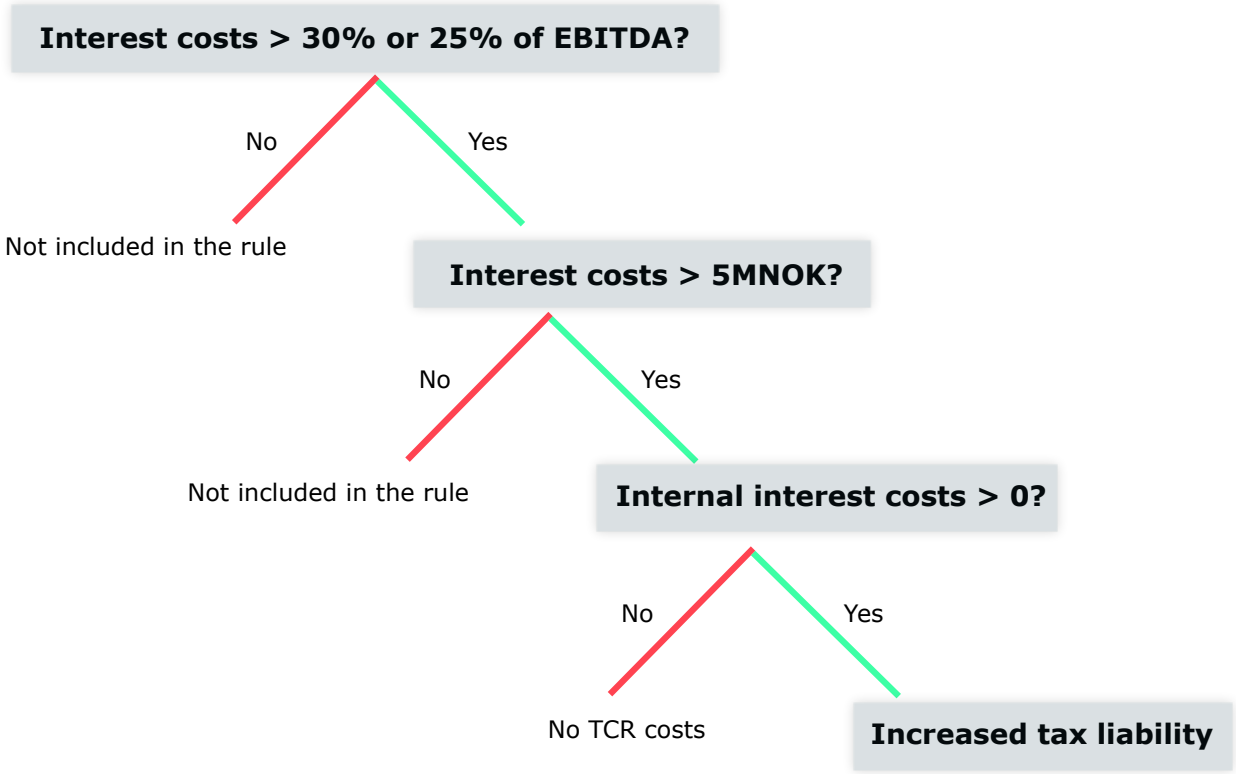


Figure 1: Thin capitalization rules in Norway

Firms with both interest costs above 30% (25% from 2016) of EBITDA and interest costs> NOK 5 million are included in the TCR. However, if the firm has no internal interest costs, there are no consequences of crossing the thresholds.

percent of earnings before interest, tax, depreciation and amortization (EBITDA).[4] Once a firm exceeds the two thresholds, its tax liability may increase. The aim of the regulation is to disallow internal interest costs above the threshold. Internal interest costs is defined in the tax act as interest payments from a firm to a firm or person which directly or indirectly owns or controls at least 50 percent of the firm. The most important categories here are loans between entities in the same corporate group and loans guaranteed for by a controlling entity.

Although there are two conditions that has to be met by a firm to be included in the rule, only one will be binding for each firm. For small firms with sufficiently low EBITDA,

[4]The regulation has been changed two times since its inception. In 2016, the threshold was lowered to 25 percent of EBITDA. In 2019, special rules for corporate groups were added with targeting of external interest costs in addition to internal interest costs. The 2019 version is not studied in this paper.

30% (25% from 2016) of EBITDA is smaller than NOK 5 million and the binding threshold will therefore be NOK 5 million. For firms with larger EBITDA, it is the other way around. To avoid extra taxes, firms with a small EBITDA thus have an incentive to bunch at the threshold of NOK 5 million in total interest costs, while larger firms have an incentive to keep total interest costs below 30% or 25% of EBITDA.

For firms exceeding both thresholds the increase in the tax base is decided by the rule:

$$\max(0, \min(z_I, z - \max(0, \eta \cdot EBITDA)))$$

where z_I is internal interest costs and z is total interest costs. η is either 30% or 25% depending on the year. In words, the smaller of internal interest costs or the difference between total interest costs and the maximum allowance is added to the tax base as long as it is nonnegative.

Based on the design of this rule, we make several important observations: 1) The increase in tax base at the threshold is in general different for each firm, as it depends on earnings and capital structure. 2) A necessary condition for increased tax costs is positive internal interest costs. 3) The difference between total interest cost and the maximum allowance can only be smaller if external interest cost are lower than the allowance ($z - z_I < \eta \cdot EBITDA$). To see this, note that internal interest costs enters in both arguments, and the decisive factor is the size of external interest costs relative to the allowance.

Finally, the consequences of crossing the threshold is different depending on which of them that binds. In particular, smaller firms facing the NOK 5 million threshold can potentially accumulate tax costs below the threshold which will be levied as additional taxes when they cross. To see this, note that to reach NOK 5 million in total interest costs, small firms will first exceed the condition of total interest cost above the allowance ceiling, making the second term argument in the rule positive. As a result, the added tax cost at the threshold can be quite large, and the firms facing this threshold will in general face a notch in the tax

function at the threshold.

At the threshold for large firms, there is no extra tax cost, but every unit of internal debt is now more expensive because the costs are no longer tax deductible. These firms therefore face a kink in the price of internal debt at 30% or 25 % of EBITDA.

3 Data and sample selection

For the empirical analysis we combine rich register data for the universe of public and non-public limited liability companies in the period 2007-2018. The main registry data sources are income statement and balance sheet data as reported to tax authorities as part of tax returns each year, in addition to firm accounts data reported separately. We link these data with the national register of business enterprises and the shareholder register, which gives us useful information such as the sector type, the number of employees and ownership structure. Importantly, we can also link firms to corporate groups, using a definition of corporate groups that requires shareholder majority, i.e. directly or indirectly owning at least 50 percent of firm shares. This definition coincides with the definition of corporate groups regularly used by Statistics Norway and Norwegian tax authorities.

Firms that exceeds the two thin-cap thresholds are also required to give a detailed report on interest costs and affiliations to related parties to the tax authorities. We have access to these reports, but since we mainly study firms that allocate below the thresholds to avoid the TCR, this information is only relevant for a small part of our estimation samples.[5] Together with the registers mentioned above, we use these forms to separate foreign controlled multinational corporations (FMNC's) from domestic controlled multinationals (DMNC) and purely domestic corporate groups and firms.

We do not observe interest rates, but we observe debt and interest costs as reported annually in the firms' tax return and balance sheet data. To separate internal and external interest costs, we exploit that firms are asked to separate intra-group interest costs from total

[5]Formally, this form is referred to as RF-1315.

interest costs. A caveat at this point is that the definition of intra-company interest cost is wider under the thin-cap rule, as it includes loans guaranteed for by a related firm. Since most firms in our sample do not cross the relevant threshold, they do not have to report information on guaranteed loans. However, by examining the detailed reports from the firms that do file them (approximately 1,000 firms each year), we find that only about one percent have such arrangements, and the discrepancy between two figures should therefore be small.

EBITDA is not directly reported by firms below the threshold, but it is straightforward to construct this measure from variables in the tax records. We compare this estimate with the reported EBITDA for firms that file the thin capitalization rules form, and find a very strong correlation (0.98).

To construct our bunching samples we start with all limited liability firms in Norway in the period 2014-2018.[6]. We exclude firms in the financial, oil and shipping sectors as these are taxed under special schemes. Next, we separate firms into notch and kink samples based on their earnings. Specifically, the notch sample will contain firms with EBITDA below NOK 16.7 million or 20 million (depending on year, the EBITDA threshold was changed from 30% to 25% in 2016), and the kink sample will contain firms with EBITDA above these limits. We finally limit attention to firms relatively close to the relevant threshold at 2 to 14 million NOK in net interest costs for the notch sample and 5% to 65% for the kink sample.

To construct the difference-in-differences sample, we use the same data as above, but we require that firms are present in the sample in 2012, in order to construct our treatment and control groups prior to the announcement of the reform. We furthermore restrict attention to firms with net interest costs above NOK 2 million in 2012 so that we compare firms that have substantial debt costs that could potentially be disallowed. We expand this sample of firms to a panel across the years 2007-2018, which means that the sample is imbalanced due to sample entry and exit. We finally drop a small number of outliers that have debt-to-asset ratios below 0 or above the 99th percentile.

[6]Placebo samples for the years 2010-2012 are constructed analogously.

To construct the difference-in-differences sample at the corporate group level, we start with all firms that belong to a corporate group in 2012. We sum our measures of firm-level exposure to the thin capitalization rules at the corporate group level, and define a corporate group as treated if it has at least one member that is exposed to the rules in 2012.

We construct a close proxy of the consolidated debt-to-asset ratio by taking the ratio of the sum of external debt to the sum of external assets across all corporate partners, subtracting from each debt to and assets held in corporate partners. We note that we can only measure Norwegian corporate partners, so that this measure of consolidated debt-to-assets ratio is for the Norwegian part of the corporate group only. As in the firm case, we exclude group-years with debt-to-asset ratios below 0 or above the 99-th percentile.

Table 1 show descriptive statistics for the bunching and firm-level difference-in-difference samples, along with all firms for comparison. We observe that the subsamples used in the bunching analysis consists of mainly private limited companies and 9 out of 10 firms are part of a corporate group. Compared to the full population, we also note that the share of companies in a multinational corporate group is substantially larger in both subsamples.

Firms in the notch sample are smaller (by construction) than those in the kink sample, but still larger than the average firm in the population. Firms in the notch sample are also characterized by having on average a negative taxable income because deductions are larger than earnings. We believe that this is mainly due to a reallocation of profits within corporate groups to concentrate the tax position at the top level. Although a firm with negative taxable income will have no de facto additional tax payment when crossing the TCR threshold in the same fiscal year, the firm still has an incentive to avoid being included in the scheme in order to accumulate a larger loss-carry forward[7] for preceding years, as well as possibly using less intra-group contributions which increases tax liabilities at the receiving firm.

[7]There is also a separate carry-forward scheme for unused thin capitalization rules allowances that may be applied in future years when a firm exceeds the threshold.

Table 1: Descriptive statistics

A: Bunching samples, 2014-2018

	Notch sample		Kink sample		All firms	
EBITDA	3.15	(21.9)	88.7	(224.7)	1.01	(30.4)
Taxable profit	-3.83	(22.9)	33.5	(150.5)	0.37	(26.6)
Total debt	167.8	(280.8)	1210.7	(12225.2)	20.2	(980.9)
Total internal debt	57.0	(193.1)	455.9	(4139.0)	6.46	(331.9)
Equity	105.2	(525.0)	777.3	(8423.2)	18.0	(730.0)
Interest costs	4.18	(2.37)	18.5	(57.2)	0.23	(16.5)
Debt-to-assets-ratio	0.87	(1.04)	0.68	(0.26)	0.86	(1.76)
Investment	8.28	(35.6)	51.7	(166.8)	1.20	(26.6)
Employees	35.3	(148.3)	200.6	(682.3)	10.1	(90.8)
Number of shareholders	19.7	(298.8)	183.7	(3380.8)	6.48	(323.2)
Assets	273.0	(668.0)	1988.0	(20487.4)	38.2	(1677.3)
Share foreign multinational	0.16	(0.37)	0.27	(0.45)	0.078	(0.27)
Share domestic multinational	0.14	(0.35)	0.23	(0.42)	0.050	(0.22)
Corporate income tax	0.17	(0.51)	9.05	(36.0)	0.20	(4.04)
Share in corporate group	0.89	(0.31)	0.93	(0.25)	0.42	(0.49)
Share of subsidiaries	0.75	(0.43)	0.83	(0.38)	0.31	(0.46)
Observations	16,508		4,714		1,288,475	

B: Difference-in-difference sample at the firm level, 2012

	Control group		Treated group		All firms	
EBITDA	42.2	(521.6)	34.0	(129.8)	1.43	(98.3)
Taxable profit	22.6	(514.3)	-17.9	(77.4)	0.79	(72.0)
Total debt	335.0	(929.1)	1102.9	(3503.7)	22.9	(789.8)
Total internal debt	83.2	(354.5)	784.4	(2763.0)	8.81	(369.2)
Equity	172.4	(735.2)	488.8	(2288.3)	17.4	(774.9)
Interest cost	8.45	(20.8)	39.5	(120.0)	0.12	(80.1)
Debt-to-assets ratio	0.81	(0.26)	0.79	(0.26)	0.82	(1.59)
Investment	25.9	(194.0)	32.9	(157.6)	1.49	(34.7)
Employees	85.7	(274.5)	87.7	(369.7)	10.5	(99.1)
Number of shareholders	64.4	(718.9)	59.1	(1028.1)	7.28	(358.5)
Assets	507.5	(1540.3)	1591.7	(5415.1)	40.3	(1487.3)
Share foreign multinational	0.15	(0.35)	0.26	(0.44)	0.074	(0.26)
Share domestic multinational	0.20	(0.40)	0.30	(0.46)	0.071	(0.26)
Total taxes	7.63	(143.7)	0.46	(3.61)	0.33	(20.0)
Share subsidiaries	0.73	(0.45)	0.92	(0.28)	0.31	(0.46)
Relative TCR exposure	0	(0)	0.48	(0.30)	0.0024	(0.040)
Observations	3,603		917		204,167	

Notes: The table show averages and standard deviations in parentheses. Panel A shows summary statistics for the two bunching samples in the years 2014-2018. Panel B shows summary statistics for the treatment and control group in the firm-level difference-in-differences sample in 2012, before the introduction of the reform. In both panels the final column shows the same measures for all firms. Non-shares are given in NOK million. One outlier based on assets is dropped from the raw data. A detailed description of the variables can be found in table A1. Descriptive statistics for the corporate group sample is shown in table A3 in the appendix.

4 Empirical approach

In this section we provide a brief overview of the empirical strategies used.

4.1 Difference-in-differences

In order to provide first evidence of the response to the thin capitalization rules, we implement a simple difference-in-differences approach. Using detailed data on tax records, we calculate the exposure to the TCR introduced in 2014, using balance sheet data for 2012. Because the reform was announced in 2013, affected firms had time and incentives to adjust their financial position before 2014 in order to prepare for the introduction of the rules. In particular, exposed firms had a clear incentive to pay down debt in 2013, in order to start the next year with less debt and therefore less exposure to the rule. For this reason, we use 2012 as the base year rather than 2013.

We use two measures of treatment in the difference in differences specification. The first is a simple dummy for whether the firms was exposed to the rule in 2012. Because there is variation in treatment exposure even among treated firms, we also construct a continuous measure of exposure as the ratio the exposure to the total net interests cost in the firm. Thus, this treatment measure ranges from 0 to 1, and averages 0.48 in the treatment group as shown in Table 1. This difference-in-differences approach compares firms with different levels of exposure to the rule, but the primary comparison is to the large part of the sample with zero exposure. Thus, we compare various degrees of exposed firms to firms that were not exposed because they a) did not exceed the 5 million kroner threshold, b) did not exceed the 30% (25%) of EBITDA threshold or c) had no interest costs to related parties.

At the corporate group level, we restrict attention to a binary treatment dummy that measure whether at least one firm in the corporate group were exposed to the rule in 2012.

To estimate our diff-in-diff estimates, we run

$$y_{it} = \alpha_i + \gamma_t + \sum_{t \neq 2012} \beta_t D_i + \epsilon_{it}$$

where D_i is the binary or continuous treatment measure, β_t are year fixed effects and α_i are firm or corporate group fixed effects, depending on specificaton. Standard errors are clustered by corporate group. The outcome is the debt-to asset-ratio. When estimated at the corporate group level, we construct a proxy of the consolidated debt-to-asset ratio by substracting debt to and investments in corporate partners before summing these measures at the corporate group level and constructing the ratio.[8]

Like all difference-in-differences-applications, causal interpretation of β_t as the effect of thin capitalization rules on the average debt-to-asset ratio of treated firms in year t relies on a common trend assumption: In the absence of the introduction of thin capitalization rules, the debt ratio of treated and control firms (or corporate groups) would follow the same trend. When we use a continuous treatment measure, this needs to hold across all levels of treatment: More exposed firms would have followed the same trend in debt-to-asset ratios as less exposed firms in the absence of TCR rules.

4.2 Bunching and regression discontinuity framework

To estimate the bunching response, we use a variant of the polynomial strategy, developed by Chetty et al. (2011). The idea is to estimate the distribution of firms in the unmanipulated region away from the relevant threshold, and use this counterfactual distribution to infer the excess number of firms allocated at or close to the threshold. A challenge with this approach is that it ignores distortion of the running variable above the threshold also for non-bunching agents. In our case, firms above the threshold will face a higher after-tax cost of debt and so has an incentive to reduce their use of debt, even when they do not bunch.

[8] Appendix figure A6 shows results for the naive debt to-to-assets ratio, where we have not attempted to subtract internal debt and assets. Results are very similar.

Chetty et al. (2011) provides an ad-hoc solution to this by iteratively adjusting frequencies above the cutoff, on which we propose an improvement below.

For the notch sample we use a bin size of 100,000 NOK, an 8th order polynomial[9] and visually specify the lower bound of the excluded region to be 4.5 million NOK. For the notch sample, we believe the large additional tax burden imposed at the threshold by far dominate the incentives to reduce interest costs above the threshold. This is in line with most papers analyzing proportional notches (see e.g. Kleven (2016)), who ignore the change in incentives caused by the change in the marginal tax rate and focus on the large additional tax burden at the notch. In our case, the size of this notch is heterogeneous and depends on earnings and the use of internal debt. To provide one example, firms who allocated in the region of missing mass[10] between NOK 5 and 6.3 millions in the placebo years 2010-2012 would have increased their tax base with on average NOK 1.44 million if the TCR rules from 2014 had been in place, so the notch is very sizable.

To specify the upper bound of the excluded region in the notch case, we start with the simple idea that the number of excess firms in the region of excess mass should equal the number of missing firms in the region of missing mass, building on the idea that the population of firms is constant. As we show below, however, the reform seems to induce the creation of new firms to act as bunchers. To account for this, we exploit that our framework for investigating alternative response among bunchers, building on Diamond and Persson (2016) and outlined below, allows us to estimate the share of bunchers that are newly established firms. We therefore use an iterative procedure, increasing the upper bound of the excluded region until the number of bunching firms net of newly established bunching firms equal the number of firms missing in the region of missing mass. This procedure yields

[9]The choice of polynomial order is based on the Akaike Information Criterion for both the notch and the kink estimations. In the notch case the AIC decreases monotonically in increasing polynomial order up until the 8-th, then increases. We show robustness to these choices in Appendix Table A4

[10]Throughout the paper we refer to the regions of excess mass and missing mass. The region of excess mass is the region below the threshold where firms are bunching. The region of missing mass is the region above the threshold where there is a missing mass due to bunching. The two regions together make up the bunching window from which we exclude data in estimations.

an excluded region that extends to 6.3 million NOK.

For the kink samples, the running variable is interest costs relative to EBITDA. We use a binwidth of 0.01 and a 6-th order polynomial. Bunching is more diffuse around the kink than the notch, which is expected due to the considerably smaller consequences of slightly crossing the threshold. We visually determine the bunching region, and consider the first bin above the cutoff to be part of the bunching region along with 3 bins below. We set the upper bound of the bunching region to include the 7 following bins, matching well the observed hole in the density that is particularly visible for the later years.

In the kink case, it is less reasonable to abstract from the distortion among non-bunching firms above the threshold, as these face the same increased after-tax price as the bunching firms. Chetty et al. (2011) propose an iterative adjustment procedure to account for this by shifting the bins above the threshold upwards until the bunching mass equals the missing mass above the cutoff. While simple and leading to a counterfactual density estimate that integrates to the number of firms in the sample, this procedure is inconsistent with the underlying theoretical model of bunching in the labor supply setting, which implies that all individuals shift earnings proportionally in response to the higher tax rate. To be consistent with this idea, instead of shifting bin counts up like Chetty et al. (2011), we proportionally shift all firms above the threshold to the right before reconstructing bins, iterating until the excess mass at the cutoff equals the missing mass above.

Like all bunching applications, consistent estimation of the number of bunching individuals relies on smoothness of the counterfactual density so that we can extrapolate from the relationship estimated outside of the manipulated region. We provide robust placebo evidence that this extrapolation is sound in our setting as there is no bunching in neither of our placebo samples. Furthermore, the bunching estimator relies on correctly specifying the bounds of the excluded region. We note that we throughout this paper only estimate reduced form parameters, so that most of the criticism that the bunching estimator cannot estimate the elasticity of taxable income is not relevant (Blomquist et al., 2021; Bertanha

et al., 2021).

Next, we want to understand both who the bunchers are and how they adjust in order to bunch. In order to understand this in the notch case,[11] we apply methods developed by Diamond and Persson (2016). The intuition is that sharp discontinuities in the relationship between an outcome and the running variable as we enter the bunching region from below are informative about the mean of this variable among bunchers, because this region consists of a combination of bunchers and firms who would have allocated here in the absence of thin capitalization rules. Likewise, sharp deviations in the relationship between the outcome and the running variable as we enter the region of missing mass from above provides evidence on the counterfactual mean of bunchers, because these firms are missing from this region.

To exploit this intuition, we estimate separate local linear regressions of the relationship between each potential endogenous variable x and the running variable z separately in samples below and above the cutoff, excluding the bunching region. Because our excluded region is large, amounting to a very large donut in RD-terms, optimal binwidth selectors (Calonico et al., 2019) are inappropriate. We therefore use the range of the data on either side to construct triangular weights, implying a bandwidth of 3 million kroners below the threshold and 9 million above, where there is considerably fewer firms.

We follow Diamond and Persson (2016) in referring to the difference between the mean among bunchers and the counterfactual mean as "bunchers LATE", a treatment effect of bunching or as part of the bunching response. This treatment effect is relative to the case where TCR rules had applied everywhere, so that we can think of it as a treatment effect of the presence of an escape clause. Alternatively, we can use this approach to characterize bunchers by using x that are predetermined.[12] By comparing the counterfactual mean of x to the average in the region of missing mass, we can illustrate what firms are more likely

[11] Remember we have assumed away response in z for non-bunching agents, as the incentives for these agents are dwarfed by the incentives to bunch. In the kink case, this is considerably more challenging. We therefore concentrate on the notch case in the following.

[12] When x are predetermined and we aim to characterize bunchers, we follow Homonoff et al. (2020) and use a single local linear regression.

to be bunchers. For predetermined variables, this also provides us with a placebo test. If a firm with a particular predetermined characteristic is more likely to bunch, that type of firm should be missing from the region of missing mass if these regions are correctly specified and the assumptions of the bunching framework hold.

Finally, our approach incidentally also estimates a regression discontinuity estimate. Although this estimate is based on a very parametric specification because of the large donut required to exclude the manipulated region, this provides some evidence on the response of the non-bunching firms that remain above the cutoff.

In order to consistently estimate the mean among bunchers, we require the counterfactual relationship between x and z estimated from the local linear regressions to be smooth. If this holds, we can estimate the counterfactual mean among non-bunchers in the bunching region and from this and the bunching estimates back out the mean for bunchers. In order to construct the counterfactual for bunchers, however, we also require all bunchers to come from the region of missing mass. This, as we will show, is a strong assumption, as the reform provided incentives to establish new firms and split assets to exploit the threshold. To verify that the violation of this assumption is not driving our estimates, we later re-estimate these treatment effects in the sample of stable firms.

Standard errors are constructed by bootstrap with 250 replications, clustering at the corporate group level to account for any within-group correlation of errors across years or firms.

5 Results

In this section we show reduced form evidence of response to the thin capitalization rules. We begin with estimates for initially exposed firms from the difference-in-differences specification. Next, we explore how this response is driven by strategic allocation around and above the two thresholds introduced in the TCR. Third, we estimate treatment effects

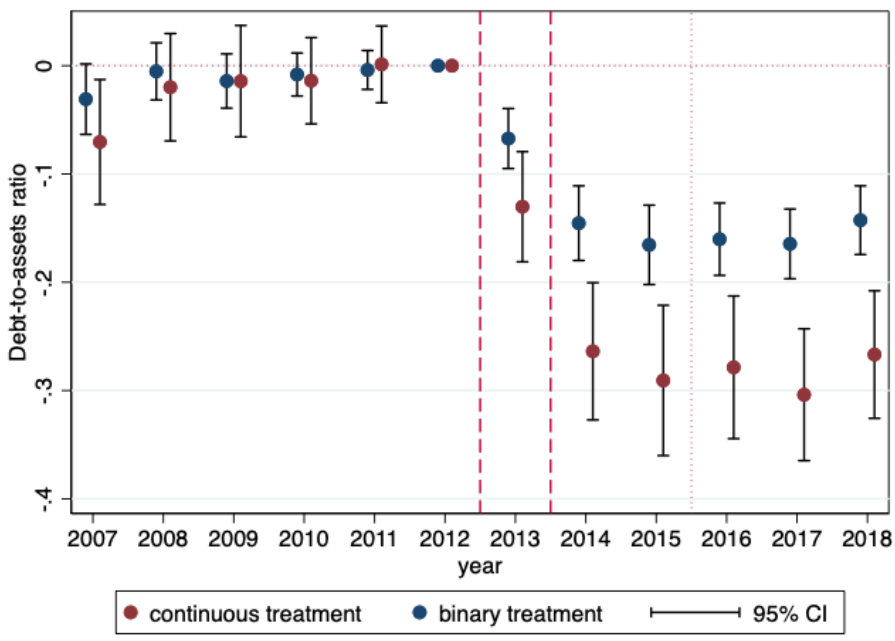


Figure 2: Difference-in-differences estimates: Firm level

Notes: Difference-in-differences estimates of the impact of thin capitalization rules on firm debt-to-assets ratio. Binary treatment is a dummy for firms that would be disallowed deductions of interest costs if the rules were implemented in 2012, two year prior to the actual reform year. Continuous treatment is defined as the amount of disallowed interest costs deductions scaled with the net interest costs in 2012. 95% confidence intervals account for clustering at the corporate group level.

for bunchers and non-bunchers around the first threshold in order to understand how they adapt their capital structure. Finally, we return to the difference-in-differences specification, estimating outcomes at the corporate group level to capture substitution of debt between corporate partners. We end with multiple robustness checks designed to probe the validity of the identifying assumptions.

5.1 Difference-in-difference estimates

We begin with presenting the motivating difference-in-difference estimates in Figure 2. Pre-trends indicate that the treatment and control groups are fairly similar before the reform, with point estimates close to zero and insignificant. In contrast, the anticipation and post-effect coefficients indicate sharp changes in firm financing decisions, with drops in the debt

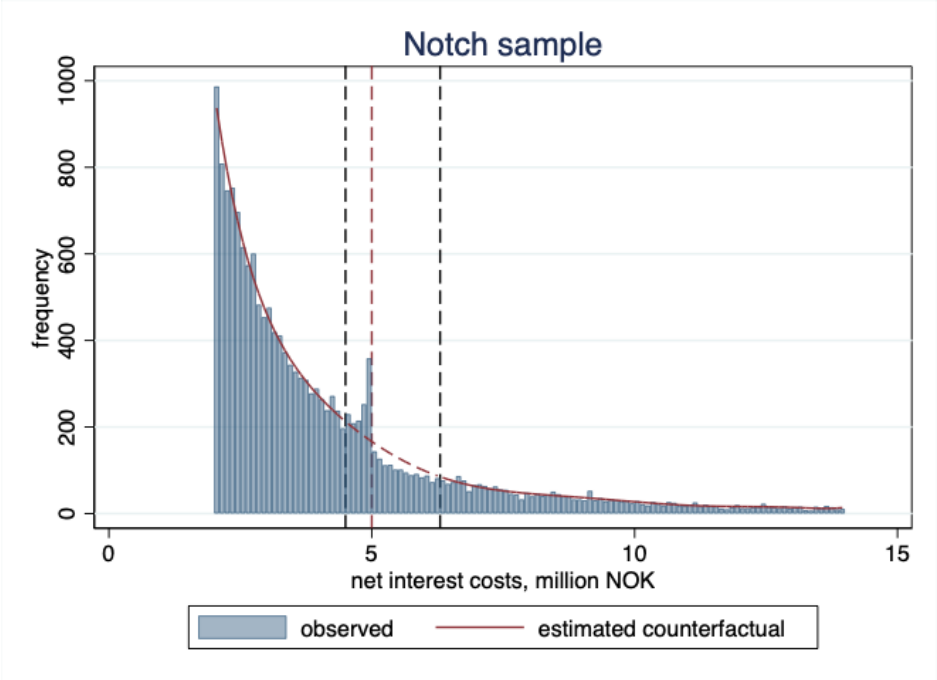
ratio of the treatment group relative to the control group. The binary treatment results suggest that exposed firms reduce debt-to-assets ratios by around 16 percentage points compared to treated firms, while the continuous treatment measure scales these estimates to around 25 percentage points to measure the impact of all interest costs being disallowed.[13] Notice that for years 2016 and later, this includes the effect of a tightening of the TCR by lowering the allowance from 30 to 25 percent, to the extent that these exposed firms are the same firms as those in our treatment group.

These estimates are considerably larger than previous studies of earnings stripping rules (Buslei and Simmler, 2012; Alberternst and Sureth, 2015). At first glance, this suggest that the thin capitalization rules had massive impacts on firm capital structure. These estimates, however, ignore the strong incentives to shift interest costs within corporate groups in order to minimize group-level exposure to TCR, which we turn to next.

5.2 Bunching estimates

To explore how the escape clauses are used to minimize exposure to the TCRs, we begin with presenting bunching estimates in Figure 3, with Table 2 providing details.

[13]Recall that the average treated firm has a treatment exposure of 0.48, indicating that 48% of their net interest costs would be disallowed if the rules had applied in 2012.



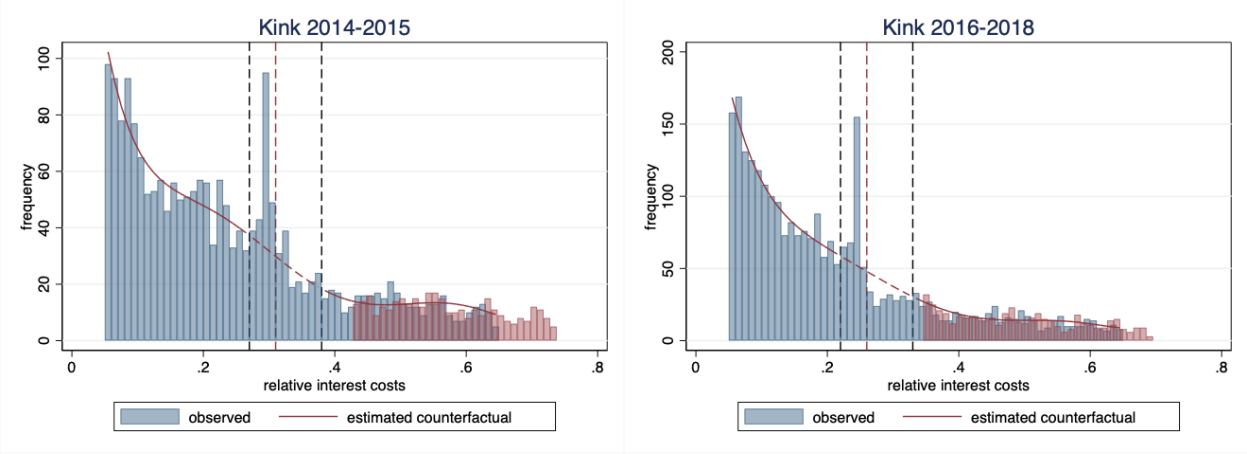


Figure 3: Bunching estimates

Notes: Observed distribution (blue bars) and the estimated counterfactual distribution (red line) at the notch and kink thresholds for the years 2014-2018. Black lines mark the excluded region, and red vertical lines mark the threshold. Red bars show the final bin counts after shifting and stretching of the distribution above the threshold to account for a behavioral response for firms impacted by the thin-cap rule (kink sample only).

We observe that the distributions of interest costs or relative interest costs are falling smoothly in both samples before spiking at the relevant threshold. There are more than 300

Table 2: Bunching estimates

	Notch	Kink 2014-2015	Kink 2016-2018
Number of bunchers	321.6***	91.52***	125.9***
	(105.8)	(17.76)	(28.99)
Share of sample	0.0195***	0.0451***	0.0469***
	(0.00623)	(0.00850)	(0.0103)
Share in bunching region	0.254***	0.405***	0.371***
	(0.0634)	(0.0522)	(0.0612)
Lower bound on marginal response	0.203***	0.0342***	0.0285***
	(0.0720)	(0.00823)	(0.00833)
Lower bound on total response	32.12	1.505**	1.743*
	(23.22)	(0.645)	(0.938)
Lower bound on average response	0.0999***	0.0164***	0.0138***
	(0.0347)	(0.00379)	(0.00391)
Required shift		-0.132***	-0.0721*
		(0.0362)	(0.0414)
Observations	16,508	2,027	2,687

Notes: Standard errors in parenthesis. Required shift is the shift of the counterfactual polynomial above the threshold required to fit all agents under the counterfactual. The response of the marginal buncher shows the lower bound of the reduction in z from the marginal bunching firm, while the response for the average buncher is the lower bound of the average reduction in interest costs/relative interest costs for the bunching firms. * p<0.10, ** p<0.05, *** p<0.01

bunching firms in the notch case and around 100 firms in the kink cases, depending on the period. This implies that around 25 and 40 percent of firms found in the bunching region right below the threshold are bunchers, respectively. By fitting the bunching firms under the counterfactual distribution, we infer that the marginal bunching firm in the notch sample reduces interest costs by at least NOK 203,000 to allocate at the threshold. This amounts to around 3.9 percent of the interest cost of the marginal firm under the counterfactual. These estimates must be considered lower bounds of the largest reduction by a bunching firm, because these agents are heterogeneous and may come from anywhere in the region of missing mass.

In the kink case the estimated marginal response is in interest costs relative to EBITDA, which could be manipulated by both interest costs and the size of earnings or other costs. The

marginal firm reduced the ratio of interest costs to EBITDA by around 3 percentage points, or 11 percent. As argued above, firms who choose not to bunch face the same incentive to reduce interest costs as bunching agents, because interest costs are no longer tax deductible. Our estimates of the shift parameter required to fit the bunchers under the counterfactual is informative of the reduction in interest cost among non-bunching firms affected by the thin capitalization rule. This estimate in the kink samples is around -0.13 and -0.07, respectively, indicating that non-bunching firms reduce the ratio between interest costs and EBITDA by 13 and 7 percent. Finally, we note that bunching seems to be sharper in the years 2016-2018, pointing to some role for dynamic adjustment to the rules, although the allowance was also reduced in 2016 to make the rule sharper. At the same time, the evolution of the observed bunching at the kink illustrates that the bunchers are able to swiftly readjust when the threshold moves from 0.3 in 2015 to 0.25 in 2016.

5.3 Who are the bunchers?

Next, we want to understand both who the bunchers are and how they adjust in order to bunch. In order to understand this in the notch case,[14] we employ methods from Diamond and Persson (2016) to investigate how covariates and outcomes change around the bunching region to understand selection into and causes of bunching.

Results to characterize bunchers are found in Table 3, where the first column shows the predicted mean among all firms in the region of missing mass and the second column shows the difference between the estimated mean among bunchers and the first column. This is a measure of sorting: How much larger is the mean of a particular variable for bunchers than the average in the region where they came from. For dummy variables, this may be interpreted as a percentage point increase in the likelihood of bunching among firms with the dummy set to 1. The final column is the ITT estimate, and may be considered a placebo

[14] Remember we have assumed away response in interest costs for non-bunching agents, as the incentives for these agents are dwarfed by the incentives to bunch. In the kink case, this is considerably more challenging. We therefore concentrate on the notch case in the following.

Table 3: Characterizing bunchers

	Mean in missing region		Sorting		Placebo ITT	
Foreign multinational	0.19	(0.011)	-0.042	(0.079)	0.0053	(0.014)
Domestic multinational	0.13	(0.0099)	0.064	(0.077)	0.0050	(0.016)
Share subsidiaries	0.74	(0.0084)	0.13	(0.12)	0.021	(0.014)
Share in corporate group	0.90	(0.0060)	0.12	(0.11)	-0.0029	(0.0084)
Sector: Manufacturing	0.068	(0.0048)	-0.078	(0.060)	0.0020	(0.0078)
Sector: Real estate	0.52	(0.011)	-0.038	(0.095)	0.061***	(0.019)
Sector: Construction	0.10	(0.0059)	-0.033	(0.067)	-0.0086	(0.0085)
Sector: Accomodation	0.0092	(0.0016)	0.00015	(0.016)	-0.0000094	(0.0025)
Sector: Information	0.024	(0.0046)	0.031	(0.031)	-0.0051	(0.0041)
Firm entry>2012	0.24	(0.0097)	0.035	(0.077)	0.024*	(0.014)
Observations	16,508		16,508		16,508	

Notes: Estimated with data for 2014-2018. Bootstrapped standard errors in parenthesis, clustered by firm. Stars only used in column 2 and 3. * p<0.10, ** p<0.05, *** p<0.01

test in this setting: If the assumption of constant population holds, the exclusion region is correctly specified and we correctly predict the counterfactual means in the two excluded regions, the excess value in the bunching region should exactly equal the missing value in the region of missing mass. This is a robustness check not previously exploited in the literature.

We obtain positive estimates for a few characteristics such as the share of subsidiaries, indicating that subsidiaries are more likely to respond by bunching. This is not surprising, given that these firms are more likely to depend on internal debt to other members of the corporate group and thus would face larger consequences of the thin capitalization rules. However, the precision in these estimates is low and none of the sorting estimates are significant at conventional levels. At the same time, the suggested placebo ITT in column 3 is significant for firms belonging to the real estate sector. This may shed some doubt on the assumptions underlying the bunching framework.

The final row of Table 3 shows estimates for a dummy of a firm being established in or after 2013 in order to investigate the tendency for corporate groups to establish new firms to exploit the threshold escape clause. While there seem to be no differential pattern of sorting among new relative to old firms, the placebo ITT is significant and positive. This

indicates that new firms are considerably overrepresented among bunchers, to an extent that cannot be explained by the missing number of new firms in the region of missing mass. While this provides evidence that corporate groups strategically establish new firms to act as bunchers, it also provides evidence of violation of some of our identifying assumptions, in particular that bunching firms are coming from the region of missing mass. Below, we probe the robustness of our results to this violation by excluding all new firms and focusing on stable firms.

5.4 How do bunchers respond?

Having documented that firms respond to the incentives in the thin-cap rule, we now consider changes in capital structure among bunching and non-bunching firms. Figure 4 show the results from this exercise for the most important outcome variables.

In order to bunch, firms will have to reduce total debt, the price of the debt, or both to land at the cutoff. For some forms of debt, such as intra-group debt, the firm and its owners likely has some discretion over the terms of the loan and the interest rate, even when the arms-length principle mandates that internal interest rates should equal that between external partners. For others, such as external debt to financial institutions, the only way to adjust is through the total amount of debt. As a clear alternative to bunching for exposed firms, firms may reduce the use of internal debt in order to avoid the consequences of remaining above the threshold. If this is the case, this will show up as significant and negative RD estimates for the outcomes that measure the use of internal debt.

There are two treatment effects of interest for each outcome: The local average treatment effect for bunchers and the donut RD estimate. It is important to re-iterate what comparisons these treatment effects are making. Taking the donut RD estimate first, the estimate represent the average treatment effect of the TCR relative to the counterfactual where there is no rule for firms who would have allocated close to the threshold in the absence of TCR. Note that the relatively large excluded region means that the RD estimate is based on more

Table 4: Causal effects of TCR on bunchers and non-bunchers

	Bunchers LATE		Sorting		Donut RD estimate	
Long-term debt	-20.01	(68.81)	26.03	(47.57)	0.436	(12.99)
Short-term debt	-104.4	(85.64)	50.08	(73.12)	14.48	(17.84)
Long-term bank debt	-143.0**	(56.12)	49.42	(45.35)	31.18***	(11.19)
Long-term intra-group debt	138.1***	(45.63)	-31.95	(30.28)	-29.94***	(8.631)
Total internal debt	126.6*	(75.27)	-36.24	(63.14)	-36.00**	(15.62)
Total debt	-124.4	(112.4)	76.10	(90.72)	14.91	(22.60)
Equity	164.4	(174.6)	-70.42	(123.3)	-16.82	(32.98)
Share premium	56.00	(111.3)	15.55	(86.90)	-19.30	(25.89)
Assets	40.02	(229.4)	5.682	(176.7)	-1.909	(47.23)
Debt-to-assets ratio	0.317	(0.459)	-0.409	(0.352)	-0.0568	(0.0882)
Internal interest costs	2.037	(1.522)	0.709	(1.183)	-0.902***	(0.289)
TCR exposure	1.897**	(0.753)	-0.327	(0.580)	-0.557***	(0.151)
Observations	16,508		16,508		16,508	

Notes: Estimates of bunchers LATE, sorting into bunching and donut RD effects of thin capitalization rules in the notch sample. Bootstrapped standard errors in parenthesis, clustered by firm. * p<0.10, ** p<0.05, *** p<0.01

parametric assumptions than semiparametric RD estimates that is usually estimated with data close to the cutoff.

The bunchers LATE, in contrast, is a measure of the treatment effect not of the TCR in general, but of the presence of a threshold. It is thus a comparison of the average outcome of agents who choose to bunch with the average counterfactual of these agents had the TCR applied everywhere, or a treatment effect of the escape clause.

Both treatment effects are displayed in Figure 4 and Table 4. In the figures, the treatment effect for bunchers is the difference between the green dot at the threshold and the one above, while the RD estimate, or the treatment effect for non-bunchers, are depicted as the difference between the blue and red lines at the threshold.

First, we note that the estimates of sorting are very imprecise, so that we cannot reject that there is no sorting into bunching for any of the outcomes.

Arguably, debt is the most important adjustment channel for firms to bunch at the threshold. While these effects suggest that firms who would have higher levels of debt are more likely to bunch and reduce their debt, this estimate is not significant at conventional

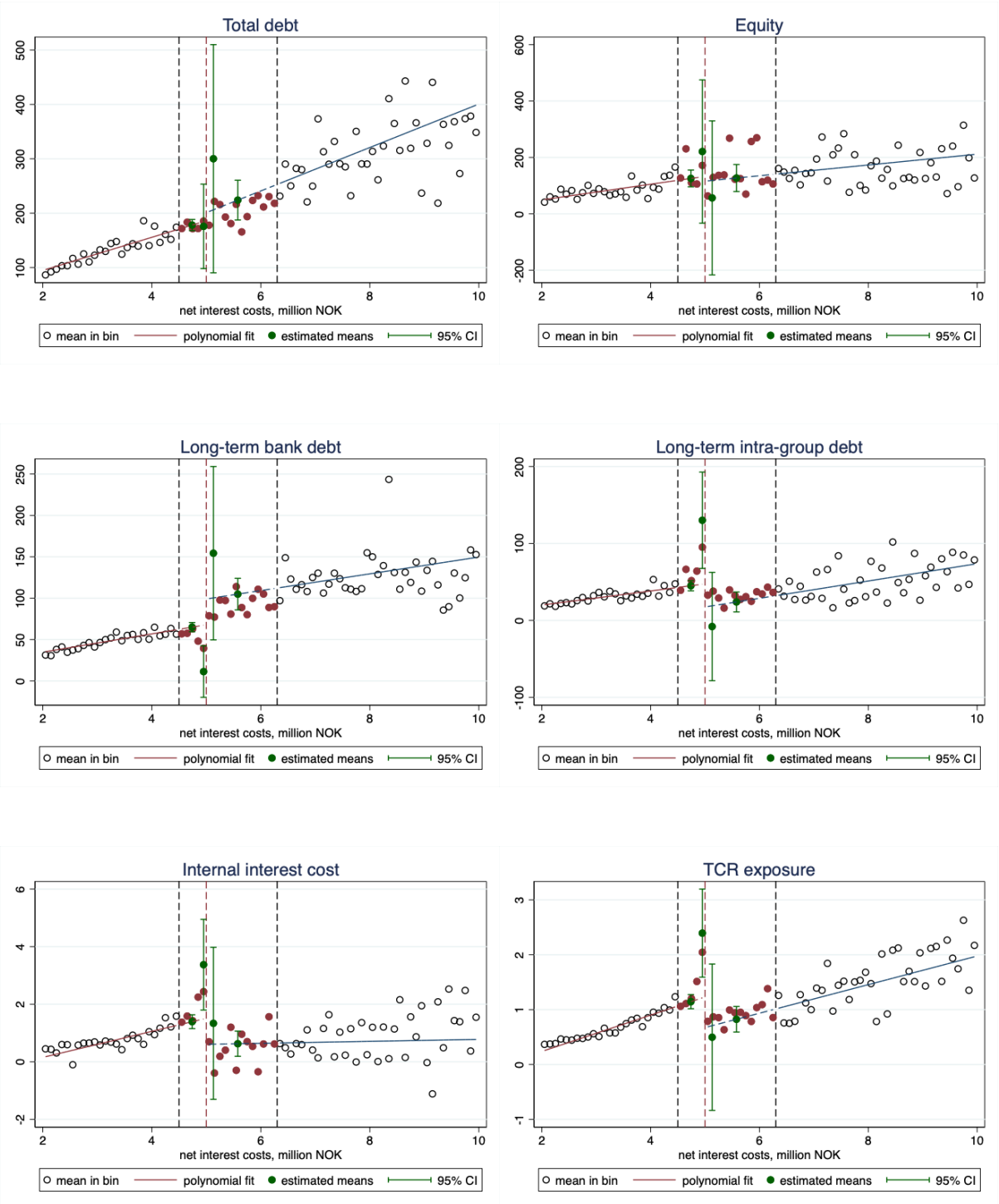


Figure 4: Treatment effects of thin capitalization rules for central outcomes

Estimates of treatment effect for bunchers (bunchers' LATE) and donut RD effects. The red vertical line marks the threshold, black lines mark the bunching window. Red dots are bin averages inside the bunching window. Green dots close to the threshold are the estimates for bunchers mean and bunchers counterfactual mean, respectively.

levels. The estimate for equity is opposite signed and of equal size as the one for debt, suggesting some role for conversion of debt to equity in order to bunch, but neither of the estimates are significantly different from zero. Neither do we find any significant results for non-bunching firms for these outcomes, such that there is no evidence that debt or equity changes in response to thin capitalization rules in this sample, but we note that the signs are in opposite directions for the bunchers and RD-estimates for both outcomes.

Instead, we see clear and significant evidence of substitution of internal corporate debt to bank debt in the second two panels of Figure 4. Bunchers substitute long term bank debt for internal debt as part of the bunching response, presumably because the thin capitalization rules do not apply to them. These estimates are significant, opposite signed and of approximately equal size. Furthermore, we find strongly significant RD effects on these variables of the opposite sign than for bunchers. Together, these results paint a clear picture of debt reorganization within corporate groups, where internal debt is offloaded onto bunching agents and non-bunching agents above the threshold replace internal debt with external debt in order to avoid the consequences of the thin capitalization rule.

This is further supported by the final two panels, where we see strong increases in internal interest cost among bunching agents and matching reductions among non-bunching agents. Using finally a measure of hypotethical exposure to the TCR, measured as the increase in the tax base a firm would have experienced if the TCR rule would apply, we see that exposure is concentrated in bunching firms while firms above the cutoff strongly reduce their exposure.

Taken together, the results illustrate limited real economic consequences of the TCR rules in the notch sample. Firms largely avoid the rule, either by bunching themselves or offloading exposure to other firms in the same corporate group in order to avoid the extra tax burden.

Before turning to robustness checks, we return to the initial difference-in-difference estimates, estimating a similar specification at the corporate group level. To this end, we re-estimate the difference-in-difference specification at the corporate group level after summing

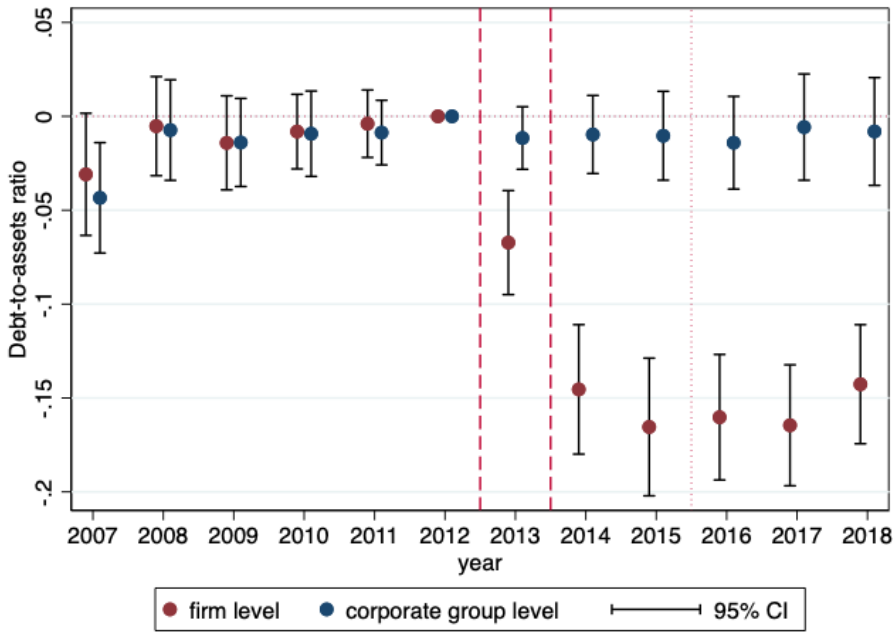


Figure 5: Difference-in-differences estimates: Firm and corporate group level

Notes: Difference-in-differences estimates of the impact of thin capitalization rules on firm and corporate debt-to-assets ratio. Treatment on firm level is a variable defined as one for all firms that would be disallowed some interest costs if the reform was implemented in 2012. Treatment at the corporate group level is defined as all corporate groups with at least one treated member at the firm level. 95% confidence intervals account for clustering at the corporate group level.

the exposure to the rule in 2012 across all firms in the corporate group and constructing a treatment indicator equal to one for the corporate groups with at least one exposed firm. The debt ratio is now measured at the corporate group level, implying that any substitution of debt cost between corporate partners cannot affect the debt ratio at the corporate group level.

The results of this exercise is presented in Figure 5 together with the initial estimates at the firm level. While pre-trends are close to zero and not significant, and there is absolutely no evidence of reduced debt-to-asset ratios at the corporate group level. This is in sharp contrast to the massive changes in debt ratio at the firm level, and provides evidence that the results we saw at the firm level were driven primarily by within-group strategic substitution of debt. Summing up, our bunching estimates together with the corporate group level results

provides strong evidence of avoidance behavior within corporate groups, but little evidence of any real economic effects. These results are likely driven by the availability of the escape clauses in the thin capitalization rules. Although evaluating the effect of the rules on profit shifting is not the purpose of this paper, the presence of these escape clauses and the ease with which firms seem to strategically adjust debt to exploit them sheds doubt on the efficiency of these rules to significantly limit the possibility of profit shifting.

5.5 Robustness checks

In this section we perform a number of checks to address potential concerns with estimates of both the response in the bunching variable and in other outcomes.

For the bunching estimates we make the crucial assumption of smoothness in the counterfactual distribution in the absence of the thin-cap rule. To verify that the results are not driven by for example round number bunching or an unobserved density with a spike in the bunching region even in the absence of thin capitalization rules, we perform two placebo exercises. First, we estimate the degree of bunching in years 2010-2012, prior to the TCR rule, using the same specification as the baseline. We exclude the year 2013, because most outcomes that we will evaluate are end-of-year balances and the reform was announced well enough in advance that a forward-looking firm could be expected to pay down debt and make other adjustments before the reform was implemented. Second, we estimate bunching in the sample of firms with interest costs around the NOK 5 million threshold, but whose EBITDA are above NOK 16.67 or 20 million, respectively, so that the threshold does not bind. Figure A1 in the appendix show absolutely no indication of an excess mass at the thresholds for either of these placebo samples.

We repeat the same exercise for the kink samples and the two placebo samples in figure Figure A2, again finding absolutely no evidence of bunching.[15] We thus conclude that

[15]Because there is no reason to expect bunching, we do not implement the adjustment technique to account for distortions above the threshold.

unobserved spikes in the counterfactual density even in the absence of thin capitalization rules are unlikely to explain the presence of bunchers.

We next explore the sensitivity to the baseline choice of 8-th and 6-th order polynomials to estimate the density of the running variable. To this end, we re-estimate the density and bunching estimates using polynomials of order 5 to 10 in tables Table A4 for the notch sample, and polynomials of order 3 to 8 in Table A5 and Table A6 for the kink samples. Results are very stable, suggesting that the main conclusion does not depend on this decision.

When estimating the anatomy of the bunching response, we crucially rely on being able to identify the counterfactual means in the two excluded regions from the relationships outside of these regions. While we use local linear regressions to allow this estimate to be local to the two regions, we still have to rely on relatively large bandwidths. To evaluate the impact of this choice, we estimate placebo test for the same outcomes in the placebo sample for the years 2010-2012. If the functional forms assumptions made are sound, we should expect these functions to well approximate the true mean in the bunching region in these samples, where we have already shown that there is no bunching. The alternative sample of firms with interest costs around the NOK 5 million cutoff, but with allowance that exceed this cutoff, is not well suited for this exercise because the majority of these firms will have the relevant kink threshold in the excluded region, such that any bunching response by these agents will show up in the placebo exercise. Only around 1,000 firms in this sample have relevant threshold above 14 million NOK.

Results are provided in Table A7. Because there is no bunching, we cannot estimate a LATE for bunchers in this setting, but instead report a placebo ITT along with the donut RD estimate, where the placebo ITT is the difference between the observed and predicted means in the entire manipulation region. While there are a couple of significant estimates, placebo ITTs and RDs are generally much smaller than estimates from the baseline and not significant, supporting our identification strategy.

Another worry for the bunching estimates is that bunchers may not come exclusively

from above the threshold, given the amount of intra-group coordination. For instance, two firms with counterfactual allocations at 3 and 7 million NOK in interest cost could avoid the TCR rule by both allocating at NOK 5 million. To get a rough idea of the magnitude of this problem, we use the bunching approach to construct estimates of the mean of bunchers outcomes in 2012, before the reform. Key estimates are reported in Table A9, indicating, for instance that the estimated mean net interest cost for bunchers in 2012 is around 7 million NOK, above the threshold.

Finally, our approach relies on an assumption that there are no effects of the thin capitalization rules on the extensive margin of firm entry or exit. We have already seen above that there is indication of an excess number of new firms in the bunching region that cannot be explained by the missing number of such firms in the region of excess mass, pointing to the possibility of corporate groups strategically starting new firms in order to bunch. While this finding is of interest in itself, we want to investigate whether this could be contaminating the response patterns already documented. Consequently, we re-estimate all bunching estimates and outcome estimates in the sample of stable firms in Figure A3 and Table A8. Results are largely unchanged, both for bunching estimates and for LATE and RDs for bunchers in the notch sample, suggesting the endogenous entry of new firms cannot explain our other findings.

6 Conclusion

This paper investigates the importance of escape clauses in thin capitalization rules for the estimation of the impact of such rules on firm debt structure. Exploiting the introduction of a thin capitalization rule in Norway in 2014, we first document that firms with large exposure to the rule based on pre-reform capital structure considerably reduced their debt-to-asset ratios relative to firms that were not exposed to such rules, suggesting sizable effects on capital structure.

Bunching estimates around the two thresholds that constitute escape clauses for the rule, however, suggest considerable bunching in order to avoid exposure to the rules. Furthermore, by analyzing how bunchers and non-bunchers adjust along other measures of capital structure, we find strong evidence of intra-group coordination to avoid exposure. Specifically, non-bunching firms seem to offload internal debt onto bunching corporate partners, allowing both to minimize exposure. We also find evidence of excess number of new firms around this threshold, suggesting that corporate groups strategically establish new firms in order to split assets and exploit the fact that the threshold applies for each firm.

Finally, we re-visit the difference-in-difference estimates at the corporate group level, finding strong and precise zero effects on capital structure on the firm level. Taken together, our estimates suggest very limited, if any, real economic effects of the thin capitalization rules, in part driven by the strategic use of a number of escape clauses common to many thin capitalization rule sets across the world. The ease with which firms seem to be able to exploit these escape clauses calls into question the efficiency of such rules. At the same time, the exemption of firms below the threshold also have its upsides in form of reducing the administrative burden for smaller firms. Whether or not this gain outweighs the effect of firms exploiting the escape clauses to avoid the regulation altogether is up for future research to decide.

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A Robustness checks and additional results

Table A1: Description of calculated variables

Variable name	Definition
Corporate group	A corporate group is defined when one or more entities owns directly or indirectly more than 50 percent of the shares in another firm.
Corporate income tax	Taxable income multiplied with the corporate income tax rate, conditional on non-negative taxable income.
Debt-to-assets ratio	On the firm level: The ratio of total debt and total assets. Group level: Consolidated assets is the sum of assets in the group minus investments and loans to other members in the corporate group. Debt is calculated as total debt minus intra-group debt. To remove extreme observations, we windsorize this variable at the 5/95th percentile in the bunching samples and at the 99th percentile in the DiD samples
Debt	At the firm level this the sum of long-term and short-term debt as reported by the firms in the balance sheet. At the group level, we sum total debt and subtract internal debt.
Domestic multinational (DMNC)	Dummy for each firm in a corporate group in which the head is Norwegian and at least one member is in another country.
Equity	At the firm level this is reported in the balance sheet. At the group level we subtract investments and credit in subsidiaries.
Foreign multinational (FMNC)	Dummy for each firm in a multinational corporate group in which the head is non-Norwegian.
Interest costs	Net interest costs, i.e., interest cost - interest revenue.
Number of shareholders	The sum of unique shareholders in an entity.
Relative TCR exposure	On the firm level: TCR tax base increase (see details about this variable below) divided by net interest costs. On the group level: The sum of the firm variable within the group.
Subsidiary	Dummy equal to 1 if the entity is member of a corporate group but not identified as the mother of the group.
Sector variables	Sector classification based on the Standard Industrial Classification 2007 (SIC 2007)
Total internal debt	The sum of long-term and short-term debt to other members within the corporate group.
TCR exposure	Additional tax liability for the entity calculated with the formula: $\max(0, \min(z_I, z - \max(0, \eta \cdot EBITDA)))$ where z_i is internal interest costs, z is total interest costs and η is 30 or 25 percent depending on the year.

Table A2: Thin capitalization rules in OECD

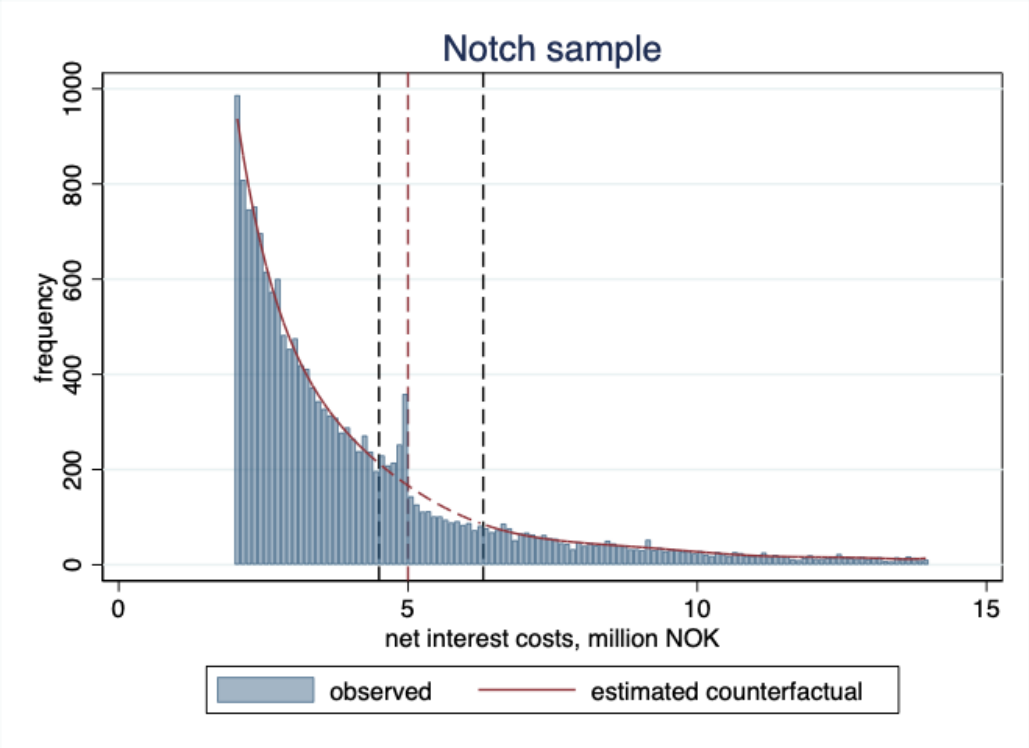
Country	Inclusion threshold(s)	Targeted interest costs
Australia	Debt/Equity > 1.5	All interest costs
Austria	Interest costs > 3 million & interest costs/ EBITDA > 30 percent	All interest costs
Belgium	Interest costs > 3 million & interest costs/ EBITDA > 30 percent	All interest costs
Belgium	Debt/Equity > 5	Internal interest costs
Canada	Interest bearing debt > 1.5 * Equity	Interest costs to non-residents
Chile	Debt/Equity > 3 million	Internal interest costs
Colombia	Debt/Equity > 2	All interest costs
Czech Republic	Debt/Equity > 4 (6 if the debtor is a bank or insurance company) & total interest costs > 80 million & interest costs/ EBITDA > 30 percent	All interest costs
Denmark	Debt/Equity > 4 or interest costs > 2.7 percent of assets or interest costs EBITDA > 30 percent	All interest costs
Estonia	Interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Finland	Interest costs > 500,000 & interest cost/EBITDA > 25 percent & firm debtratio > consolidated debtratio	All interest costs
France	Member in corporate group & interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Germany	Interest costs > 3 million & interest costs/EBITDA > 30 percent & debtratio-0.02 > consolidated debtratio	All interest costs
Greece	Interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Hungary	Interest costs/EBITDA > 30 percent & interest costs > 3 million (last condition only for standalones)	All interest costs
Iceland	Interest costs > 100 million & interest costs/EBITDA > 30 percent & debtratio-0.02 > consolidated debtratio	Internal interest costs
Italy	Interest costs/(EBITDA + financial leasing installments) > 30 percent	All interest costs
Japan	Debt/Equity > 3 (2 for certain repo transactions)	All interest costs
Japan	Internal interest costs > 20 million & internal interest costs/adjusted taxable income > 20 percent & internal interest costs/total interest costs > 20 percent	Internal interest costs
Korea	Debt/Equity > 2 or interest costs/EBITDA > 30 percent	All interest costs
Latvia	Debt/Equity > 4 or IC > 3 million & IC/EBITDA > 30 percent	
Lithuania	Debt/Equity > 4	Internal interest costs
Lithuania	Interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Luxembourg	Interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Mexico	Debt/Equity > 3	Internal interest costs
Mexico	IC / adjusted taxable income > 30 percent & IC > 20 million	All interest costs
Netherlands	Interest costs > 1 million & interest costs/EBITDA > 30 percent	All interest costs
New Zealand	Inbound companies: Domestic consolidated Debt/Equity > 60 percent & Domestic consolidated/ Worldwide consolidated debtratio > 110 percent	All interest costs
New Zealand	Outbound companies: Domestic consolidated Debt/Equity > 75 percent & Domestic consolidated/ Worldwide consolidated debtratio > 110 percent	All interest costs
Poland	Interest costs > 3 million & interest costs/EBITDA > 30 percent	All interest costs
Portugal	Interest costs > 1 million & interest costs/EBITDA > 30 percent	All interest costs
Slovakia	Internal interest cost/EBITDA > 25 percent	Internal interest costs
Slovenia	Debt/Equity > 4	All interest costs
Spain	Interest costs > 1 million & interest costs/EBITDA > 30 percent	All interest costs
Sweden	Interest costs > 5 million & interest costs/EBITDA > 30 percent	All internal interest costs
Switzerland	Asset-type specific debt-to-equity ratios.	All interest costs
Turkey	Debt/Equity > 3	Internal interest costs
United Kingdom	Interest costs/EBITDA > 30 percent & interest costs > 2 million	All interest costs
United States	Interest costs/EBITDA > 30 percent (either firm level or consolidated level)	All interest costs

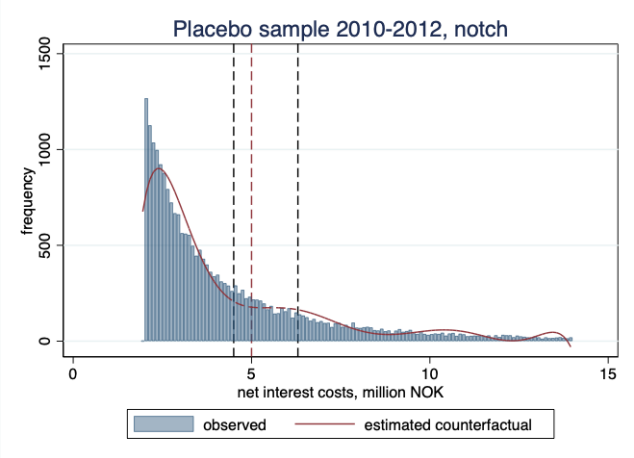
Notes: Thin capitalization rules in OECD countries as of 2021. Most group-related escape clauses allow for at most two percentage points higher debt-to-assets ratio than the consolidated measure for the group. Local currencies. Table based on the overview by Pomerleau et al. (2021). IC = Interest costs.

Table A3: Descriptive statistics, corporate groups 2012

	Control group		Treated group		All groups	
Debt	49.0	(443.3)	3353.4	(20433.8)	109.0	(2820.2)
Equity	56.1	(1020.9)	6453.6	(41746.9)	172.3	(5773.5)
Debt-to-assets-ratio	0.59	(0.35)	0.50	(0.29)	0.59	(0.37)
Number of group members	2.75	(2.77)	15.5	(24.0)	2.98	(4.57)
TCR exposure	0	(0)	39.2	(145.1)	0.71	(20.2)
Employees	31.8	(218.3)	681.5	(2278.3)	43.6	(385.2)
Corporate income tax	1.15	(14.9)	82.1	(1012.4)	2.62	(137.5)
Share foreign multinational	0.12	(0.33)	0.33	(0.47)	0.12	(0.33)
Share domestic multinational	0.012	(0.11)	0.23	(0.42)	0.016	(0.12)
Observations	28,610		529		29,139	

Notes: Non-shares given in NOK million. Data for 2012. Details about the calculation of consolidated variables is given in table A1.





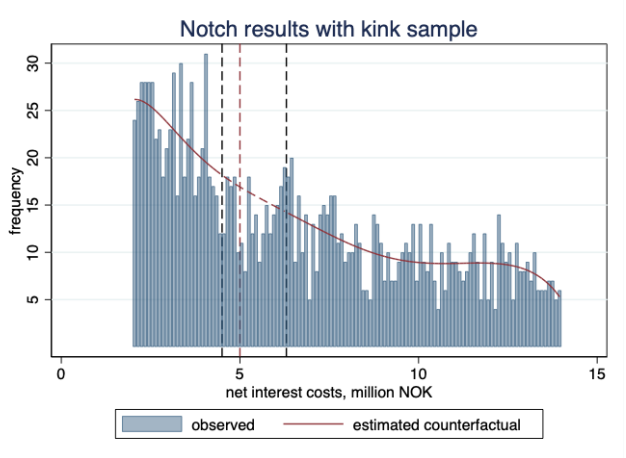


Figure A1: Placebo test, notch

Top left: Baseline results at the notch. Below left: Results at the notch using only pre-reform years. Below right: Results using only firms with allowance $>$ 5mNOK (the kink sample)

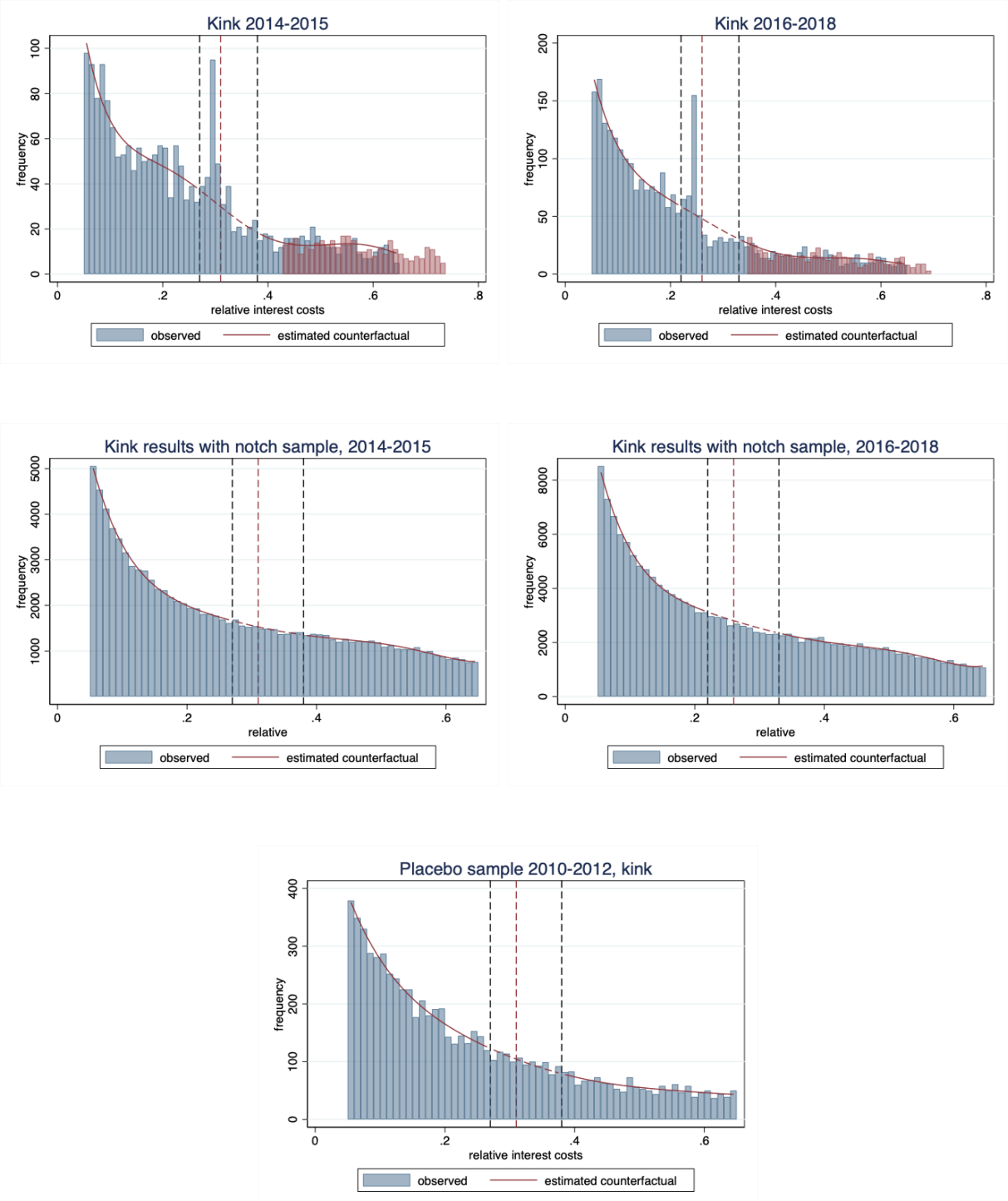


Figure A2: Placebo tests, kink

Top: Baseline results at the kink. Middle: Results using only firms with allowance $<$ 5mNOK (the notch sample) Below: Results at the kink using only pre-reform years

Table A4: Polynomial sensitivity notch

	5	6	7	8	9	10
Number of bunchers	449.3***	360.0***	305.0***	321.6***	337.2***	323.0***
	(115.8)	(108.6)	(102.8)	(105.8)	(104.7)	(112.6)
Share of sample	0.0272***	0.0218***	0.0185***	0.0195***	0.0204***	0.0196***
	(0.00663)	(0.00634)	(0.00604)	(0.00623)	(0.00613)	(0.00661)
Excess mass	0.355***	0.284***	0.241***	0.254***	0.266***	0.255***
	(0.0557)	(0.0612)	(0.0636)	(0.0634)	(0.0632)	(0.0675)
Marginal response	0.343***	0.233***	0.185***	0.203***	0.219***	0.205***
	(0.0960)	(0.0749)	(0.0674)	(0.0720)	(0.0773)	(0.0789)
Observations	16,508	16,508	16,508	16,508	16,508	16,508

Notes: Bunching results with different order of polynomials in the notch sample. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

Table A5: Polynomial sensitivity kink 2014-2015

	3	4	5	6	7	8
Required shift	-0.150	-0.105**	-0.0850**	-0.132***	-0.118***	-0.211*
	(0.104)	(0.0461)	(0.0354)	(0.0362)	(0.0368)	(0.109)
Number of bunchers	106.5***	101.7***	84.02***	91.52***	87.45***	96.09***
	(22.58)	(21.13)	(21.72)	(17.76)	(19.85)	(19.84)
Share of sample	0.0526***	0.0502***	0.0414***	0.0451***	0.0431***	0.0474***
	(0.0105)	(0.0100)	(0.0103)	(0.00850)	(0.00938)	(0.00941)
Excess mass	0.471***	0.450***	0.372***	0.405***	0.387***	0.425***
	(0.0633)	(0.0602)	(0.0713)	(0.0522)	(0.0586)	(0.0602)
Marginal response	0.0432***	0.0381***	0.0270***	0.0342***	0.0308***	0.0395***
	(0.0126)	(0.0106)	(0.00884)	(0.00823)	(0.00845)	(0.0103)
Observations	2,027	2,027	2,027	2,027	2,027	2,027

Notes: Bunching results with different order of polynomials in the kink sample 2014-2015. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

Table A6: Polynomial sensitivity kink 2016-2018

	3	4	5	6	7	8
Required shift	-0.201***	-0.150**	-0.0951**	-0.0721*	-0.0745**	-0.0779
	(0.0725)	(0.0715)	(0.0417)	(0.0414)	(0.0379)	(0.0475)
Number of bunchers	150.0***	157.7***	139.2***	125.9***	126.2***	126.6***
	(24.61)	(30.07)	(32.86)	(28.99)	(27.67)	(31.64)
Share of sample	0.0558***	0.0587***	0.0518***	0.0469***	0.0470***	0.0471***
	(0.00875)	(0.0107)	(0.0116)	(0.0103)	(0.00991)	(0.0115)
Excess mass	0.442***	0.465***	0.411***	0.371***	0.372***	0.373***
	(0.0397)	(0.0596)	(0.0605)	(0.0612)	(0.0589)	(0.0681)
Marginal response	0.0423***	0.0451***	0.0332***	0.0285***	0.0287***	0.0289***
	(0.00771)	(0.0121)	(0.00970)	(0.00833)	(0.00778)	(0.0104)
Observations	2,687	2,687	2,687	2,687	2,687	2,687

Notes: Bunching results with different order of polynomials in the kink sample 2016-2018. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

Table A7: Placebo estimates notch: 2010-2012

	Baseline ITT	Placebo ITT	Baseline RD	Placebo RD
Long-term debt	-2.505	2.007	0.436	-5.216
	(7.945)	(4.447)	(12.99)	(7.401)
Short-term debt	-13.07	-6.632*	14.48	3.871
	(9.431)	(3.451)	(17.84)	(5.825)
Long-term bank debt	-17.91***	-0.624	31.18***	4.110
	(6.706)	(3.597)	(11.19)	(5.504)
Long-term intra-group debt	17.29***	2.685	-29.94***	-10.42*
	(6.332)	(3.172)	(8.631)	(5.809)
Total internal debt	15.85*	3.176	-36.00**	-12.18*
	(8.894)	(3.584)	(15.62)	(6.583)
Total debt	-15.57	-4.625	14.91	-1.345
	(12.61)	(5.174)	(22.60)	(9.249)
Equity	20.58	4.353	-16.82	-5.553
	(20.13)	(8.812)	(32.98)	(15.06)
Share premium	7.010	-0.531	-19.30	3.136
	(12.79)	(6.199)	(25.89)	(9.023)
Assets	5.010	-0.272	-1.909	-6.898
	(26.47)	(11.78)	(47.23)	(21.04)
Debt-to-assets ratio	0.0397	0.0203	-0.0568	-0.0158
	(0.0462)	(0.0171)	(0.0882)	(0.0323)
Internal interest costs	0.255	-0.250	-0.902***	0.116
	(0.200)	(0.180)	(0.289)	(0.300)
TCR exposure	0.237**	0.00135	-0.557***	-0.133
	(0.0992)	(0.0662)	(0.151)	(0.110)
new	0.0181		-0.0251	
	(0.0201)		(0.0348)	
Observations	16,508	22,607	16,508	22,607

Notes: Placebo estimates for other outcomes in the notch sample, 2010-2012. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

Table A8: Specification check: No new firms

	LATE	, no new	RD	, no new
Long-term debt	-20.01	9.048	0.436	6.094
	(68.81)	(95.98)	(12.99)	(12.95)
Short-term debt	-104.4	-117.4	14.48	16.39
	(85.64)	(134.6)	(17.84)	(21.49)
Long-term bank debt	-143.0**	-182.0*	31.18***	35.25***
	(56.12)	(102.6)	(11.19)	(12.28)
Long-term intra-group debt	138.1***	165.3**	-29.94***	-26.59***
	(45.63)	(79.79)	(8.631)	(7.158)
Total internal debt	126.6*	164.0	-36.00**	-34.49*
	(75.27)	(139.2)	(15.62)	(19.60)
Total debt	-124.4	-108.3	14.91	22.48
	(112.4)	(172.3)	(22.60)	(26.19)
Equity	164.4	358.2	-16.82	-8.430
	(174.6)	(319.6)	(32.98)	(31.14)
Share premium	56.00	82.03	-19.30	-9.319
	(111.3)	(176.4)	(25.89)	(28.10)
Assets	40.02	249.8	-1.909	14.05
	(229.4)	(404.4)	(47.23)	(45.71)
Debt-to-assets ratio	0.317	0.424	-0.0568	0.0151
	(0.459)	(0.642)	(0.0882)	(0.0685)
Internal interest costs	2.037	2.100	-0.902***	-0.730**
	(1.522)	(2.011)	(0.289)	(0.322)
TCR exposure	1.897**	2.207	-0.557***	-0.464***
	(0.753)	(1.356)	(0.151)	(0.173)
new	0.144		-0.0251	
	(0.183)		(0.0348)	
Observations	16,508	13,323	16,508	13,323

Notes: Baseline estimates for other outcomes in the notch sample, excluding firms founded after 2013. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

Table A9: Estimated means for bunchers in 2012.

	Mean	Se
Long-term debt	185.0	(100.1)
Short-term debt	-36.91	(66.90)
Total debt	148.1	(101.4)
Net interest costs	7.219	(3.606)
Intra-group interest costs	3.923	(3.227)
Observations	11,632	

Notes: Estimates of means of central variables for bunchers in the notch sample, measured in 2012. Bootstrapped standard errors in parentheses, clustering at the corporate group level. * p<0.10, ** p<0.05, *** p<0.01

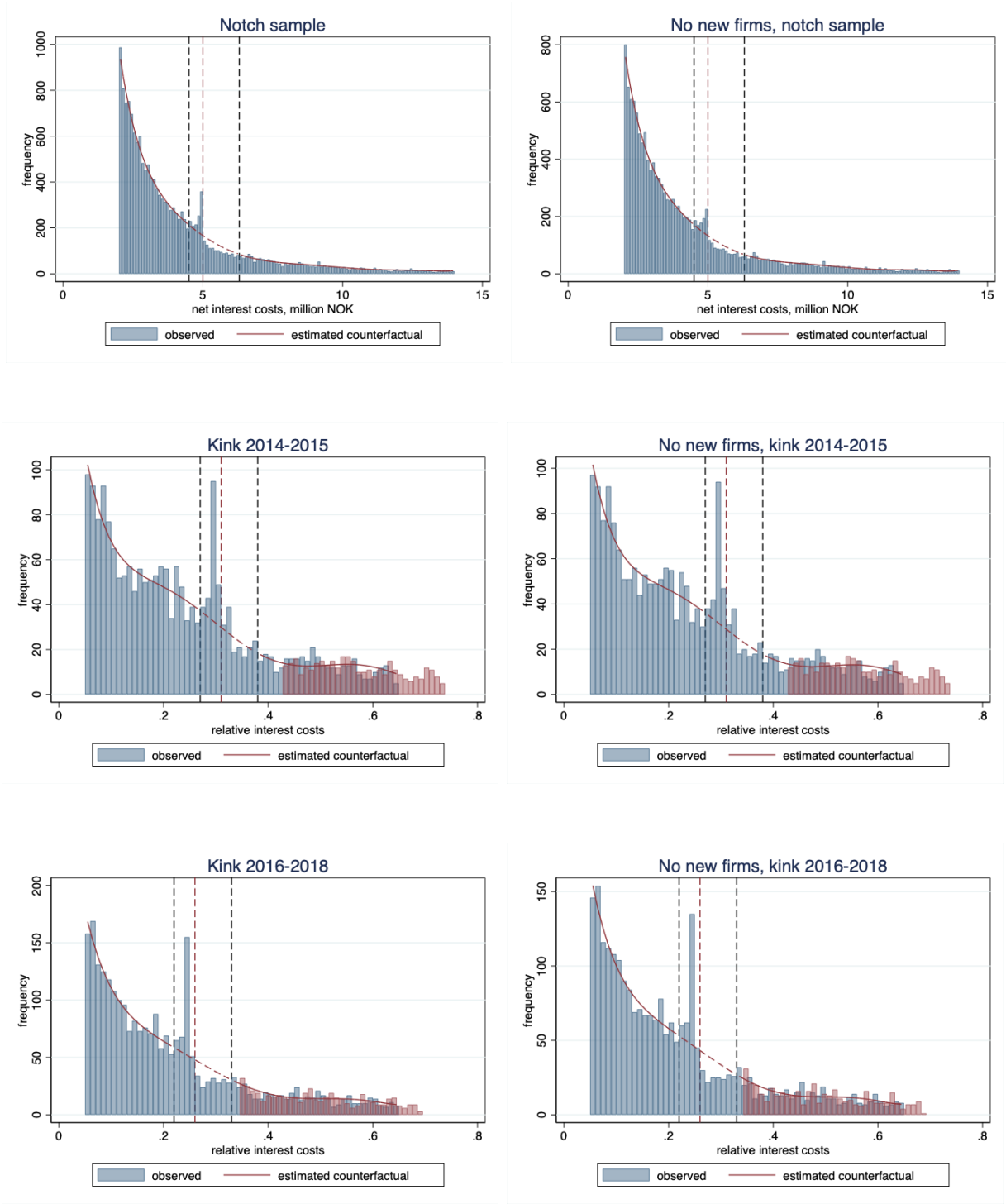


Figure A3: Results with/without new firms

Baseline bunching plots (left) and bunching plots when excluding firms that appear after 2013 (right).

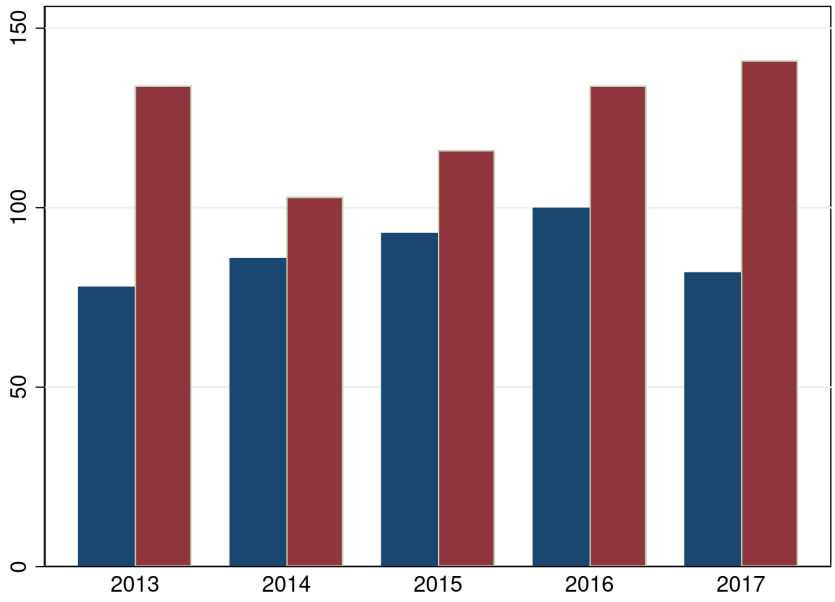


Figure A4: Number of new entrants (red) and exits (blue) in the notch sample

Figure A5

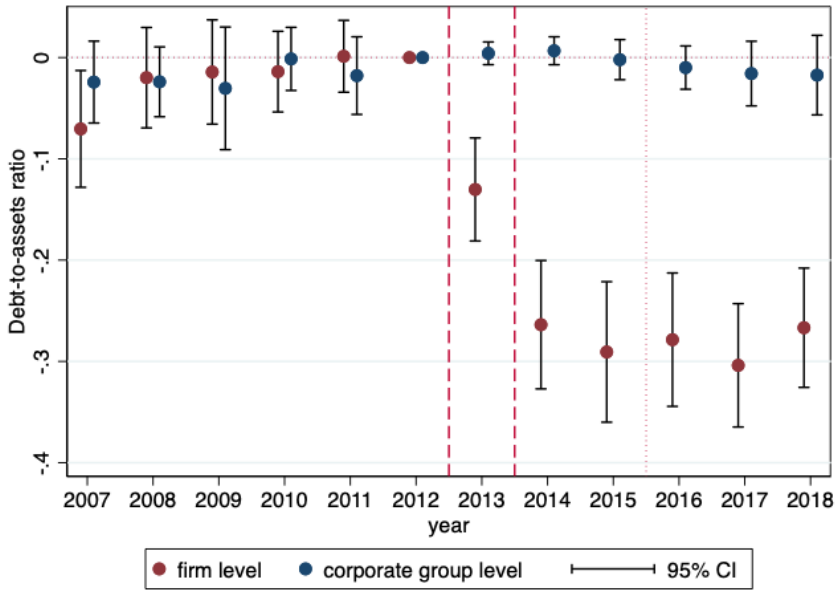


Figure A6: Naive consolidated debt-to-asset ratio

Baseline difference-in-differences estimates with naive consolidated debt-to-asset ratio naively calculated as sum of debt divided by sum of assetsassets i.e. no elimination of internal transactions within the group.