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Real Effects of Earnings Stripping Rules

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ABSTRACT

This study examines the real effects of earnings stripping rules introduced in the European Union in 2019, which tie interest deductibility to contemporaneous profitability. Exploiting a quasi-natural experiment created by the EU's harmonized implementation under the Anti-Tax Avoidance Directive and using a difference-in-differences design, we analyze consolidated data from 3,312 firms across 22 EU Member States from 2012 to 2023. We find that earnings stripping rules significantly reduce operational risk-taking, investment, and innovation, consistent with profit-contingent deductibility lowering the expected debt tax shield in low-profit years. These effects are particularly pronounced among firms with high pre-reform operating risk, which also experience slower growth and a higher likelihood of financial distress following the reform. This study contributes to the literature on corporate taxation and risk-taking, showing that profit-linked interest limitations have real effects and underscoring the importance of rule design in balancing anti-avoidance objectives with investment and innovation.

Keywords: corporate risk-taking; capital structure; asymmetric taxation; earnings stripping rule
JEL Classifications: G32, G33, H25, H26, H87

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I. INTRODUCTION

The OECD and the European Union (EU) consider interest limitation rules a critical tool in mitigating base erosion and profit shifting strategies by multinational firms, and a large body of literature documents their effectiveness in addressing profit shifting (Blouin et al., 2014; Buettner et al., 2012, 2016; Buslei and Simmler, 2012; Overesch and Wamser, 2010; Wamser, 2014) and reducing the corporate use of debt (Buslei and Simmler, 2012; Carrizosa et al., 2023; De Mooij and Hebous, 2018; Heitzman and Hanlon, 2024). However, less is known about their real effects on firms. We study these real effects by examining how linking interest deductions to current earnings makes the after-tax value of debt profit-contingent—least valuable in low-profit years—discouraging risk-taking. Because investment and innovation are especially sensitive to uncertainty and financing frictions, we analyze how they respond and trace downstream consequences for growth and financial distress.

Our setting is the mandatory earnings stripping rule reform in the EU in 2019.[1] Under earnings stripping rules, the ability to deduct interest expenses to obtain tax benefits is tied to a firm's profitability in that year, enabling higher deductions for more profitable firms while restricting deductions for firms with volatile earnings or losses. Under the Anti-Tax Avoidance Directive (ATAD I), Member States adopted a harmonized rule with limited national discretion and a common 2019 implementation date. Pre-reform regimes differed across countries, creating common timing but meaningful cross-country variation that we use for identification.

Earnings stripping rules introduce an incentive for firms to reduce their operating risk due to the asymmetric treatment of interest expenses at the threshold. Thus, these rules amplify the asymmetry inherent in the tax system, where firms are taxed in profitable years but may not receive tax relief in loss-making years—consistent with the limited-loss-offset framework (Mossin, 1968; Sandmo, 1969).[2] Because greater earnings volatility increases the likelihood that interest is disallowed, firms may curb operational risk-taking. Higher borrowing costs associated with more volatile earnings may reinforce this effect. In response, they may take steps to reduce their operating risk to limit the potential disallowance of interest deductions. In the Hall and Jorgenson (1967) user cost of capital framework, the lower expected debt tax shield in low-profit years raises the effective cost of capital and tightens investment thresholds. In addition, earnings stripping rules can raise the cost of capital directly by inducing deleveraging or disallowing part of interest expense. An increased cost of capital may dampen investment and innovation (John et al., 2008; Lang et al., 1996).

[1] By 2024, 68% of the 147 BEPS Inclusive Framework members and all EU Member States have implemented some form of interest limitation rule (OECD, 2024). Broadly, these rules fall into two categories. Thin capitalization rules restrict the deductibility of interest expenses based on a firm's debt-to-equity ratio, while earnings stripping rules limit net interest deductions to a specific proportion of the firm's profits. Both approaches aim to limit debt driven profit shifting from high- to low-tax jurisdictions.

[2] Under a symmetric proportional tax with full loss offset (Domar and Musgrave, 1944), the government shares proportionately in gains and losses; tax scales mean and variance, and optimal risk-taking need not fall (it can rise). Earnings stripping rules break this symmetry by making interest deductibility profit-contingent, effectively a form of limited loss relief; in that case, the expected tax shield is lower in bad states and optimal risk-taking declines (Mossin, 1968; Sandmo, 1969).

Our analysis is based on a panel of consolidated financial statements for 3,312 publicly listed firms headquartered in 22 different EU Member States over the period 2012 to 2023. Using consolidated accounts rather than unconsolidated subsidiary-level data allows us to capture group-level behavior rather than intra-group reallocations. We estimate difference-in-differences models that compare firms in countries with already directive-compatible rules prior to 2019 (control) to firms in countries that had to tighten their regimes (treatment). Event-study tests confirm parallel pre-trends, and all specifications include firm and year fixed effects, country-level macro and institutional controls, and standard errors clustered at the country level.

As validation that the earnings stripping regulations were sufficiently stringent to impact firms, we find that treated firms reduce their debt-to-asset ratio, on average, by 2.3 percentage points relative to control firms following the implementation of the new earnings stripping rule. These effects are more pronounced in countries lacking pre-reform interest limitation rules or those limiting only internal debt. Consistent with expectations, our results also show that the implications of earnings stripping rules depend on the pre-reform level of a firm's operational risk, measured as the variance of future returns (Acharya et al., 2011; Faccio et al., 2011; John et al., 2008; Langenmayr and Lester, 2018). Firms in the highest quartile of pre-reform operational risk exhibit the strongest reduction in their debt-to-asset ratio.

Beyond capital structure, we document sizable real effects. First, operational risk-taking declines by around 0.7 percentage points—an approximately 13% reduction relative to the pre-reform mean. Second, investment falls by roughly 11 percentage points (18% relative to the pre-reform mean). This investment response is strongly heterogeneous, with firms in the highest risk quartile cutting investment by about 24 percentage points, while the lowest risk quartile shows no significant change. Third, innovation slows, as two-year-ahead patent applications decline by almost 8%, with the drop concentrated in granted patents rather than non-granted filings, indicating lower innovative output and quality. Supporting the mechanism, effects are largest in countries moving from no interest limitation rule or only a thin-cap regime to earnings

stripping rules. A 2SLS design indicates the drop in risk-taking is not explained by deleveraging per se. Finally, downstream outcomes move accordingly—sales growth falls by about 10% on average (around 21% for the highest-risk quartile) and the likelihood of financial distress rises for high-risk firms by 5 percentage points, with little change elsewhere. Our findings are robust across matched-sample estimators, alternative treatment weighting, industry-by-year fixed effects, and controls for the COVID period.

Our study makes three key contributions. First, we show that tying interest deductibility to contemporaneous profitability shapes firms' real behavior, reducing risk-taking and, in turn, investment and innovation, thereby extending the interest limitation literature beyond tax planning and capital structure. Prior research primarily highlights the effectiveness of these rules in curbing tax planning, with limited attention to or mixed results on adverse outcomes (Buettner et al., 2012; Carrizosa et al., 2023; Goodman et al., 2025). Although theoretical studies often endorse earnings stripping rules as welfare-optimal, they overlook potential downsides, particularly for high-risk firms or those engaged in innovative activities (Gresik et al., 2017; Kalamov, 2020; Mardan, 2017). We demonstrate that earnings stripping rules impose costs, particularly on high-risk firms, and highlight their broader implications for corporate risk-taking and financial distress. Policymakers should balance these adverse effects against the benefits of curbing tax avoidance when designing such rules. This conclusion likely extends to other types of anti-tax avoidance rules.

Second, we contribute to the literature on tax system asymmetries and corporate risk-taking. Building on the limited-loss-offset framework (Mossin, 1968; Sandmo, 1969), we show that profit-contingent interest deductibility withholds relief in low-profit states, lowering the expected debt tax shield and, consistent with theory, reducing firms' risk-taking. We also document that activities most exposed to uncertainty and financing frictions, such as investment and innovation, decline, especially among ex-ante high-risk firms, thereby linking tax-induced asymmetries to real choices.

Third, we emphasize the importance of regulatory design in determining the effects of interest limitation rules. Beyond their mere existence, the specific design of interest limitation rules—such as tying the tax benefits of interest to the firm's profitability level—affects not only capital structure but also firm risk-taking, investment, innovation, growth, and bankruptcy risk. Our findings suggest that researchers and policymakers should carefully consider the regulatory nuances when analyzing or implementing such measures. Taken together, the evidence underscores the need for thoughtful policy design that balances anti-avoidance objectives with real economic outcomes.

Although our setting and empirical tests are focused on the EU, our study also has implications for U.S.-based firms. In 2017, the Tax Cuts and Jobs Act (§163(j)) included a provision limiting the deductibility of interest for U.S. federal income tax purposes to 30 percent of adjusted taxable income—measured as EBITDA through 2021 and EBIT from 2022 onward. Our results suggest that such profit-linked limitations can have comparable real effects, although specifically targeted at reducing income shifting through the use of intercompany debt, could have similar consequences for firms. In particular, prior work documents capital-structure responses to §163(j) (Carrizosa et al., 2023; Heitzman and Hanlon, 2024), and our evidence indicates potential spillovers to risk-taking, investment and innovation, with implications for firm growth and financial distress—especially for firms with high earnings volatility.

II. INSTITUTIONAL BACKGROUND

International debt shifting has been shown to be one of the main channels, besides transfer pricing and the allocation of intangibles, of corporate tax avoidance (Heckemeyer and Overesch, 2017; Tørsløv et al., 2023). One prominent legislative response to prevent excessive interest deductions that could erode tax revenues are interest limitation rules. The first multilateral initiative to standardize interest limitation rules was launched by the G20/OECD (2013) as part of the action plan on Base Erosion and Profit Shifting (BEPS) in 2013. The

OECD's (2015, 2017) recommendation on limiting BEPS through interest deductions and other financial payments is the implementation of an earnings stripping rule based on a net interest expenses to EBITDA threshold.

In 2016, the European Commission issued the EU Anti-Tax Avoidance Directive 2016/1164 (ATAD I), requiring Member States to implement an earnings stripping rule by 2019. The stated goal was to restrict tax avoidance through "excessive interest payments" (European Commission, 2016). Prior to the reform, Member States differed markedly in whether and how they applied interest limitation rules. Twelve Member States used a thin capitalization rule prior to the reform, which restricts the deductibility of interest based on a firm's debt-to-equity ratio. In all of these cases, thin capitalization rules applied only to related-party interest (see Table A1 in the Appendix for details). Nine Member States already applied an earnings stripping rule, which restricts the deductibility of interest based on a percentage of profits. In two of these Member States (Finland and Slovak Republic) only internal interest expenses were limited. France and Denmark were the only countries to apply both a thin capitalization and an earnings stripping rule before the reform. Nine of the twelve thin capitalization countries subsequently layered an earnings stripping rule on top of their existing interest limitation rule regime and applied both.

Table A2 in the Appendix summarizes implementation dates and country-specific design features of the new earnings stripping rules. All Member States except Finland, which implemented a 25% EBIT threshold, opted for a 30% net interest expense-to-EBITDA threshold. All Member States except Italy, albeit to varying degrees, apply a "de minimis" threshold up to which net interest expense is fully deductible, independent of the EBITDA threshold. About two thirds of Member States include at least one escape clause through which a firm can avoid application of the earnings stripping rule—for example, because it is not part

of a group[3], because its equity ratio is at least roughly equal to that of the consolidated financial group, or by applying the 30% EBITDA threshold at the consolidated financial group level. Additionally, all Member States except Estonia, Latvia, and Slovenia allow firms to carry forward disallowed interest expenses into future financial years. About half of Member States allow firms to carry forward unused EBITDA capacity. Following de Mooij and Hebous (2018), we do not consider cross-country heterogeneity in escape clauses and carry forward provisions in our research setup.

As of May 2024, 147 countries are members of the OECD/G20 Inclusive Framework on BEPS. In principle, this membership implies a commitment to transpose OECD recommendations; yet more than a decade later only 34 members have implemented an earnings stripping rule, 27 of which are EU Member States. The long-standing reluctance of other Inclusive Framework members to transpose an earnings stripping rule into national law raises the question of whether concerns about broader economic effects have constrained adoption.

These concerns may be particularly relevant now for two main reasons. First, interest rates in the Euro Area have risen sharply—more than doubled over the past decade and more than tripled relative to 2019 (European Central Bank, 2024), with an even larger increase in the US (Federal Reserve Bank, 2025). Higher rates raise net interest expense and make earnings-based deductibility caps more likely to bind, even without changes in leverage. Second, the reluctance of other countries to implement earnings stripping rules (e.g., China and Brazil) or the choice to apply them only to foreign related-party interest (e.g., India, Japan, and Korea) can create competitive disadvantages for EU firms (EY, 2023; PwC, 2024).

III. HYPOTHESES

We analyze the firm-level real effects of the EU-wide adoption of earnings stripping rules. Earnings stripping rules differ from the thin capitalization rules in that their threshold is tied to

[3] All firms in our sample are part of a corporate group based on accessible Orbis data.

a firm's (adjusted) income rather than a debt-to-equity ratio. This design makes tax planning more challenging as profits typically fluctuate more than assets. The OECD (2015) explicitly recommended the earnings stripping rule threshold over a thin capitalization rule threshold in its final reports on the BEPS project, the prototype for the earnings stripping rule in the ATAD I Directive, because EBITDA is more difficult to manipulate than equity.

We posit that earnings stripping rules affect firm behavior through two distinct channels. The first is the well-established (Buettner et al., 2012; Carrizosa et al., 2023; De Mooij and Liu, 2021) *cost of capital channel*: by reducing the marginal tax benefit of debt, these rules raise the weighted average cost of capital (Hall and Jorgenson, 1967). This can occur either because firms proactively deleverage to avoid interest disallowance or because disallowed deductions directly increase after-tax borrowing costs. Both thin capitalization and earnings stripping rules operate through this channel. Because deductibility under ESRs is tied to contemporaneous profitability, this channel may be stronger when earnings are volatile.

In addition, and in contrast to thin capitalization rules, earnings stripping rules open a *risk channel*. Because interest deductibility is tied to volatile operating income, firms have an incentive to reduce operational risk[4] to avoid hitting the threshold in low-income years.[5] Put differently, these rules make the debt tax shield profit-contingent: it remains fully available in high-profit years but is partly lost in low-profit years. Consequently, greater earnings volatility reduces the expected value of the tax shield. In real options terms, the rule reduces the convexity of the after-tax payoff function, thereby lowering the option value of risk-taking. As earnings volatility rises, the expected value of the shield falls, and optimal risk-taking declines in the limited-loss-offset framework (Mossin, 1968; Sandmo, 1969). The OECD (2015) similarly

[4] We define operating risk as the variance of future returns, following Acharya et al. (2011), Faccio et al. (2011), John et al. (2008) and Langenmayr and Lester (2018).
[5] Firms may be denied interest deductibility simply because of a timing mismatch between net interest expenses and EBITDA in individual financial years, even if the threshold is not exceeded when considering the total period.

noted that volatility of operating returns can unduly restrict a firm's ability to deduct interest expenses under an earnings stripping regime.

This risk-reducing effect is reinforced if higher earnings volatility also translates into higher interest rates on debt. Unlike thin capitalization rules, which tie deductibility to leverage, earnings stripping rules link non-deduction directly to the level of net interest expense. Firms with higher borrowing costs—typically those with greater risk—are therefore more severely affected. By reducing operational risk, firms can improve both the numerator (EBITDA) and the denominator (net interest) in the earnings stripping formula, thereby lowering the probability of disallowed deductions.

H 1: *Firms decrease their operational risk after the introduction of the earnings stripping rule.*

Both channels have implications for firms' real activities, in particular investment and innovation. The risk channel has direct implications not only for operational volatility, but also for activities that are inherently uncertain, such as innovation. Innovative projects typically involve long time horizons, high upfront costs, and uncertain payoffs. As such, they are particularly vulnerable when firms deliberately choose safer, more predictable investment profiles to avoid volatile earnings. Accordingly, lower risk-taking should coincide with weaker innovative output and reduced capital formation.

The cost of capital channel reinforces these effects. By reducing the marginal tax benefit of debt, earnings stripping rules raise the weighted average cost of capital (Hall and Jorgenson, 1967). The higher cost of capital can shrink the set of profitable investment opportunities, leading to reduced investment spending (Blouin et al., 2014; Buettner et al., 2012; De Mooij and Liu, 2021). Because R&D and other innovation activities are capital-intensive, the cost of capital channel can also contribute to a decline in innovation, even absent deliberate changes in risk appetite.

H 2: *Firms reduce investment and innovation after the reform.*

However, there are also reasonable arguments for why we may not observe these expected effects. In particular, multinational firms may be able to substitute debt in other high-tax countries without an interest limitation rule in place. If the cross-border financing decisions of multinational firms are perfectly elastic, then one can expect effects at the consolidated group level to be significantly mitigated following the reform to the extent debt can be shifted to other affiliates not subject to an interest limitation rule. However, tax restructuring, to a certain extent, may be unattractive due to high deadweight costs or for non-tax reasons (Huizinga and Laeven, 2008). Furthermore, as the new earnings stripping rule covers all European Member States and because many developed non-European countries have at least implemented some kind of interest limitation rule, it seems unlikely that the average European multinational can fully circumvent an interest restriction purely through reallocation of debt. Nonetheless, tax restructuring is not fully ruled out and may decrease the observed effect of the reform on a consolidated firm level.

IV. RESEARCH DESIGN

According to Hypothesis 1, we expect that the introduction of an earnings stripping rule reduces firm risk-taking. We use the following difference-in-differences (DiD) research design described by Equation (1) based on consolidated firm-level data to test this hypothesis. We consider all firms *i* headquartered in a European country *c* in year *t* as separate observations.

$$Risk_{it} = \beta_0 + \beta_1 * Treat_c * Reform_t + \beta_x * x_{it} + \beta_y * y_{ct} + \beta_z * z_{ct} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Firm risk is not directly observable, as there is no way to track management decisions using financial statement information directly. However, riskier operations should result in more volatile future returns. Therefore, the inherent risk of a firm's operations can be proxied by the volatility of its future returns. Following this notion, we use three different risk-taking proxies. First, we follow John et al. (2008), Faccio et al. (2011), Acharya et al. (2011), and Langenmayr and Lester (2018) and define $Risk_{it}$ as the volatility of the difference of a firms return on assets (ROA) to the industry-country-year ROA average over the next three years

($EarnVol_{it}$). We follow Acharya et al. (2011) and Langenmayr and Lester (2018) and use earnings before interest and taxes (EBIT) instead of earnings before interest, taxes, depreciation and amortization (EBITDA) to ensure that amortization and depreciation—potentially affected by investment responses—are reflected. Second, we directly use the (unadjusted) standard deviation of EBIT over assets over three years ($UnadjEarnVol_{it}$). Lastly, we use Idiosyncratic Volatility ($IVol_{it}$) defined as the variance of the residuals from a Fama-French three factor model[6] (Campbell et al., 2001; Fu, 2009), which captures firm-specific return fluctuations not explained by market, size, and value factors. Because this measure is based on market returns, it should reflect information beyond accounting data.

$Treat_c$ is an indicator variable taking the value of one if a firm is headquartered in a country that had to adopt or tighten an earnings stripping rule in 2019 and zero otherwise (De Mooij and Liu, 2021; Mukherjee et al., 2017). We follow the European Commission's assessment to classify countries into the two groups. The European Commission's classification is based on the pre-reform interest limitation regime (see Table A1 in the Appendix). Member States that did not apply an effective[7] interest limitation rule before 2019 were required to implement the earning stripping rule in 2019. The European Commission (2018) deemed existing measures by Germany[8], Greece, France, Slovakia, Slovenia, and Spain as "equally effective". Based on this classification, we consider firms with their headquarters in countries that did not have an effective interest limitation rule prior to the reform as the treatment group and those in countries that already had effective measures in place as the control group. Figure A1 (Appendix) gives an overview of the assignment of treatment and control countries and the number of observations per country. Table A2 (Appendix) summarizes the specific

[6] The daily factor data for European firms can be accessed at Kenneth R. French's Website, see: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[7] A regulation was deemed effective only if it had both "(1) the legal similarity and (2) the economic equivalence" (European Commission, 2018) to the new measures proposed by the Directive.

[8] Germany was allowed to postpone the implementation until 2024 because their earnings stripping rule served as the prototype for Article 4 (European Parliament, 2022).

implementation of the earnings stripping rule for all Member States and the United Kingdom. In untabulated robustness tests, we also allow for cross-border exposure by constructing a continuous treatment variable that weights a firm's exposure to the reform by the presence of subsidiaries across affected countries.

$Risk_{it}$ is a forward-looking measure which affects financial statement outcomes only with a time-lag. We therefore define $Reform_t$ using the announcement year (2017) rather than the implementation year (2019). $Reform_t$ equals one for observations in and after 2017, and zero otherwise. We restrict our sample period to five years pre- and post-reform. The explanatory variable of central interest is the interaction term $Treat_c \times Reform_t$. According to Hypothesis 1, we expect a negative coefficient for the interaction term.

We control for several firm- and country-level covariates to account for other determinants of risk. Following Langenmayr and Lester (2018), the vector x_{it} denotes a set of firm-level control variables including the log of total assets (ln_Assets_{it}) as a control for firm size, market-to-book-ratio (MtB_{it}) and the percentage change in revenue compared to the prior year ($Growth_{it}$) capturing firm's investment growth potential, as well as profitability and firm's investment capabilities via earnings before interest and taxes relative to total assets ($EBITOA_{it}$).

The vector y_{ct} denotes a set of time varying country characteristics, including GDP growth ($GDPGrowth_{ct}$), inflation ($Inflation_{ct}$), and the 10-year governmental bond interest rate (InterestRate_{ct}). We also include the standard deviation of the quarterly growth in real industrial production for each country-year ($MacroRisk_{ct}$) as a measure for macroeconomic risk. We do not have access to the country control variables for political risk and creditor rights used by Blouin et al. (2014). Instead, following Langenmayr and Lester (2018) and Mihet (2013), we control for the rule of law ($RuleOfLaw_{ct}$), regulatory quality ($RegulatoryQuality_{ct}$), and corruption ($Corruption_{ct}$), which should correlate with creditor rights and political risk. Lastly, the vector z_{ct} captures tax regulations that may affect risk: the combined corporation tax rate ($CorpTR_{ct}$), reflecting both central and regional or local taxes on corporate profits.

$EquityAllowance_{ct}$ is an indicator variable taking the value of one if an equity allowance rule is present in a country, and zero otherwise. Further, we include an indicator variable to identify countries with a group taxation regime ($GroupTaxation_{ct}$), and an indicator for the strictness of existing loss offset provisions ($LossOffset_{ct}$) which has a value between 0 and 4, 4 being the most favorable carryover provisions.

Additionally, we include the Anti-Tax Avoidance Rule Index by Bruehne et al. (2019) in all regression specifications to control for other measure of the ATAD I Directive. We extend the index with hand-collected data from the EY Worldwide Corporate Tax Guide and KPMG country tax guides through 2023 and exclude interest-limitation parameters, ensuring that the estimated treatment effect is not driven by other elements of the directive.

Additionally, we include firm fixed effects (μ_i) to control for unobserved time-invariant firm properties and year fixed effects (λ_t) to control for time-specific properties such as macroeconomic shocks to the European Union.[9] Because treatment is assigned on the country-level, we use heteroskedasticity-robust standard errors clustered at the country level in all regressions (Abadie et al., 2022). We provide definitions for all variables in Table 1, and report descriptive statistics for all dependent and independent variables in Table 2.

We estimate analogous models to test Hypothesis 2 for the dependent variables $Investment_{it}$ and $PatentApps_{it}$, our measures for investment and innovation. We follow de Mooij and Liu (2021) and define $Investment_{it}$ as the current-year investment in fixed tangible assets divided by lagged fixed tangible assets. For these specifications, we use a different vector of firm-level controls. Following prior literature (De Mooij and Liu, 2021), we control for the natural logarithm of lagged revenue (ln_Sales_{it-1}, lagged) as a proxy for firm size, current year cashflow relative to lagged capital stock ($CashFlowRate_{it-1}$) as an indicator for financial constraints, EBIT relative to sales ($Profitability_{it-1}$) as a measure for profitability and the

[9] The separate factors $Treat_c$ and $Reform_t$ are subsumed in the firm- and year fixed effects. In untabulated alternative specifications, we follow Langenmayr and Lester (2018) and use industry-by-year fixed effects and find similar inferences.

percentage change in revenue compared to the prior year ($Growth_{it-1}$, lagged). Based on Hypothesis 2, we expect a negative coefficient for the interaction term. In contrast to the risk regressions, we define $Reform_t$ here with reference to the year of enactment (2019), as we expect changes in investment to become immediately effective.

For innovation, we use two-year-ahead patent applications as the dependent variable (Atanassov and Liu, 2020; Mukherjee et al., 2017). Consistent with the risk specification, we set 2017 as the treatment year for patent applications, as firms can adjust risky innovation activity upon the reform's announcement. For firm controls, we follow Atanassov and Liu (2020) and Mukherjee et al. (2017) and use ln_Sales_{it}, $Profitability_{it}$ and $Tangibility_{it}$, and we omit leverage and R&D ratios that may be directly affected by the reform. Based on Hypothesis 2, we expect a negative reform effect. Because patent applications are count data with many zeros (left-skewed), we rely on a Poisson pseudo-maximum-likelihood specification in our main analysis.

V. DATA

Our sample comprises the universe of publicly listed firms headquartered in Europe with consolidated financial statement information in Compustat Global for the years 2012 to 2023.[10] We restrict our sample to 2012 to 2023 for two main reasons. First, it provides sufficient pre-reform years to establish a credible common-trend assumption. Second, starting in 2012 avoids distortions from the immediate aftermath of the European debt crisis (European Parliament, 2019).

For our innovation analysis, we use patent data from PATSTAT. We match the Compustat observations to Orbis data based on the headquarter ISIN. We then implement a name-standardization routine and match patent applicant names to Orbis subsidiary names

[10] In contrast to other firm responses we expect that firms adjusted their risk-taking and innovation activities immediately after the reform was announced in 2017 (and not only after the enactment in 2019). For the risk and innovation regressions, the sample covers the period 2012–2023. For all others, we refer to the period 2014–2023.

using fuzzy matching, consolidating matches to the headquarters level (for the methodology see for example: Abramovsky et al., 2008; Arora et al., 2021).

We exclude firms from countries that introduced the earnings stripping rule earlier or later than 2019. Latvia, Poland, and Romania voluntarily implemented the reform in 2018, while Austria and Ireland delayed the implementation until 2021 or 2022, respectively. These staggered adoptions support treating the 2019 ATAD-mandated implementation as an external shock for the remaining countries and motivate their exclusion here for comparability.

Moreover, we exclude firms headquartered in the United Kingdom to eliminate any potential distortion that may arise due to its exit from the European Union. We exclude financial industry firms based on the Global Industry Classification Standard (GICS) from our sample due to their particular capital structure (Buettner et al., 2012; Buslei and Simmler, 2012; De Mooij and Hebous, 2018).[11] Moreover, we require each firm to have at least one firm-year observation pre- and post-reform to account for our DiD strategy. This sample selection procedure yields an unbalanced panel of 27.730 observations for 3,312 unique firms in 22 Member States.

We collect information on the interest limitation rules in European Member States before the reform and details on the national implementation of the earnings stripping rule reform, among other things to determine the time of treatment (see Tables A1 and A2 in the Appendix). The data stems from the International Bureau of Fiscal Documentation (IBFD; Popa, 2019), the PwC Worldwide Tax Summaries (2024) and the EY Worldwide Corporate Tax Guide (EY, 2023). The classification of treatment and control group is based on the evaluation of existing interest limitation rules by the European Commission (2018).

We complement the firm-level data with various macroeconomic variables. We use the combined statutory tax rates, long-term interest rates, and indices for industrial production

[11] Many countries also exclude the financial sector from earnings stripping rules.

provided by the OECD. The variables on country-specific inflation and GDP growth, as well as the World Governance Indicators for corruption, regulatory quality, and rule of law, are obtained from the World Bank database. We manually collect historical data on loss carryover regulations, group taxation, equity allowances, other Anti-Tax-Avoidance measures and the Nexus and IP Box implementation based on the EY worldwide global tax guide and KPMG country tax guides and cross-checked those with prior studies (Boie-Wegener, 2024; Chen et al., 2023; Gschossmann and Pfrang, 2024).

Table 2 reports summary statistics for the dependent and independent variables used in our regression analysis, separately for firms in treated and control countries. Figure A2 (Appendix) complements these statistics by depicting the time trends of the main dependent variables across both groups. The figures show level differences between treated and control firms, while trends are similar, suggesting a credible basis for our empirical design. In addition, we employ matched-sample techniques in our robustness tests (Table 11) to further enhance comparability between treated and control firms.

VI. EMPIRICAL RESULTS

Validation: Effect on capital structure

We start our empirical analysis with a validation exercise that the earnings stripping rules were implemented and enforced rigorously enough to impact firm behavior. To do so, we focus on an intended consequence of this reform: to limit the tax benefits of debt finance in order to ensure more conservative capital structures of European firms (European Commission, 2016). Firms in treated Member States did not face an "equally effective" interest limitation rule prior to the reform. Therefore, the new earnings stripping rule constitutes a stricter interest limitation regime, whether via an extension of the scope of application from internal to total interest, a stricter threshold, or by closing loopholes. The tax advantage of debt is driven by the possibility of deducting interest expenses from corporate income. When the interest deduction becomes limited above a certain threshold, debt loses its marginal tax advantage while the associated

marginal costs of debt remain unaltered. Based on earlier theoretical and empirical research, the average firm is expected to decrease its debt ratio so that the marginal benefit and marginal cost of debt are in equilibrium again (Buettner et al., 2012; Buslei and Simmler, 2012; DeAngelo and Masulis, 1980; Myers, 1984). This assumes firms are not severely cash constrained and can substitute equity for debt if necessary.

We use the same regression design described by Equation 1 to analyze the effect of earnings stripping rules on firms' capital structures. DtA_{it} is the dependent variable, which captures the consolidated debt-to-asset ratio by firm i in year t. In further analyses, we replace the debt-to-asset ratio with the natural logarithm of equity and of debt to also investigate whether the reform has (adversely) affected both types of capital or the reform effect is limited to either of the two. $Reform_t$ equals one for the reform year 2019 and onward. Following Blouin et al. (2014), we replace the vector x_{it} with a set of firm-level controls appropriate for examining capital structure and consisting of proxies for lending collateral ($Tangibility_{it}$), profitability (ROA_{it}), size (ln_Assets_{it}) and prospects of future profitability ($GrowthOptions_{it}$). We include the same country-level controls as in Equation 1.

We report regression results for the debt-to-asset ratio in column (1) of Table 3, followed by the individual effects on equity (column (2)), current debt (column (3)) and long-term debt (column (4)). Our results clearly confirm that treated firms decrease their debt-to-asset ratio following the reform (column (1)). The coefficient estimate of -0.023 translates into an approximately 11% reduction in the debt-to-asset ratio. This result is at the lower end of estimates reported by previous studies investigating the effects of thin capitalization rules (-9.6 to -21%), and comparable to findings of most prior studies on earnings stripping rules (-8 to -10%[12]).

[12] Buslei and Simmler (2012) as well as Jamal (2024) report reductions of 10%, very close to this study. Mooij and Hebous (2018) estimate a reduction of 8%. Our result is very similar to these prior findings. Only Bashir et al. (2024) find a stronger reduction of 20%.

The analysis of the unscaled natural logarithm of equity (column (2)), short-term debt (column (3)) and long-term debt (column (4)) indicates a significant decrease in both short- and long-term debt which is partly substituted by an increase in equity. This observation is in line with prior studies which find that firms partly substitute debt with equity upon a limitation of total interest expenses (Goodman et al., 2025; Weichenrieder and Windischbauer, 2008).

We further investigate the heterogeneity of the debt-to-assets finding in Table 4. The OECD (2015) raised concerns in its final report on the earnings stripping rule framework that a uniform threshold might discriminate against firms with naturally, due to their business model or sector, higher leverage. We argue that this concern does not only apply to a firm's leverage but also to its operational risk. Although a firm may aim to reduce its operational risk, the extent will be limited based on the inherent risk in its sector or its specific business model. Therefore, the earnings stripping rule discriminates between firms based on their inherent operational risk. As a result, firms with a higher operating risk prior to the reform need to decrease their debt-to-asset ratio more significantly if they want to avoid an application of the earnings stripping rule. Those firms will try to create an additional buffer between their net interest expenses and EBITDA quota through a decrease in debt to account for fluctuation in their operating returns.

Partitioning firms into quartiles based on their pre-reform operational risk in Table 4, we find that the results are influenced by the degree of firm-level risk. Although all coefficient estimates are negative, only those for the second, third, and fourth quartiles are statistically significant. Moreover, the magnitude of the coefficients increases from quartile one to quartile four, with the estimate in quartile four nearly twice the baseline effect observed in Table 3. This pattern supports that firms with higher pre-reform risk adjust their capital structures more significantly to accommodate EBITDA volatility.

Tests of Hypothesis 1: Effects on operational risk

In our tests of Hypothesis 1, we investigate potential effects of an earnings-based threshold by investigating firms' risk-taking behavior after the reform. Following prior literature (John et al.

2008, Faccio et al. 2011, Acharya et al. 2011, and Langenmayr and Lester 2018) our primary measure of firm risk is the volatility of the difference of a firms return on assets (ROA) to the industry-country-year ROA average over the three years ($EarnVol_{it}$). Additionally, we use an unadjusted risk measure using the volatility in ROA over three years ($UnadjEarnVol_{it}$), and, lastly, $IVol_{it}$ as a market-based idiosyncratic volatility measure from a Fama–French three-factor residual regression. The results in Table 5 clearly document that firms reduce their operational risk after the reform. The coefficient estimate of -0.657 translates into a decrease in risk taking of approximately 13% compared to the overall sample average of treated firms. This reduction is approximately half of the risk reductions induced by the reduction in loss carry-back periods (Langenmayr and Lester, 2018). The results remain highly significant across all measures, with a similar magnitude.

The event study graph (Figure 1, Panel A) illustrates the dynamic effects of the reform on operational risk ($EarnVol_{it}$) over time. The coefficients for the pre-treatment periods remain close to zero and are statistically insignificant, without a clear pre-reform trend. This stability in the pre-treatment period increases our confidence that the parallel trends assumption of our DiD design holds. Four out of five post-treatment years show a significant reduction in operational risk.

A key distinction between earnings stripping and thin capitalization rules is that only the former operate through a risk channel. We therefore expect the impact on risk-taking to depend on the design of the pre-reform regime. Specifically, the effect should be strongest in countries that previously had no interest limitation rule or only a thin capitalization rule, and weaker in countries that already operated an earnings stripping rule that was incompatible with the EU directive. To test this prediction, we partition the treated countries by their pre-reform regulation (no rule, thin capitalization rule, earnings stripping rule) and re-estimate our regressions for our main risk measure (Table 6). Consistent with our prediction, we find that the treatment effect is statistically significant and larger than the full-sample effect in countries

without an interest limitation rule and in countries with a thin capitalization rule. By contrast, the effect is smaller than the full-sample estimate in countries that already had an earnings stripping rule in place. These results reinforce our interpretation that it is the introduction of a new earnings stripping regime—rather than other aspects of the reform—that drives the reduction in risk-taking.

Capital structure choice and risk-taking are not necessarily independent of each other. We, therefore, have also conducted a 2SLS regression to test whether the risk-taking effect is driven by the reform-related change in leverage. We estimate the reform effect on leverage (DtA_{it}) as before (first stage), and included the predicted DtA_{it} as an additional control in our risk-taking regression (second stage). The untabulated results of this test reveal that predicted DtA_{it} is not a significant determinant of $EarnVol_{it}$. Hence, we conclude that the change in risk-taking is not explained by the corresponding reduction in leverage.

Tests of Hypothesis 2: Effects on investment and innovation

Table 7 presents the estimated treatment effect of the earnings stripping rule reform on investment, testing part of Hypothesis 2. We capture investment as capital expenditure in tangible fixed assets, scaled by lagged tangible fixed assets ($Investment_{it}$). In Column (1) of Table 7 we estimate the reform effect for the full sample. The estimated treatment effect for $Investment_{it}$ is negative and statistically significant at the 5 percent level. The estimate corresponds to a 11.2 percentage point decrease in the investment rate after the earnings stripping rule reform, a 17.8% decrease based on the treatment group's mean investment rate of 0.63 prior to the reform. The effect is close to the 21% (11 percentage point) investment rate reduction found by de Mooij and Liu (2021).[13] Our findings are also consistent with the effects

[13] De Mooij and Liu (2021) investigate the effect of thin capitalization rules on investment using an interaction term between the statutory tax rate and an indicator variable for a thin capitalization rule. The average statutory tax rate in their sample is 27%, which is similar to the 26% reported in our study. This similarity makes their results directly comparable to ours on the effects of an earnings stripping rule.

documented by Buettner et al. (2018) on foreign direct investment after the implementation of interest limitation rules.

We expect the earnings stripping reform to operate through both the cost of capital and the risk channel. Consistent with the latter, we have shown that the reform's impact on debt financing is more negative for firms with higher pre-reform risk. In Columns (2)–(5) of Table 7, we examine whether this pattern extends to investment by splitting the sample into quartiles based on pre-reform risk. The results strongly support our prediction: firms in the highest-risk quartiles experience large reductions in investment of 6.5, 17.5, and 24.2 percentage points, respectively, while low-risk firms in Column (2) show no significant response.

R&D and innovation represent particularly risky activities and should therefore be especially affected by the reform through the risk channel. We test this prediction using a set of PPML and OLS regressions, reported in Table 8. The main dependent variable is $PatentApps_{it+2}$, the number of patent applications per firm and year, included with a two-year lead. We find the number of patent applications to be associated with the design of tax regulations. In Column (1), we estimate statistically positive coefficients for $RaDTaxSubsidy_{ct}$ and $IPBox_{ct}$, reflecting the provision of research-related tax subsidies and preferential tax regimes for intellectual property. By contrast, the earnings stripping rule has significantly reduced the number of patent applications in Column (1). The coefficient of -0.079 translates into a reduction in overall patent applications by 7.6 percent by treated firms after the ESR reform became effective. The OLS specification in Column (2) confirms this negative effect on patent applications. Further untabulated tests reveal that the effect on patent applications is driven by the declining number of successful patent applications, whereas we find no similar effect on non-granted patents. The effects of the earnings stripping rule reform, thus, do not appear to be limited to the *quantity* of innovation activities but also extend to their *quality*.

Consequences: Effects on firm growth and bankruptcy risk

We next explore some of the potential consequences of our results so far at the firm level. First, firm growth may be affected by a decrease in the debt-to-asset ratio, a decrease in operational risk and a decrease in investment and innovation after the reform, all effects we examine above. Lang et al. (1996) and Hovakimian et al. (2001) find that leverage affects firm growth differently depending on a firm's investment opportunities. The effect of a decrease in leverage on the growth of firms in our sample can therefore not be predicted without a firm-level analysis of growth opportunities. Prior empirical literature suggests that firm risk has a strong positive influence on growth (John et al., 2008; Langenmayr and Lester, 2018). Under the assumption that investment is only made if a positive return is expected, a decrease in investment leads to slower firm growth (Bai et al., 2020; Lang et al., 1996). We expect the negative effect of a decrease in operational risk and investment to outweigh the uncertain effect of a decrease in leverage and therefore predict a decline in firm growth after the earnings stripping rule reform.

We follow Fisman and Svensson (2007) and define ln_Growth_{it} as the current year natural logarithm of sales minus the last year natural logarithm of sales. In this specification, ln_Sales_{it} denotes the natural logarithm of sales as a control for firm size. The reported results for firm growth in Table 9 show a statistically significant decrease in firm growth of approximately 10 percent after the reform for the full sample (Column (1)). This overall effect is driven by firms with the highest pre-reform operational risk, which show a highly significant decline in growth of 21 percent (Column (5)). We observe smaller or even insignificant growth effects for firms with lower levels of risk.

Second, we predict an effect on firm bankruptcy risk. The only study to analyse potential effects of interest limitation rules on firm bankruptcy risk was conducted by de Mooij and Hebous (2018). The authors find that interest limitation rules generally reduce bankruptcy risk. However, they do not differentiate between thin capitalization rules and earnings stripping

rules. We argue that the effect on bankruptcy may vary between thin capitalization rules and earnings stripping rules. A thin capitalization rule prevents excess leverage and therefore decreases overall bankruptcy risk (IMF, 2009). Under a thin capitalization rule a firm's deductibility of interest expenses is not directly affected by a slump in sales, at least not insofar as the firm is not forced to take on additional debt, and will therefore generally not exacerbate a firm's crisis.

This may be different under an earnings stripping rule. Because the deductibility of interest is directly linked to a firm's financial performance, a slump in sales may be accompanied by a deduction limit on interest expenses. In extreme cases, a firm with no profit may have to pay taxes if the addition of disallowed interest results in a positive tax base. The resulting loss in liquidity may increase the risk of financial distress. On the other hand, we expect earnings stripping rules to reduce operating risk and leverage, two effects that should decrease the bankruptcy risk of firms. The overall effect on bankruptcy risk is therefore not clear ex ante. To examine bankruptcy risk, we replace the dependent variable with bankruptcy proxies. We use Altmann's Z''-Score (see for example Altman et al., 2014) for manufacturing and non-manufacturing firms as a basis for our dummy variable indicating firms in financial distress. The Z-Score is calculated as follows:

$$ZScore_{it} = 6.56 * X_1 + 3.26 * X_2 + 6.72 * X_3 + 1.05 * X_4 \quad (2)$$

where X_1 denotes the ratio of working capital to total assets, X_2 denotes the ratio of retained earnings to total assets, X_3 is the ratio of EBIT to total assets, X_4 the book value of equity relative to its book value of total liabilities. The indicator for firms in financial distress ($ZDummy_{it}$) turns one for firms with Z-Scores below 1.1, and zero otherwise (Altman et al., 1998; Altman and Hotchkiss, 2005). We follow De Mooij and Hebous (2018) and include $Volatility_{it}$ as our sole firm level control, defined as the standard deviation of the difference of a firm's return on assets (ROA) to the country-year ROA average over the next three years.

Table 10 reports the results for the firms' bankruptcy risk. For the full sample, we find no significant effect of the ESR reform on $ZDummy_{it}$, neither in the LPM specification (Column (1)) nor when using logit regression (Column (2)). This result differs from de Mooij and Hebous (2018), who find that interest limitation rules reduce the risk of financial distress. However, the sample used by de Mooij and Hebous (2018) mainly consists of thin capitalization rules, which do not have the same drawbacks regarding operational risk as they do not consider profitability in their threshold.

Again, we find that the consequences of the ESR reform depend on the level of pre-reform risk. Performing the same sample split as before, we find that firms in the risk quartiles 1 to 3 (Column (3)-(5)) show no significant reaction in their bankruptcy risk. By contrast, the ESR reform increased the risk of financial distress by 5 percentage points for the firms with the highest level of risk (Column (6)). These differences are in line with our theory that earnings stripping rules have mixed effects on bankruptcy risk, dependent on a firm's pre-reform risk profile. Generally, a decrease in leverage and operational risk should decrease bankruptcy risk. However, for firms with high operational risk, the application of an earnings stripping rule appears to exacerbate financial distress, possibly by entailing additional liquidity constraints through higher tax payments.

Robustness

We use a variety of matching procedures for our full sample estimations to account for possible concerns regarding the similarity between our treatment and control group firms (Table 11). The firms are matched based on the pre-reform values of all firm specific control variables in 2018 (2016 for operational risk and patents as dependent variable). The results are overall very consistent regardless of the matching technique and in line with the results we reported based on the unmatched samples.

We conduct several additional (untabulated) robustness tests. In one test, we account for the fact that the earnings-stripping rules are applied at the affiliate level. Specifically, we

construct a treatment exposure measure defined as the ratio of affiliates located in treated Member States to the total number of European affiliates. The results remain highly consistent across all main specifications; only the reform effect on investment falls just short of conventional significance levels. In another test, we run all main specifications with an alternative fixed effects structure. Following other studies on firm risk (Langenmayr and Lester, 2018; Welsch, 2023), we use industry-by-year fixed effects instead of our firm and year fixed effects. While most of our results hold, we no longer find a significant reform effect on patent applications. We also control for potential distortions due to the COVID pandemic through additional controls based on confirmed COVID cases and deaths. Again, our results are very consistent across all main specifications. Lastly, our results also hold if we include only those treated countries that did not implement a Controlled Foreign Corporation (CFC) Rule at the same time.

VII. CONCLUSION

We analyze the impact of the EU's 2019 earnings stripping rule (ESR) reform under ATAD I on publicly listed firms in the European Union. The analysis is based on the consolidated financial statements of 3,312 firms in 22 Member States from 2012 to 2023. Our study provides evidence on the real effects of earnings stripping rules and contributes to the literature on earnings stripping rules and anti-corporate tax avoidance measures in general. We confirm that the earnings stripping rule reform was effective in reducing firms' debt-to-asset ratios in treated Member States based on consolidated financial statements. While the effectiveness of interest limitation rules in curbing corporate debt finance is well-documented, our findings reveal that earnings stripping rules also have economically meaningful real effects, concentrated among firms with high operating risk. These firms reduce leverage, investment, and innovation more sharply, experience slower growth, and face a higher likelihood of financial distress. Moreover, the introduction of earnings stripping rules is associated with a broad-based reduction in

corporate risk-taking and innovative output. Policymakers should carefully balance anti-avoidance objectives against these real economic costs.

Our research also speaks to the theoretical framework on tax system asymmetries by showing that profit-contingent deductibility withholds relief in low-profit states, lowering the expected debt tax shield and discouraging risk-taking—paralleling the limited-loss-offset mechanism. Furthermore, we emphasize that the design of interest limitation rules, whether a thin capitalization rule or an earnings stripping rule, is crucial in shaping their effects, and that these effects vary with pre-reform regimes and firm risk profiles. This finding highlights the need for further research into how the design and implementation of anti-tax avoidance measures influence corporate behavior, particularly regarding risk-taking, investment decisions, and innovation.

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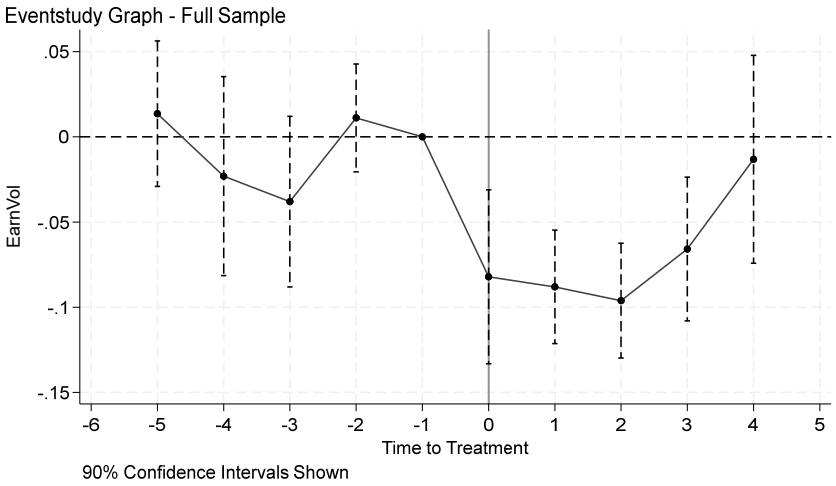
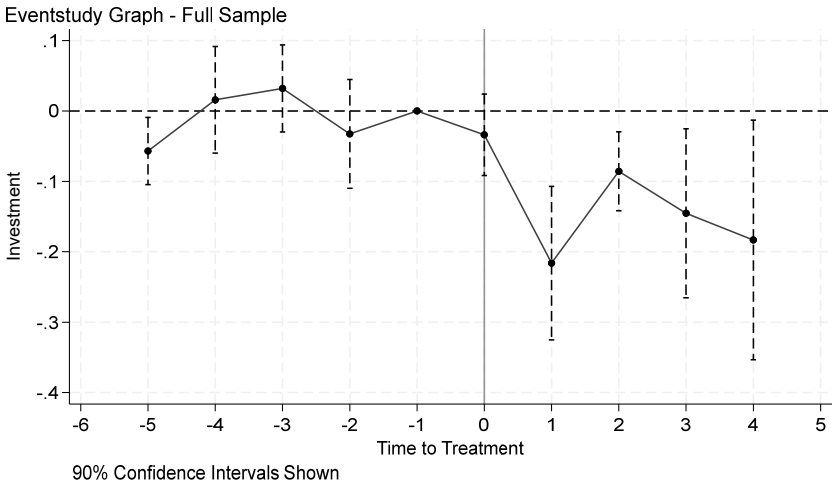
Figures

Figure 1: Event Study Graphs

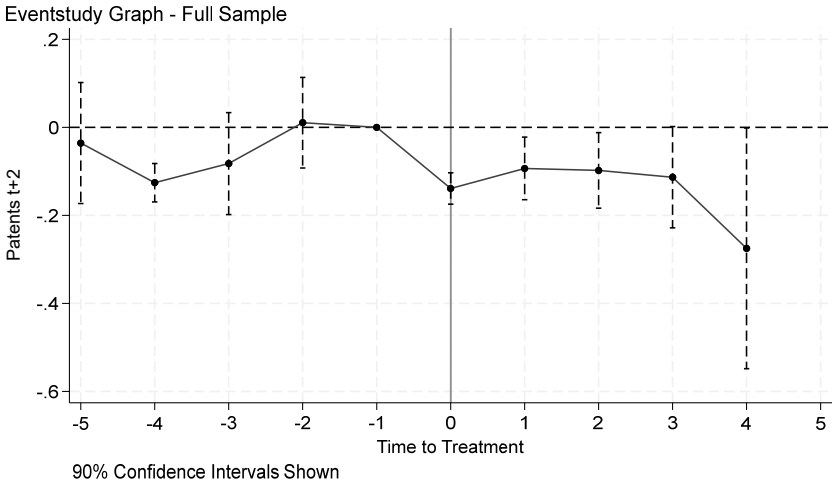
Panel A



Panel B



Panel C



Notes: Figure 1 depicts the event study coefficient estimates of the main dependent variables from our difference-in-differences models using the full sample. Panel A shows $EarnVol_{it}$, the industry-adjusted standard deviation of EBIT over the years *t* to *t+2*. Panel B shows the dependent variable $Investment_{it}$, the capital expenditure in fixed tangible assets over lagged tangible assets by firm *i* in year *t*. Panel C shows $Patents_{it+2}$the number of patent applications by firm *i* in year *t+2*.

Tables

Table 1: Variable Definitions

Variable	Definition	Source
All continuous variables are winsorized at the one percent level		
Dependent variables		
DtA_{it}	Total debt divided by total assets	Compustat Global
ln_Equity_{it}	Natural logarithm of shareholders' total equity	Compustat Global
$ln\_CurrentDebt_{it}$	Natural logarithm of current debt	Compustat Global
$ln\_LongtermDebt_{it}$	Natural logarithm of long-term debt	Compustat Global
$EarnVol_{it}$	*Step 1*: calculation of the difference between the firm's EBIT divided by total assets and the average country-industry-year EBIT divided by total assets *Step 2*: standard deviation of this difference over years *t* to *t+2*	Compustat Global
$UnadjEarnVol_{it}$	Standard deviation of EBIT divided by total assets over years *t* to *t+2*	Compustat Global
$IVol_{it}$	The standard deviation of daily abnormal returns (residuals from a Fama-French three factor model) for each firm	Thomson Reuters / Kenneth R. French
$Investment_{it}$	Capital expenditure in fixed tangible assets divided by lagged fixed tangible assets	Compustat Global
ln_Growth_{it}	Natural logarithm of sales in year *t* minus the natural logarithm of sales in year *t-1*	Compustat Global
$ZScore_{it}$	$ZScore = 6.56 \cdot X_1 + 3.26 \cdot X_2 + 6.72 \cdot X_3 + 1{,}05 \cdot X_4$ X_1: ratio of working capital to total assets X_2: ratio of retained earnings to total assets X_3: ratio of EBIT to total assets X_4: book value of equity relative to book value of total liabilities	Compustat Global / Thomson Reuters
$ZDummy_{it}$	Indicator variable that equals one if the ZScore of firm *i* is below 1.1, and zero otherwise	Compustat Global / Thomson Reuters
$Patents_{it+2}$	The number of patent applications of firm *i* in *t+2*	Patstat
Firm controls		
$CashflowRate_{it}$	Capital expenditure in fixed tangible assets divided by lagged capital stock	Compustat Global
$EBITOA_{it}$	EBIT divided by total assets	Compustat Global
$Growth_{it}$	Current year revenue divided by last year revenue minus one	Compustat Global
$GrowthOptions_{it}$	Country-sector-year average of current year revenue divided by last year revenue minus one	Compustat Global
ln_Assets_{it}	Natural logarithm of total assets	Compustat Global
ln_Sales_{it}	Natural logarithm of revenue	Compustat Global
MtB_{it}	Ratio of market capitalization (Thomson Reuters) to common equity (Compustat)	Thomson Reuters, Compustat Global
$Profitability_{it-1}$	EBIT divided by revenue, lagged by one year	Compustat Global
ROA_{it}	EBITDA divided by total assets	Compustat Global
$Tangibility_{it}$	Property, plant & equipment divided by total assets	Compustat Global
$Volatility_{it}$	Standard deviation (over the years *t+1* to *t+3*) of the difference between firm *i*'s return on assets (ROA) and the country-year ROA average	Compustat Global

Country controls:

$Corruption_{ct}$	Perception of the extent to which public power is exercised for private gain (percentile rank of country *c* in year *t*)	World Bank (World Governance Indicators)
$GDPGrowth_{ct}$	One year percentage change in gross domestic product, measured in current prices	World Bank
$Inflation_{ct}$	Change in the consumer price index	World Bank
$InterestRate_{ct}$	Long-term (10 years) interest rate on government bonds	OECD
$MacroRisk_{ct}$	Standard deviation of quarterly growth in real industrial production for each country	OECD
$RegulatoryQuality_{ct}$	Perception of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (percentile rank of country *c* in year *t*)	World Bank (World Governance Indicators)
$RuleOfLaw_{ct}$	Perception of the extent to which agents have confidence in and abide by the rules of society (percentile rank of country *c* in year *t*)	World Bank (World Governance Indicators)

Country tax controls

$CorpTR_{ct}$	Statutory corporate tax rate; total of central and subcentral/local rates; if the tax system is progressive, the top marginal tax rate is used	OECD
$EquityAllowance_{ct}$	Indicator variable that equals one if a country has a form of equity allowance in place (fictional interest rates on equity for tax base calculations), and zero otherwise	EY / KPMG
$GroupTaxation_{ct}$	Indicator variable that equals one if a country has a group taxation or group relief system in place that enables loss transfer between group members, and zero otherwise	EY / KPMG
$LossOffset_{ct}$	Score that reflects a country's flexibility in regard to loss carry regulations and take on values between 0 and 4, 4 being the most lenient	EY / KPMG
$GBARD_{ct}$	government budget allocations for R&D (input subsidies)	OECD
$RaDTaxSubsidy_{ct}$	1 minus the B-Index, a measure of the before-tax income needed by a "representative" firm to break even on one additional monetary unit of R&D outlay	OECD
$IPBox_{ct}$	Indicator variable that equals one if a country has an IP Box in place, and zero otherwise	EY / KPMG
$Nexus_{ct}$	Indicator variable that equals one if a country implemented the OECD Nexus approach which links tax benefits for intellectual property (IP) income to the actual R&D spending that created the IP, and zero otherwise	EY / KPMG
$AntiTaxAvoidance_{ct}$	Anti-Tax Avoidance Rule Index by Brühne/Jacob/Schütt. An indicator between 0 and 1 that includes nine different anti-tax avoidance measures. We exclude the two measures for interest limitation rules from the index. We extended the index until 2023	Brühne et al., 2023 / EY / KPMG

Notes: This table presents definitions and data sources for all dependent and independent variables. All continuous variables are winsorized at the 1st and 99th percentiles at the firm-year level. Accounting variables come from consolidated statements unless noted. Country variables are assigned by headquarters country. Detailed construction and timing (e.g., announcement vs. implementation year) are described in Section 3.

Table 2: Summary Statistics

	Treatment group					Control group				
	N	Mean	Std. dev.	p1	p99	N	Mean	Std. dev.	p1	p99
Dependent Variables										
DtA	15,249	0.223	0.203	0	0.930	12,481	0.262	0.219	0	1.055
ln_Equity	14,718	4.794	2.475	-0.724	10.950	11,714	4.459	2.482	-0.887	10.383
ln_CurrentDebt	12,446	2.924	2.729	-3.817	9.093	11,216	2.513	2.817	-5.298	8.894
ln_LongtermDebt	12,187	3.781	2.989	-2.882	10.472	10,971	3.482	2.990	-3.352	10.194
EarnVol	9,910	5.317	7.562	0.000	44.080	10,191	4.033	5.781	0.183	30.997
UnadjEarnVol	9,910	4.893	7.820	0.080	46.360	10,191	3.864	6.034	0.091	32.042
IVol	9,743	2.850	2.082	0.620	13.302	10,126	2.812	1.920	0.550	11.300
Investment	11,799	0.517	1.505	0.002	12	10,638	0.464	1.211	0.002	6.735
PatentApplit+2	3,594	8.395	36.158	0	200	3,074	17.569	58.200	0	340
PatentAppl_posit+2	3,594	3.885	17.558	0	120	3,074	7.145	25.464	0	160
PatentAppl_negit+2	3,594	4.102	17.774	0	114	3,074	9.053	29.323	0	166
ln_Growth	13,889	0.098	0.606	-1.719	2.084	11,810	0.049	0.490	-1.292	1.298
ZDummy	12,486	0.340	0.474	0	1	11,135	0.413	0.492	0	1
Firm Controls										
CashFlow Rate	11,799	0.115	0.721	-3.368	2.588	10,638	0.135	0.684	-3.141	2.362
Growth	9,910	0.162	0.803	-0.753	3.736	10,191	0.102	0.648	-0.677	1.981
ln_Assets	15,249	5.603	2.498	0.699	11.868	12,481	5.358	2.558	0.059	11.587
ln_Sales	9,910	5.504	5.504	5.504	5.504	10,191	5.137	2.631	-1.343	11.009
MtB	9,910	3.251	4.581	-4.375	28.739	10,191	2.443	3.668	-7.336	19.487
Profitability t-1	11,799	-0.564	3.925	-21.236	0.434	10,638	-0.241	2.689	-5.763	0.435
ROA	15,249	-0.056	0.284	-1.300	0.331	12,481	-0.001	0.187	-0.890	0.291
Tangibility	15,249	0.196	0.219	0	0.880	12,481	0.222	0.208	0	0.850
Volatility	15,158	0.071	0.109	0.001	0.558	12,379	0.046	0.079	0.001	0.419
Country Controls										
Corruption	15,249	87.058	16.417	47.596	100	12,481	84.783	12.390	53.333	95.755
GDPGrowth	15,249	1.942	2.933	-8.868	8.931	12,481	1.295	3.238	-10.940	8.654
Inflation	15,249	2.291	3.030	-1.355	10.661	12,481	1.749	2.218	-1.736	9.645
InterestRate	15,249	1.192	1.150	-0.359	4.334	12,481	1.207	1.776	-0.511	9.666
MacroRisk	15,249	0.283	0.338	-0.222	1.183	12,481	0.064	0.040	0.009	0.176
RegulatoryQuality	15,249	89.129	10.735	64.762	99.048	12,481	85.398	9.270	60.000	96.667
RuleOfLaw	15,249	87.029	15.544	50	100	12,481	85.196	9.889	55.714	93.750
Country Tax Controls										
AntiTaxAvoidance Index	15,249	0.720	0.205	0.143	1.000	12,481	0.834	0.167	0.393	1.014
CorpTR	15,249	22.788	5.109	10.000	33.990	12,481	30.355	5.027	19.000	44.433
EquityAllowance	15,249	0.239	0.427	0.000	1.000	12,481	0.095	0.293	0.000	1.000
GBARD	3,594	0.736	0.157	0.233	1.016	3,074	0.759	0.164	0.482	1.1
GroupTaxation	15,249	0.904	0.295	0.000	1.000	12,481	0.861	0.346	0	1
IPBox	3,594	0.301	0.459	0	1	3,074	0.561	0.496	0	1
LossOffset	15,249	1.758	0.447	0.700	3.100	12,481	1.794	0.316	1.200	2.500
Nexus	3,594	0.198	0.405	0	1	3,074	0.227	0.419	0	1
RaDTaxSubsidy	3,594	0.071	0.079	-0.020	0.390	3,074	0.234	0.197	-0.020	0.450

Notes: This table reports summary statistics separately for firms in treated and control countries. Variables are defined in Table 1. All continuous variables are winsorized at the 1st and 99th percentiles. Sample period is 2012–2023 with units being firm-years. Treatment is defined by the European Commission's pre-reform assessment of interest-limitation regimes.

Table 3: Effect on Debt

Dependent variable	DtA	ln_Equity	ln_current Dta	ln_Longterm DtA
	(1)	(2)	(3)	(4)
Treat x Reform	-0.023**	0.075***	-0.131**	-0.170*
	(0.009)	(0.010)	(0.059)	(0.087)
Tangibility	0.356***	-0.680***	1.732***	2.341***
	(0.035)	(0.054)	(0.195)	(0.238)
ROA	-0.151***	0.405***	-1.097***	-1.158***
	(0.043)	(0.112)	(0.114)	(0.108)
ln_Assets	0.009	1.031***	0.908***	1.052***
	(0.008)	(0.037)	(0.038)	(0.064)
Growth Options	0.001	-0.016	-0.078**	0.043
	(0.005)	(0.016)	(0.035)	(0.035)
CorpTR	-0.003***	0.002	-0.007*	-0.014***
	(0.000)	(0.001)	(0.004)	(0.004)
GDPGrowth	-0.001	-0.003	-0.006	0.006
	(0.001)	(0.003)	(0.004)	(0.004)
Inflation	0.000	-0.013***	-0.007	0.011
	(0.001)	(0.004)	(0.011)	(0.008)
InterestRate	0.001	0.003	0.074***	-0.031**
	(0.002)	(0.003)	(0.008)	(0.014)
RuleOfLaw	-0.001	0.004	0.006	-0.001
	(0.001)	(0.003)	(0.006)	(0.009)
RegulatoryQuality	0.000	-0.002	0.004	0.002
	(0.001)	(0.002)	(0.004)	(0.004)
Corruption	0.001	0.000	0.001	0.010
	(0.001)	(0.002)	(0.005)	(0.011)
LossOffset	-0.019*	0.023	0.024	-0.169**
	(0.010)	(0.031)	(0.064)	(0.081)
AntiTaxAvoidance	-0.030	0.117	-0.357**	-0.096
	(0.018)	(0.072)	(0.138)	(0.161)
GroupTaxation	-0.002	-0.092	0.023	0.053
	(0.009)	(0.059)	(0.063)	(0.176)
EquityAllowance	-0.011	-0.053	-0.079	-0.010
	(0.012)	(0.057)	(0.049)	(0.072)
Observations	27730	26483	23636	23128
Adjusted R^2	0.71	0.97	0.87	0.90
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y

Notes: This table presents estimated effects of the ESR reform on corporate debt. The dependent variables are the debt-to-asset ratio (1), the natural logarithms of equity (2), current debt (3), and long-term debt (4). The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2019 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Debt Effect and Pre-reform Firm Risk

Dependent variable	DtA_{it}			
	(1)	(2)	(3)	(4)
Subsample	1. Quartile	2. Quartile	3. Quartile	4. Quartile
Treat x Reform	-0.008	-0.026**	-0.018**	-0.039**
	(0.010)	(0.012)	(0.008)	(0.016)
Tangibility	0.345***	0.345***	0.353***	0.336**
	(0.076)	(0.069)	(0.073)	(0.119)
ROA	-0.320***	-0.356***	-0.247***	-0.108**
	(0.110)	(0.044)	(0.037)	(0.040)
ln_Assets	0.040**	0.029***	0.011**	-0.001
	(0.016)	(0.007)	(0.005)	(0.011)
GrowthOptions	0.007	0.007	0.000	-0.001
	(0.010)	(0.009)	(0.005)	(0.009)
CorpTR	-0.003***	-0.001	-0.001***	-0.005***
	(0.001)	(0.000)	(0.000)	(0.001)
GDPGrowth	-0.001	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.000	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.003)
Interest Rate	-0.002	0.003	0.000	-0.008*
	(0.002)	(0.002)	(0.002)	(0.004)
RuleOfLaw	-0.001	0.002	-0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.004)
RegulatoryQuality	0.001	0.000	0.000	0.003*
	(0.001)	(0.001)	(0.001)	(0.001)
Corruption	0.002*	0.001	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
LossOffset	0.008	-0.043***	-0.010	-0.034
	(0.010)	(0.014)	(0.009)	(0.031)
AntiTaxAvoidance	-0.021	-0.008	-0.060*	-0.035
	(0.024)	(0.028)	(0.029)	(0.044)
Group Taxation	-0.002	0.018	0.000	-0.031
	(0.008)	(0.017)	(0.008)	(0.019)
Equity Allowance	-0.007	-0.019	0.003	-0.036
	(0.010)	(0.024)	(0.016)	(0.026)
Observations	6,939	6,939	6,923	6,929
Adjusted R^2	0.83	0.80	0.72	0.59
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y

Notes: This table presents the estimated effects of the ESR reform on corporate debt for sub-samples defined by pre-reform operational risk (lowest quartile in Column (1), highest quartile in Column (4)). The dependent variable is the debt-to-asset ratio. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2019 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Effect on Risk

Dependent variable	$EarnVol_{it}$	$UnadjEarnVol_{it}$	$Ivol_{it}$
	(1)	(2)	(3)
Treat x Reform	-0.657***	-0.412**	-0.208***
	(0.156)	(0.156)	(0.061)
ln_Assets	-1.582***	-1.668***	-0.274**
	(0.374)	(0.422)	(0.105)
EBITOA	-13.263***	-13.328***	-0.311
	(0.538)	(0.747)	(0.279)
Growth	-0.006	-0.044	0.057***
	(0.115)	(0.116)	(0.019)
ln_Sales	-0.014	-0.030	0.004
	(0.034)	(0.040)	(0.005)
MtB	0.953***	1.036***	-0.118**
	(0.209)	(0.222)	(0.056)
MacroRisk	1.047	1.193	2.284**
	(1.560)	(1.759)	(1.086)
CorpTR	0.001	-0.004	-0.010
	(0.025)	(0.018)	(0.012)
GDPGrowth	0.004	-0.019	-0.009
	(0.014)	(0.015)	(0.014)
Inflation	-0.073	-0.087	-0.029
	(0.121)	(0.089)	(0.041)
InterestRate	0.007	-0.012	0.067***
	(0.017)	(0.013)	(0.009)
RuleOfLaw	-0.055	-0.068***	0.007
	(0.036)	(0.016)	(0.011)
RegulatoryQuality	-0.029	-0.003	0.000
	(0.030)	(0.021)	(0.008)
Corruption	0.018	0.005	-0.013
	(0.025)	(0.014)	(0.010)
LossOffset	0.240	0.281	-0.074
	(0.653)	(0.457)	(0.217)
AntiTaxAvoidance	-0.049	-0.289	-0.326
	(0.755)	(0.482)	(0.237)
GroupTaxation	-0.361	0.433	-0.032
	(0.882)	(0.416)	(0.150)
EquityAllowance	0.190	0.470*	-0.115
	(0.264)	(0.250)	(0.170)
Observations	20,101	20,101	20,101
Adjusted R^2	0.58	0.58	0.62
Firm FE	Y	Y	Y
Year FE	Y	Y	Y

Notes: This table presents estimated effects of the ESR reform on corporate risk-taking. The dependent variables are $EarnVol_{it}$, the industry-adjusted standard deviation of EBIT over the years t to $t+2$ (1), $UnadjEarnVol_{it}$, the standard deviation of EBIT over the years t to $t+2$ (2), and $IVol_{it}$, the standard deviation of the residuals from a regression of a firm's daily excess return on factor data (idiosyncratic risk) (3). The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform announcement (2017 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Risk Effect and Pre-reform ILR Regulations

Dependent variable	$EarnVol_{it}$		
	(1)	(2)	(3)
Subsample	NoILR	onlyTCR	onlyESR
Treat x Reform	-0.811***	-0.964***	-0.383**
	(0.189)	(0.278)	(0.161)
Observations	14,948	11,200	13,174
Adjusted R^2	0.58	0.55	0.55
Firm FE	Y	Y	Y
Year FE	Y	Y	Y

Notes: This table presents estimated effects of the ESR reform on corporate risk-taking, based on subsamples of treated countries: *NoILR* denotes treated countries that had no interest limitation rule prior to the reform, *onlyTCR* denotes treated countries that had a thin cap rule prior to the reform, and *onlyESR* denotes treated countries that already had an earnings stripping rule prior to the reform. In all cases, the full set of control countries is considered. The dependent variable is $EarnVol_{it}$, the industry-adjusted standard deviation of EBIT over the years t to $t+2$. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform announcement (2017 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Effect on Investment

Dependent variable	$Investment_{it}$				
	(1)	(2)	(3)	(4)	(5)
Subsample	Full	1. Quartile	2. Quartile	3. Quartile	4. Quartile
Treat x Reform	-0.112**	0.019	-0.065***	-0.175**	-0.242*
	(0.049)	(0.017)	(0.020)	(0.068)	(0.132)
ln_Revenue	-0.421***	-0.247***	-0.155***	-0.397**	-0.503***
	(0.073)	(0.087)	(0.049)	(0.157)	(0.061)
CashFlow Rate	0.029	0.064	0.092**	0.083***	0.004
	(0.018)	(0.047)	(0.034)	(0.025)	(0.019)
Profitability	0.053***	-0.038	0.004	0.032*	0.069***
	(0.012)	(0.048)	(0.008)	(0.016)	(0.011)
Growth	0.038	0.124	0.080	0.076**	0.006
	(0.023)	(0.099)	(0.066)	(0.028)	(0.026)
CombCorpTR	0.006**	0.006***	0.008**	-0.004	0.021**
	(0.003)	(0.002)	(0.004)	(0.005)	(0.009)
GDP Growth	0.003	-0.002	0.013***	-0.003	0.004
	(0.004)	(0.002)	(0.002)	(0.008)	(0.008)
Inflation	-0.010	-0.001	-0.003	-0.005	-0.035*
	(0.006)	(0.003)	(0.004)	(0.010)	(0.017)
InterestRate	-0.001	-0.013	-0.017***	-0.010	0.058***
	(0.006)	(0.010)	(0.005)	(0.014)	(0.020)
Rule of Law	0.015***	0.002	0.016**	0.012	0.027**
	(0.004)	(0.004)	(0.008)	(0.011)	(0.011)
Regulatory Quality	-0.006**	0.000	-0.001	-0.008	-0.016**
	(0.003)	(0.003)	(0.004)	(0.008)	(0.008)
Corruption	0.007*	0.005	-0.001	-0.005	0.016
	(0.004)	(0.001)	(0.002)	(0.009)	(0.016)
LossCarry Score	-0.058	-0.021	-0.059**	-0.049	-0.164
	(0.035)	(0.023)	(0.023)	(0.057)	(0.192)
AntiTaxAvoidance	0.231***	0.073	-0.024	0.082	0.638**
	(0.077)	(0.071)	(0.084)	(0.198)	(0.232)
Group Taxation	0.071*	0.123***	0.105*	-0.027	-0.089
	(0.039)	(0.028)	(0.059)	(0.171)	(0.126)
Equity Allowance	0.065	0.043**	-0.003	0.096	0.062
	(0.069)	(0.016)	(0.040)	(0.155)	(0.298)
Observations	22437	5614	5618	5610	5595
Adjusted R^2	0.43	0.63	0.40	0.44	0.36
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Notes: This table presents the estimated effects of the ESR reform on corporate investment, for the full sample (1) and for sub-samples defined by pre-reform operational risk (lowest quartile in Column (2), highest quartile in Column (5)). The dependent variable is $Investment_{it}$, the capital expenditure in fixed tangible assets over lagged tangible assets. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2019 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Effect on Innovation

Dependent variable	PPML	OLS
	$Patents_{it+2}$	$Patents_{it+2}$
	(1)	(2)
Treat x Reform	-0.079***	-2.465***
	(0.028)	(0.605)
Profitability	-0.005	-0.009
	(0.007)	(0.025)
Tangibility	-0.676***	-2.660**
	(0.182)	(1.154)
ln_Sales	0.089	0.226
	(0.055)	(0.174)
CorpTR	-0.004	0.223*
	(0.003)	(0.113)
GBARD	0.060	-8.261
	(0.296)	(6.939)
RaDTaxSubsidy	0.436**	12.594
	(0.217)	(8.833)
GDPGrowth	-0.005	-0.111
	(0.011)	(0.156)
Inflation	0.049**	0.379
	(0.023)	(0.392)
Interest Rate	-0.020	0.137
	(0.029)	(0.144)
RuleOfLaw	0.012	-0.045
	(0.014)	(0.183)
RegulatoryQuality	0.007	0.114
	(0.007)	(0.140)
Corruption	-0.005	0.018
	(0.004)	(0.096)
LossOffset	0.256	-1.352
	(0.196)	(4.592)
AntiTaxAvoidance	0.065	4.519*
	(0.270)	(2.539)
Group Taxation	-0.391***	-1.212
	(0.103)	(2.429)
EquityAllowance	-0.051	-0.498
	(0.098)	(1.004)
IPBox	0.260***	0.402
	(0.067)	(0.981)
Nexus	-0.006	-0.508
	(0.053)	(0.606)
Observations	6,668	7,296
Pseudo R^2/Adjusted R^2	0.91	0.90
Firm FE	Y	Y
Year FE	Y	Y

Notes: This table presents the estimated effects of the ESR reform on patent applications using PPML and OLS regressions. The dependent variables are $PatentAppl_{it+2}$, the number of patent applications by firm *i* in year *t+2*. Independent variables are considered in terms of their two-year leads. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2017 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Effect on Firm Growth

Dependent variable	*In_Growth$_{it}$*				
	(1)	(2)	(3)	(4)	(5)
Subsample	Full	1. Quartile	2. Quartile	3. Quartile	4. Quartile
Treat x Reform	-0.104*	-0.061*	-0.051	-0.087	-0.215***
	(0.058)	(0.033)	(0.047)	(0.056)	(0.053)
ln_Sale	0.371***	0.569***	0.368***	0.311***	0.381***
	(0.020)	(0.103)	(0.069)	(0.026)	(0.015)
CombCorpTR	0.000	0.005**	-0.002	0.001	-0.007
	(0.003)	(0.002)	(0.002)	(0.003)	(0.006)
GDP Growth	0.016***	0.011**	0.011***	0.008***	0.031***
	(0.004)	(0.005)	(0.003)	(0.002)	(0.008)
Inflation	0.002	-0.009	0.002	0.010	0.004
	(0.003)	(0.006)	(0.005)	(0.007)	(0.010)
InterestRate	-0.017**	-0.017*	-0.017***	-0.021***	-0.035
	(0.008)	(0.009)	(0.005)	(0.006)	(0.034)
Rule of Law	0.011**	0.000	0.005	0.014*	0.028**
	(0.005)	(0.004)	(0.003)	(0.007)	(0.012)
Regulatory Quality	-0.003	-0.004	-0.005*	0.003	-0.006
	(0.003)	(0.004)	(0.003)	(0.004)	(0.006)
Corruption	0.003	0.000	-0.007*	0.004	0.003
	(0.005)	(0.003)	(0.004)	(0.004)	(0.007)
LossCarry Score	-0.016	0.015	-0.020	0.027	-0.149
	(0.048)	(0.035)	(0.036)	(0.036)	(0.125)
AntiTaxAvoidance	0.157	0.224**	0.102	0.208*	-0.238
	(0.102)	(0.080)	(0.093)	(0.112)	(0.210)
Group Taxation	-0.015	0.005	-0.103	-0.013	-0.078
	(0.064)	(0.053)	(0.049)	(0.063)	(0.099)
Equity Allowance	0.051	0.078*	0.048	-0.117*	0.247
	(0.090)	(0.044)	(0.062)	(0.059)	(0.207)
Observations	25699	6443	6415	6421	6420
Adjusted R^2	0.19	0.40	0.21	0.18	0.17
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

Notes: This table presents the estimated effects of the ESR reform on firm growth, for the full sample (1) and for sub-samples defined by pre-reform operational risk (lowest quartile in Column (2), highest quartile in Column (5)). The dependent variable is *ln_Growth$_{it}$*, the natural logarithm of sales in year *t* divided by the natural logarithm of sales in year *t-1* divided by two. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2019 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Effect on Bankruptcy

	LPM	Logit	LPM			
Dependent variable	Z-Dummyit	Z-Dummyit	Z-Dummyit			
	(1)	(2)	(3)	(4)	(5)	(6)
Subsample	Full	Full	1. Quartile	2. Quartile	3. Quartile	4. Quartile
Treat x Reform	0.005	-0.009	-0.001	0.001	-0.036	0.050***
	(0.011)	(0.106)	(0.019)	(0.020)	(0.024)	(0.017)
Volatility	0.250***	1.671***	0.041	0.366***	0.442***	0.249***
	(0.050)	(0.360)	(0.184)	(0.093)	(0.116)	(0.058)
CombCorpTR	0.000	0.008	0.002	0.000	0.003	-0.002
	(0.001)	(0.010)	(0.001)	(0.002)	(0.002)	(0.002)
GDP Growth	-0.004	-0.040	-0.002	-0.001	-0.005	-0.003
	(0.002)	(0.025)	(0.003)	(0.003)	(0.003)	(0.004)
Inflation	0.003	0.019	-0.003	0.003	0.003	0.003
	(0.004)	(0.039)	(0.003)	(0.006)	(0.005)	(0.008)
InterestRate	0.003	0.040	0.001	0.015**	0.001	-0.009
	(0.003)	(0.033)	(0.003)	(0.006)	(0.005)	(0.008)
Rule of Law	-0.001	-0.007	0.001	0.002	-0.005	-0.002
	(0.001)	(0.013)	(0.002)	(0.003)	(0.004)	(0.003)
Regulatory Quality	0.001	0.008	0.001	0.001	-0.002	0.007***
	(0.001)	(0.013)	(0.002)	(0.002)	(0.003)	(0.002)
Corruption	-0.002*	-0.018*	-0.001	0.000	-0.001	-0.006*
	(0.001)	(0.010)	(0.001)	(0.002)	(0.002)	(0.003)
LossCarry Score	-0.003	-0.005	-0.016	0.004	0.039	-0.049
	(0.023)	(0.228)	(0.020)	(0.020)	(0.050)	(0.036)
AntiTaxAvoidance	-0.029	-0.168	-0.013	0.052	-0.039	-0.104
	(0.044)	(0.453)	(0.045)	(0.095)	(0.051)	(0.101)
Group Taxation	-0.032	-0.302	-0.051 **	-0.076	0.147 ***	-0.201
	(0.024)	(0.257)	(0.019)	(0.063)	(0.032)	(0.019)
Equity Allowance	-0.015 **	-0.162 **	0.014	-0.084	0.019	-0.044
	(0.007)	(0.070)	(0.063)	(0.106)	(0.017)	(0.082)
Observations	27537	13453	6888	6890	6888	6871
Adjusted R^2	0.57	0.01	0.65	0.58	0.55	0.41
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table presents the estimated effects of the ESR reform on financial distress, for the full sample (1) and (2) and for sub-samples defined by pre-reform operational risk (lowest quartile in Column (3), highest quartile in Column (6)). The dependent variable is $ZDummy_{it}$, which equals one firms in financial distress, i.e. those with a *ZScore* at or below 1.1. We use Logit regression in Column (2) and LPM regressions in all other columns. The main independent variable is *Treat x Reform*. *Treat* equals one if the firm is headquartered in a country that was affected by the ESR reform, and zero otherwise. *Reform* equals one if the observation refers to years after the reform (2019 onward). We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country-level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

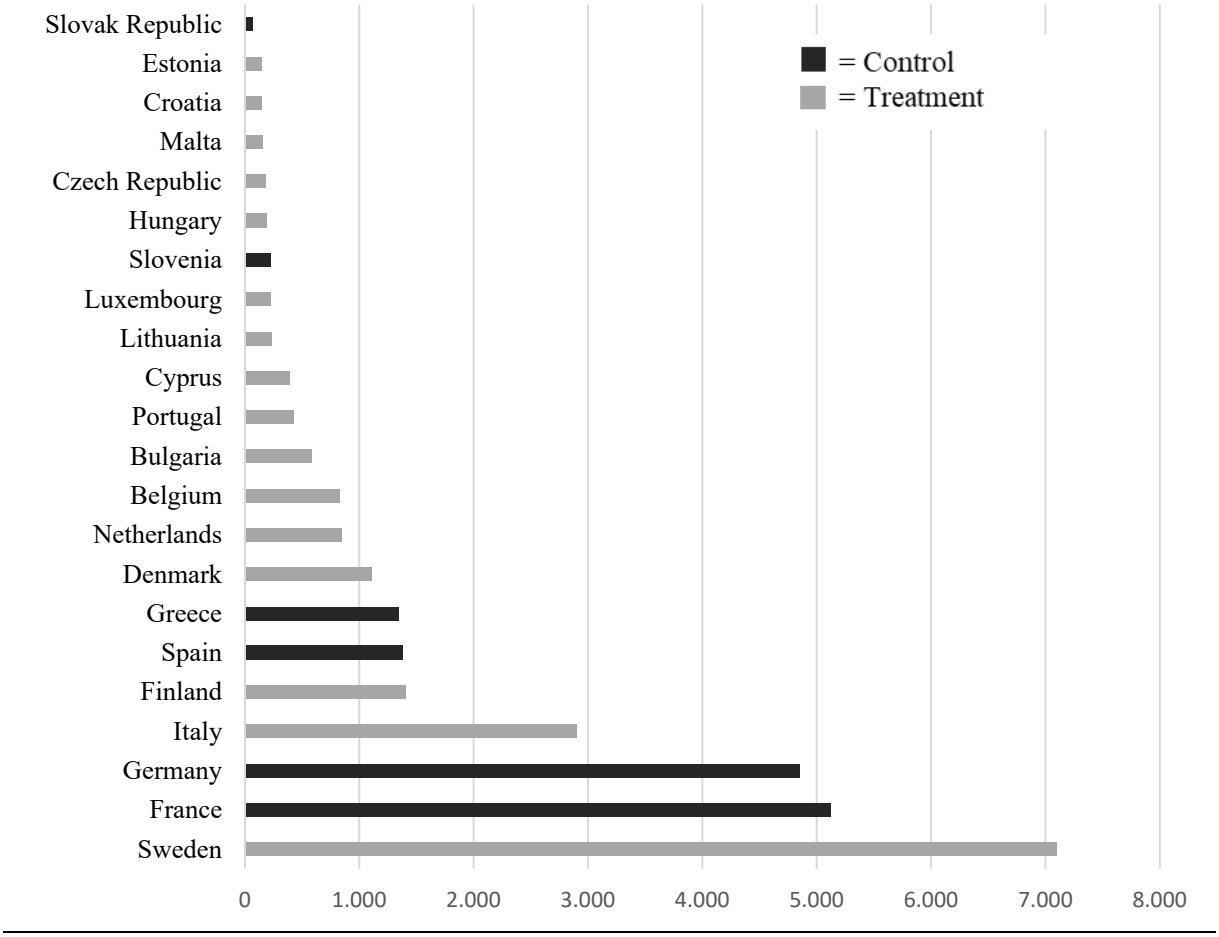
Table 11: Robustness Test – Matched Samples

Dependent variable	$EarnVol_{it}$	$Investment_{it}$	$PatentsAppl_{it}$	DtA_{it}	$Z\text{-}Dummy_{it}$	Ln_Growth_{it}
Matching Characteristics	(1)	(2)	(3)	(4)	(5)	(6)
Nearest-neighbor	-0.451***	-0.148***	-0.110***	-0.023**	-0.001	-0.122*
(1:1, no replacement, Cal. 0.001)	(0.152)	(0.045)	(0.031)	(0.009)	(0.012)	(0.062)
Nearest-neighbor	-0.478***	-0.087*	-0.120***	-0.022**	-0.018	-0.134**
(1:1, replacement, Cal. 0.001)	(0.154)	(0.045)	(0.033)	(0.010)	(0.012)	(0.056)
Nearest-neighbor	-0.525***	-0.121**	-0.118***	-0.023*	-0.0165	-0.112*
(1:5, replacement, Cal. 0.001)	(0.154)	(0.048)	(0.029)	(0.011)	(0.010)	(0.057)
Mahalanobis match	-0.517***	-0.091*	-0.013	-0.025**	-0.014	-0.133**
(1:1, Cal. 0.5)	(0.135)	(0.052)	(0.023)	(0.010)	(0.012)	(0.054)
Mahalobis Match	-0.453***	-0.085**	-0.385***	-0.032***	-0.002	-0.130**
(1:1, with sector matching, Cal. 0.5)	(0.109)	(0.034)	(0.111)	(0.008)	(0.009)	(0.052)

Notes: This table presents the estimated effects of the ESR reform on the main dependent variables, based on matched samples obtained using different matching techniques. We report coefficient estimates for *Treat x Reform*. All regressions use firm and year fixed effects as well as the same firm and country controls as before. We define all variables in Table 1. We report standard errors in parentheses. Standard errors are heteroscedasticity-robust and clustered at the country level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix

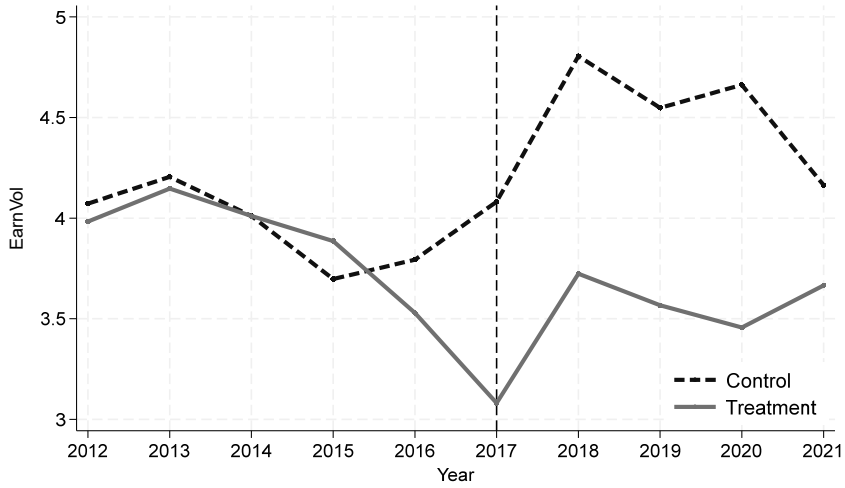
Figure A1: Country-Level Composition of Treatment and Control Group



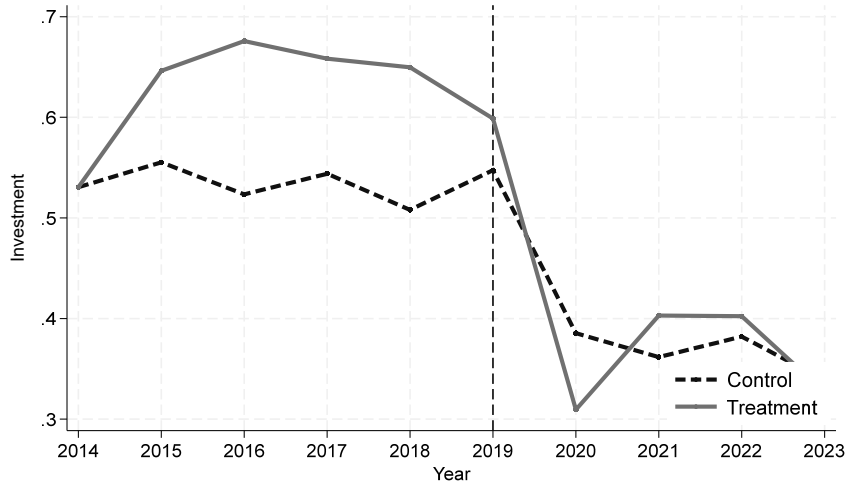
Notes: Composition of treatment and control groups by Member State (firm-year counts). Treatment classification follows the European Commission (2018).

Figure A2: Time trends of main dependent variables

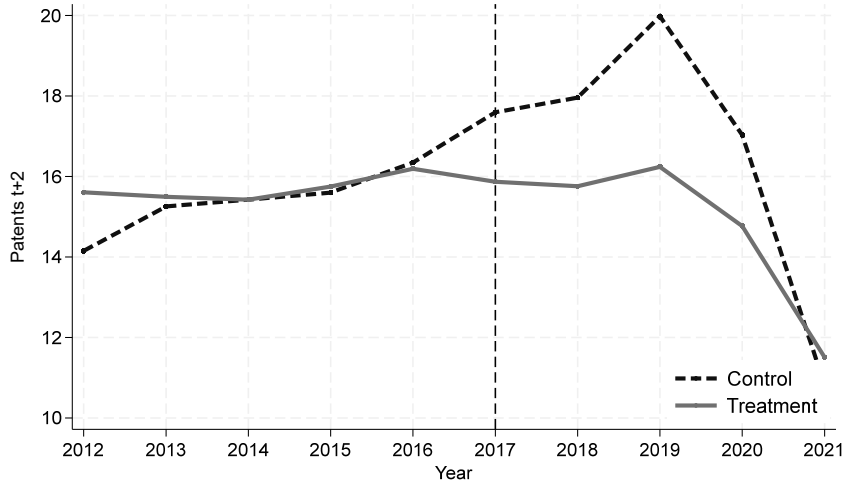
Panel A



Panel B



Panel C



Notes: Figure A2 depicts the parallel trends, based on the average dependent variable per year, separately for treatment and control group. Panel A is based on average $EarnVol_{it}$. Panel B is based on the average $Investment_{it}$. Panel C is based on the average $PatentAppl_{it+2}$.

Table A1: Pre-Reform Design of ILR

Country	Prior ILR		Keep prior ILR	In line with EU Directive
	TCR	ESR		
Austria	x	x	x	x
Belgium	internal interest	x	Yes	x
Bulgaria	internal interest	x	Yes	x
Croatia	internal interest	x	Yes	x
Cyprus	x	x	x	x
Czech Republic	internal interest	x	Yes	x
Denmark	internal interest	total interest	Yes	x
Estonia	x	x	x	x
Finland	x	related interest	x	x
France	internal interest	total interest	Yes	Yes
Germany	x	total interest	x	Yes
Greece	x	total interest	x	Yes
Hungary	internal interest	x	x	x
Ireland	x	x	x	x
Italy	x	total interest	x	x
Latvia	internal interest	x	Yes	x
Lithuania	internal interest	x	Yes	x
Luxembourg	x	x	x	x
Malta	x	x	x	x
Netherlands	x	x	x	x
Poland	internal interest	x	x	x
Portugal	x	total interest	x	x
Romania	internal interest	x	x	x
Slovak Republic	x	internal interest	x	Yes
Slovenia	internal interest	x	Yes	Yes
Spain	x	total interest	x	Yes
Sweden	x	x	x	x
United Kingdom	x	x	x	x

Notes: Table A1 gives an overview of the interest limitation rules (ILR) implemented in the European Member States and the UK prior to the reform. This table only considers codified rules and not court ruling and best practices. The columns identify the form of interest being limited. We consider the thin capitalization rules by Bulgaria, Hungary, Latvia and Romania to be restrictions on internal interest expenses only as they exclude interest on loans from banks or finance lease. France combined its earnings stripping rule with the "French rabot" under which total interest expenses above 3 million net interest expenses were only deductible up to 75 percent. We therefore consider it to be a limitation on total interest expenses. Belgium also restricted external interest expenses in situations where the beneficial owner is not subject to income taxes or a substantially more advantageous tax system. We still classified Belgium under internal interest restriction only because the main mechanism is limited to loans by related parties.

Table A2: Details on the Implementation of the ESR Reform

Country	Date of Impl.	30% of EBITDA Threshold	Escape Rules				Carry Forward	
			De Minimis	Stand-alone	Financial Group Esc.		Interest	EBITDA
					Equity	EBITDA		
Austria	2021	Yes	3m	Yes	Yes	x	∞	5 years
Belgium	2019	Yes	3m	Yes	x	x	∞	x
Bulgaria	2019	Yes	3m	x	x	x	∞	x
Croatia	2019	Yes	3m	Yes	x	x	3 years	x
Cyprus	2019	Yes	3m	Yes	Yes	Yes	5 years	5 years
Czech Republic	2019	Yes	3.2m	Yes	x	x	∞	x
Denmark	2019	Yes	3m	x	x	Yes	∞	5 years
Estonia	2019	Yes	3m	Yes	Yes	Yes	x	x
Finland	2019	25%/EBITD	3m	Yes	Yes	x	∞	x
France	2019	Yes	3m	Yes	Yes	Yes	∞	5 years
Germany	2024	Yes	3m	Yes	Yes	x	∞	5 years
Greece	2019	Yes	3m	x	x	x	∞	x
Hungary	2019	Yes	2.5m	x	Yes	Yes	∞	∞
Ireland	2022	Yes	3m	Yes	Yes	Yes	∞	5 years
Italy	2019	Yes	x	x	x	x	∞	5 years
Latvia	2018	Yes	3m	x	x	x	x	x
Lithuania	2019	Yes	3m	Yes	Yes	Yes	∞	x
Luxembourg	2019	Yes	3m	Yes	Yes	Yes	∞	5 years
Malta	2019	Yes	3m	Yes	Yes	Yes	∞	5 years
Netherlands	2019	Yes	1m	x	x	x	∞	x
Poland	2018	Yes	0.7m	x	x	x	5 years	x
Portugal	2019	Yes	1m	x	x	Yes	5 years	5 years
Romania	2018	Yes	1m	Yes	x	x	∞	x
Slovak Republic	2024	Yes	3m	x	x	x	5 years	x
Slovenia	2024	Yes	1m	Yes	x	x	x	x
Spain	2024	Yes	1m	x	x	x	∞	5 years
Sweden	2019	Yes	0.45m	x	x	x	6 years	x
United Kingdom	2017	Yes	2.2m	x	x	Yes	∞	5 years

Notes: Table A2 illustrates the specifics of the national earnings stripping rule at the time of its implementation in European Member States and the UK. Currency conversions of the Member States are based on December 31, 2018.

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