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POLICY WATCH

The EU's new era of "fair company taxation": the impact of DEBRA and Pillar Two on the EU Member States' effective tax rates

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Abstract

The European Union (EU) recently implemented the Minimum Tax Directive (Pillar Two) to ensure that profits of large companies are at least taxed at 15%. At the same time, the European Commission proposed the Debt-Equity Bias Reduction Allowance Directive (DEBRA) to reduce the tax-induced distortions between debt and equity financing. In this simulation study, we examine the impact of DEBRA, Pillar Two, and their interaction on countries' effective tax levels. Based on our results, we evaluate the policy reforms' effectiveness in achieving their objectives. Our analysis of DEBRA shows that, on average, the effective tax levels decrease and the debt-equity bias diminishes, which should lead to more equity financing. In low-tax countries, Pillar Two increases the effective tax levels, but not necessarily up to 15%. Still, as the deviations from the 15% minimum effective tax level remain rather small, Pillar Two mostly succeeds in setting a floor on international tax competition. The interaction of both directives results in a convergence of tax levels across the EU, creating a more level playing field. However, Pillar Two offsets the tax-reducing effect of DEBRA and limits its ability to reduce the debt-equity bias.

Keywords Effective tax rates · DEBRA · Debt-equity bias · Global minimum tax · Pillar Two · BEFIT

JEL Classification F23 · H25 · K34

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1 Introduction

The European Commission aims to move towards fair, efficient and growth-friendly taxation by eliminating tax-related frictions and behavioural distortions in the European single market (European Commission, 2021). Although the European Union (EU) has no primary-law mandate to harmonise direct taxation across its Member States, it can implement legislation to address relevant tax-related frictions that hamper the functioning of the single market.

One important behavioural distortion emanating from the tax system is the so-called debt-equity bias. Due to a discriminatory tax treatment of the returns on equity relative to interest payments on debt capital, most tax systems are not financing neutral but favour debt over equity financing. To reduce the tax-induced debt-equity distortion, the European Commission proposed the Debt-Equity Bias Reduction Allowance Directive (European Commission, 2022; in the following referred to as "DEBRA") in May 2022. The draft directive comprises two measures: First, it provides for an allowance on corporate equity (ACE), which mirrors the tax deductibility of interest expenses specifically for the case of equity financing. Second, it restricts the deductibility of actual interest expenses. The aim is to create a level playing field for equity- and debt-financed investments. In addition, by directly mandating the implementation of an ACE, DEBRA seeks to harmonise the tax treatment of equity through similar schemes, which today still vary widely in their generosity and scope of application across countries (European Commission, 2022).

The Minimum Tax Directive (Council of the European Union, 2022; in the following referred to as "Pillar Two") is a major piece of legislation that the EU has pushed through to reduce tax distortions resulting from wide international tax rate differentials. While DEBRA is still a proposal, the minimum tax was enacted in December 2022 as a commitment to the OECD's global tax reform efforts (OECD, 2021). The directive requires EU Member States to impose a 15% minimum effective tax rate (ETR) on large domestic groups and multinational enterprises (MNEs) by way of a top-up tax. By setting a minimum ETR, Pillar Two seeks to combat aggressive tax planning. Moreover, the directive aims to stop the "race to the bottom" in corporate tax rates by setting a floor on international tax competition (Council of the European Union, 2022).

This paper examines the impact of DEBRA, Pillar Two, and their interaction on companies' effective tax burden across EU Member States. We conduct a simulation study based on the Devereux/Griffith methodology (Devereux & Griffith, 1999, 2003) to measure the impact of these proposed (DEBRA) and implemented (Pillar Two) tax reforms on the cost of capital (CoC) as well as the effective average tax rate (EATR) of corporations.[1] Specifically, we are interested in two key questions: Do DEBRA and Pillar Two achieve their aims to reduce tax distortions in financing and investment decisions, as measured by relevant differentials in the CoC and EATRs across sources of financing, investment assets, and locations? Are there any

[1] Measuring countries' tax-related location attractiveness using the Devereux/Griffith methodology is well-established in the scientific literature (e.g. Bräutigam et al., 2017; Evers et al., 2015; Müller et al., 2022).

relevant interactions between these two major reform projects that may potentially mitigate their effectiveness?

First, we consider the effects of DEBRA, Pillar Two, and their interaction on a hypothetical country. Using a stylised setting allows us to illustrate the mechanisms that drive the changes in the effective tax levels. Second, we examine the impact of the tax reforms on the effective tax burden in the EU Member States, taking into account their national tax legislation as of 2022. The country-specific analyses allow us to determine the extent to which DEBRA, Pillar Two, and their interaction will alter tax distortions in financing and investment decisions of companies in the EU. Moreover, we perform robustness tests to account for recent economic and legal developments, including the harmonised corporate tax base as proposed in the draft directive on "Business in Europe: Framework for Income Taxation" (European Commission, 2023; in the following referred to as "BEFIT").[2]

Our results suggest that DEBRA leads to lower effective tax levels in the hypothetical country. This net decrease in effective tax levels is the result of two opposing effects. While the interest deduction limitation increases the effective tax burden on debt-financed investments, the ACE lowers the effective tax burden on equity-financed investments. Thus, the higher the share of equity financing relative to debt financing, the more important is DEBRA's diminishing effect on the overall effective tax burden. The results hold for most EU Member States. Only those countries that have more favourable ACE regimes in their national legislation would experience an increase in effective tax levels due to DEBRA. Overall, the findings suggest that DEBRA decreases the debt-equity bias and provides tax incentives for more equity financing. Moreover, implementing harmonised ACE regimes reduces the heterogeneity of national tax regimes with respect to notional interest deductions for corporations.

When implementing Pillar Two in our simulation, we find an increase in the effective tax levels of the hypothetical low-tax country. Importantly, the EATR is not fully levelled up to 15%. The reason for this is the substance-based income exclusion, whereby normal returns on local substance are carved-out from the top-up taxation and thus remain subject to the lower national tax level. We illustrate that the proportion to which companies are able to benefit from low tax levels even under Pillar Two depends on the carve-out percentage, profitability, and the investment's asset composition. Our findings hold when applying Pillar Two to the four EU Member States that have a statutory tax level below 15%, i.e. Bulgaria, Cyprus, Ireland, and Malta.[3] Across these four countries, the EATRs increase due to Pillar Two, however, not exactly up to 15%. Deviations from the 15% threshold are mostly

[2] The European Commission proposed BEFIT in September 2023, which, among other aspects, is a new attempt to introduce EU-wide harmonised rules for the determination of the corporate tax base. As such, it succeeds the formerly failed Common Corporate Tax Base (CCTB) and Common Consolidated Corporate Tax Base (CCCTB) proposals (European Commission, 2011, 2016a, 2016b).

[3] In our analysis, we use the statutory tax level to identify countries where Pillar Two is likely to apply. However, please note that low-taxed profits may also arise in high-tax countries, e.g. due to the use of tax incentives, which may lead to the application of Pillar Two (Hugger et al., 2023; Hugger et al., 2024).

driven by the lower statutory tax levels, which still apply to the carved-out profits. Thus, while Pillar Two succeeds in setting a lower limit for corporate tax competition, it also permits deviations from the minimum tax level of 15%.

The interaction of DEBRA and Pillar Two leads to increased effective tax levels in the hypothetical country. This occurs because DEBRA's tax-reducing effect applies only to carved-out profits, while Pillar Two's top-up tax raises the tax burden on residual profits to the minimum rate of 15%. Due to DEBRA's limited impact in countries where Pillar Two applies, its ability to reduce the debt-equity bias is constrained. These results can also be observed for the four EU Member States for which we simulate Pillar Two. For all other countries, the interaction of both directives boils down to the sole application of DEBRA, resulting in reduced effective tax levels. Overall, the interaction of both directives leads to a convergence of tax levels in the EU by reducing the effective tax levels above the Pillar Two threshold and increasing those below. Our results thus provide initial evidence that DEBRA and Pillar Two lead to a more level playing field in terms of corporate taxation between EU Member States.

This paper contributes to existing research in two ways. First, we assess DEBRA and Pillar Two against their own objectives based on our simulation results.[4] A simulation study is particularly valuable, as empirical studies cannot yet be carried out due to the still pending acceptance of DEBRA or very recent implementation of Pillar Two. Second, to the best of our knowledge, we are the first to examine the interaction effects of DEBRA and Pillar Two in terms of effective tax levels. In doing so, we take advantage of the fact that the Devereux/Griffith methodology allows us to quantify both tax base (DEBRA) and tax rate (Pillar Two) effects in a single framework. A further benefit of this methodology lies in precisely assessing effect sizes. Thus, our analysis allows us to examine the extent to which tax distortions in financing and investment decisions are affected by the two directives.

With our study, we contribute to the literature on DEBRA and Pillar Two. The literature on DEBRA published so far puts a focus on technical and conceptual aspects of the proposal (Gaut & McDonnell, 2022; Hohlwegler et al., 2023; Ismer, 2022; Kemmeren, 2023; Schnitger & Schäfer, 2022). Heckemeyer and Nippel (2023) examine the impact of DEBRA on tax incentives in the choice of capital structure and Bettens (2022) assesses DEBRA and its interactions with Pillar Two from a legal perspective. Closely connected, there are several empirical studies that examine the stand-alone effect of ACE regimes (Bernasconi et al., 2005; Branzoli & Caiumi, 2020; Hebous & Ruf, 2017; Schepens, 2016; Van Campenhout & Van Caneghem, 2013) and interest deduction limitation rules (Buettner et al., 2012,

[4] The simulation study is not suitable to address all objectives of DEBRA and Pillar Two. In particular, we do not assess DEBRA's goals of promoting economic growth and reducing tax planning. For existing literature on the effects of interest deduction limitation rules and ACE regimes on investment and employment, please refer to Buettner et al. (2018), De Mooij and Liu (2021), Konings et al. (2022), Leszczylowska and Meier (2021), and more broadly for the effect of taxes on foreign direct investments to Feld and Heckemeyer (2011). Finke et al. (2014) provide insights into the effect of ACE regimes on tax planning. Moreover, we refrain from evaluating Pillar Two's objective of reducing tax avoidance and tax planning. For literature considering tax planning under Pillar Two, see Wardell-Burrus (2022).

2016; De Mooij & Hebous, 2018; Overesch & Wamser, 2010) on firms' financing choices.

Beyond this, a wide range of literature critically evaluates the opportunities and challenges of Pillar Two from a conceptual perspective (Bammens & Bettens, 2023; Devereux, 2023; Dourado, 2022; Eberhartinger & Winkler, 2023). Johannesen (2022) assesses the net welfare effect of Pillar Two using a theoretical model. Moreover, fiscal revenue estimates for Pillar Two have been published by several authors (e.g. Baraké et al., 2022; Devereux et al., 2020; Janeba & Schjelderup, 2023). Schjelderup and Stähler (2023) analyse the potential effects of the substance-based income exclusion, which exempts part of the profit from the global minimum tax. The papers most closely associated with our study are Hanappi and González Cabral (2022) and Bares et al. (2021). Hanappi and González Cabral (2022) use forward-looking ETR metrics to demonstrate the impact of Pillar Two on MNE group-specific investment decisions in the context of profit shifting. In contrast, we apply a different modelling approach and concentrate on the per-country investment implications of Pillar Two. The simulation study by Bares et al. (2021) focuses on the dispersion of EATRs across countries by including a proxy for profit shifting of an MNE resident in the OECD countries. Instead of analysing the tax planning behaviour of firms in a worldwide cross-border setting, we focus on the effect of the interaction between Pillar Two and DEBRA on the domestic effective tax levels in the EU Member States.

The remainder of this article is organised as follows: In Chapter 2, we provide a theoretical overview of DEBRA and Pillar Two, focusing on the relevant parameters for the following simulation study. In Chapter 3, we introduce the Devereux/Griffith methodology used for the simulation and conduct sensitivity analyses on its economic assumptions. Chapter 4 presents our main results, showing the effects of DEBRA, Pillar Two, and their interaction on the effective tax levels of a hypothetical country. Chapter 5 then extends the results to the EU Member States in a country heterogeneity analysis. Chapter 6 concludes.

2 Overview of the directives

2.1 DEBRA

In May 2022, the European Commission presented the proposal for DEBRA, a legislative initiative aimed at reducing the tax-induced distortions between debt and equity financing through two measures that apply independently: an ACE and a limitation to interest deduction.[5] By mandating the implementation of these measures, the proposed directive aims also to incentivise companies to use more equity and

[5] This chapter and the following analyses are based on the DEBRA proposal published by the European Commission in May 2022. The amendments proposed by the European Parliament in January 2024 are not considered as the DEBRA proposal has not been officially updated. For the proposed changes see https://www.europarl.europa.eu/doceo/document/TA-9-2024-0006_EN.html.

ultimately to promote economic growth. In addition, DEBRA seeks to harmonise national tax laws, which vary widely in their use of notional interest deductions.

According to the proposal, DEBRA will apply to all taxpayers subject to corporate tax in an EU Member State, including non-EU tax residents with a permanent establishment in the EU. However, financial enterprises are excluded from the scope of the directive. Under the proposal, Member States are expected to adopt DEBRA into national law by 31 December 2023 and to apply its provisions from 1 January 2024.[6] In addition, a grandfathering rule has been included, allowing Member States that already apply a domestic ACE under national law to defer the application of DEBRA's provisions.

The ACE aims to equalise the tax treatment of debt and equity by allowing companies to deduct a notional interest on equity, providing a tax benefit comparable to that of interest payments on debt. The proposed directive stipulates that the ACE equals the allowance base multiplied by the notional interest rate (Article 4 DEBRA). The allowance base consists of the annual increase in equity, which is defined as the difference between the level of net equity at the end of the current tax period and the previous tax period. In this context, net equity means the company's equity less participations in the capital of associated enterprises[7] and own shares. The notional interest rate consists of two components: a risk-free interest rate and a risk premium. The risk-free interest rate is currency-specific and reflects a maturity of ten years as of 31 December of the year preceding the relevant tax period. The proposed directive refers to the corresponding interest rate published by the European Insurance and Occupational Pensions Authority (EIOPA). A risk premium of 1% is added to the risk-free interest rate to calculate the notional interest rate.

According to the proposed directive, the ACE is deductible from the tax base in the tax period in which the net increase in equity occurs and in the nine consecutive tax periods. This provision approximates the tax treatment and the maturity of debt. To prevent abuse, the deduction is limited to 30% of the company's annual earnings before interest, tax, depreciation, and amortisation (EBITDA). If, in a given year, the ACE exceeds the 30% EBITDA threshold, the excess may be carried forward for a maximum of five years. If the ACE exceeds the company's net taxable income in a given year, DEBRA provides for an unlimited carryforward of the excess allowance.

Prior to the DEBRA proposal, several EU Member States already introduced an ACE regime. In 2022, Belgium, Cyprus, Italy, Malta, Poland, and Portugal offered an ACE. These regimes contain the same features as DEBRA, namely a definition of the allowance base, a notional interest rate, deduction limits for the notional interest, and carryforwards of excess notional interest. However, the specific design of these features, e.g. the value of the notional interest rate, deviates from DEBRA in most countries.[8]

[6] The EU has not yet adopted the directive or published a new timetable for implementing and enforcing the directive.

[7] An associated enterprise, as defined in Article 3 (1) DEBRA, is deemed to exist, in particular, if the taxpayer holds a participation of more than 25% in the voting rights, capital or profit of the enterprise.

[8] See Appendix 1. Table 6 for an overview of national ACE legislations.

Besides addressing the debt-equity bias from the equity side, DEBRA also considers the debt side by limiting the interest deductibility to 85% of the exceeding borrowing costs, which are defined as the difference between tax-deductible interest paid and taxable interest received (Article 6 DEBRA). Restricting the deductibility of interest payments for tax purposes should discourage excessive debt financing and reduce the directive's impact on Member States' tax revenues.

In addition to DEBRA, the already implemented Anti-Tax Avoidance Directive (Council of the European Union, 2016; in the following referred to as "ATAD") limits the deduction of excess borrowing costs to 30% of the company's EBITDA through the interest deduction limitation rule.[9] While under the ATAD, the exceeding borrowing costs that are not deductible can be carried back or forward, those not deductible under DEBRA are lost for tax purposes (Article 4 ATAD, Article 6 DEBRA). In cases where both the ATAD and DEBRA interest deduction limitation rules apply, DEBRA sets out the priority of the rules. The regime that results in the lower deductible amount of exceeding borrowing costs prevails (Article 6 DEBRA).

2.2 Pillar Two

The mandate for the EU Member States to implement a global minimum tax became effective with the enactment of the directive in late 2022. This directive had to be transposed into the Member States' national laws by the end of 2023. Pillar Two aims to fight aggressive tax planning by levying an effective minimum tax rate of 15% on profits generated by large companies. Moreover, it aims to stop the "race to the bottom" in corporate tax rates and to set a floor on international tax competition. The Minimum Tax Directive applies to affiliates of multinational and domestic groups with annual consolidated revenues above 750 million EUR (Article 2 Pillar Two).

If a company is effectively taxed at a rate below 15%, under Pillar Two, it has to pay a top-up tax amounting to the difference between 15% and its ETR. To calculate the top-up tax, a company's ETR is determined under a jurisdictional blending approach, i.e. all constituent entities in a jurisdiction are aggregated. The ETR is defined as the ratio between the adjusted covered taxes of all entities in one jurisdiction and their net qualifying income in this jurisdiction. First, the net qualifying income is derived from the net income used to prepare the consolidated financial statements (Article 15 Pillar Two), which must be based on an acceptable accounting standard.[10] The financial accounting net income has to be adjusted for various items (Article 16 Pillar Two). Second, the covered taxes are derived by adjusting the current tax expenses according to financial accounting standards for different items, e.g. for temporary differences as measured by deferred taxes (Articles 21, 22 Pillar Two).

[9] For exceptions from this rule, see Article 4 (1), (3), and (5) ATAD.

[10] Acceptable accounting standards include e.g. IFRS and US GAAP.

To collect the top-up tax, Pillar Two builds on three different main mechanisms. First, under the income inclusion rule (IIR), the residence country of the parent company imposes a top-up tax on all low-taxed subsidiaries within the group (Article 5 Pillar Two). The top-up tax increases the ETR up to the 15% threshold. Second, the undertaxed profits rule (UTPR) is applied as a backstop if the IIR is not implemented in the ultimate or intermediate parent company's residence country (Article 12 Pillar Two). Member States can implement one of the two following UTPR mechanisms: Either certain intra-group payments are no longer tax deductible, or a top-up tax is imposed on the EU subsidiaries of the group, which leads to an increase in the effective tax burden. Under both mechanisms, the tax liability equals the top-up tax that would have been due if an IIR was in place. Besides the IIR and UTPR, the third mechanism to collect the top-up tax is the qualified domestic minimum top-up tax (QDMTT, Article 11 Pillar Two). Low-tax countries can electively introduce the QDMTT and thereby directly impose a top-up tax on companies resident in their territory. Thus, low-tax countries can increase the tax burden for entities belonging to large groups to the 15% threshold while maintaining low-tax benefits for any other resident company. The QDMTT takes precedence over the IIR and the UTPR and is credited against the international minimum tax.

To reach the final top-up tax, the substance-based income exclusion must be considered (Article 28 Pillar Two). Under this provision, the so-called routine profit from substantial economic activity (i.e. tangible assets and costs associated with employees) is exempt from the top-up tax. In the year of introduction, the substance-based income exclusion amounts to 8% of the carrying value of the eligible tangible assets and 10% of the costs associated with employees. Both percentage levels are reduced continuously to 5% within ten years (Articles 27 and 46 Pillar Two).

3 Methodology

3.1 Devereux/Griffith methodology

To measure the impact of the introduction of DEBRA and Pillar Two on the location attractiveness for capital investments, we rely on the well-established forward-looking effective tax measures developed by Devereux and Griffith (1999, 2003). While this methodology uses a stylised representation of corporate investment, it allows for a consistent policy evaluation across different countries as it incorporates country-specific tax parameters in a coherent economic modelling framework (Spengel et al., 2020). These tax parameters include tax base regulations, such as interest deductibility and capital allowances, and tax rates of profit and non-profit taxes at the corporate level. The impact of these tax parameters on the effective company tax burden is derived by considering the net present value (NPV) of a hypothetical corporate investment. By taking into account several investment assets, sources of financing, and rates of return, we are able to measure the influence of taxes and tax-induced distortions on both the location and the scale of the investment.

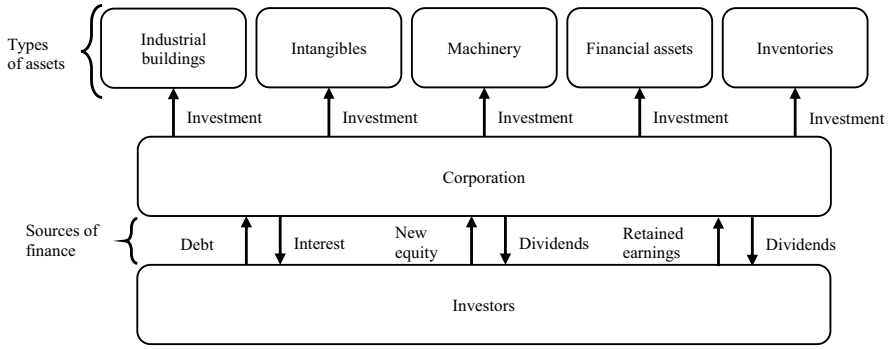


Fig. 1 Schematic illustration of the Devereux/Griffith methodology (Spengel, 2003). *Notes*: The figure shows the considered investment setting of a domestic corporation that is financed by an investor. The latter undertakes an investment in the corporation through debt, new equity, retained earnings, or a mix of these sources. The domestic corporation passes the additional capital to invest in five different assets: industrial buildings, intangibles, machinery, financial assets, and inventories (20% each). The taxation of the investor is not considered in our setting as DEBRA and Pillar Two intend to impact solely the corporation level

In general, the methodology is based on the neoclassical investment theory and assumes a discrete, hypothetical investment decision of a profit-maximising manufacturing company. The company invests in five different assets: industrial buildings, intangibles, machinery, financial assets, and inventories. Moreover, the company has access to three sources of financing: debt, new equity, and retained earnings (see Fig. 1). The investment implies a one-periodic increase in capital stock (i.e. early replacement investment), and we only consider a domestic scenario without cross-border transactions.

Two types of investment are distinguished based on their outcome: marginal investments, which earn a pre-tax rate of return just equal to their CoC, and infra-marginal (i.e. profitable) investments that yield a very high pre-tax return, for which the effective tax burden is expressed in terms of the EATR. The CoC demonstrates how taxation affects both the level of investment and a country's attractiveness for investment expansion. The CoC is interpreted relative to the real market interest rate: if the CoC is lower (higher) than the real market interest rate, the corporate investment is tax preferred (disadvantaged) relative to an alternative investment on the capital market (Lammersen, 2005). Hence, the CoC conceptually reflects the tax effect on the optimal scale of investments. However, when companies make decisions about the location of profitable investments, i.e. determining the geographical allocation of economic rents, then the EATR is the appropriate metric. A lower (higher) EATR signals a higher (lower) tax attractiveness of the location for profitable investments (Devereux & Griffith, 1998, 2003). For our comprehensive analysis,

Table 1 Considered tax parameters and economic assumptions of the Devereux/Griffith methodology

Types of taxes and tax base elements			
Types of taxes	Corporate income tax, including surcharges, local business taxes, non-profit taxes		
Tax base elements	Depreciation, inventory valuation, deductibility of interest expenses, tax allowances		
Assumptions on assets and financing			
Types of assets	Intangibles, buildings, machinery, financial assets, inventory (20% each)		
Types of financing	Debt (35%), retained earnings (55%), new equity (10%)		
Assumptions on depreciation, inflation, interest rate, and pre-tax rate of return			
Economic depreciation (degressive)	Intangibles	Buildings	Machinery
	15.35%	3.10%	17.50%
Inflation rate	2%		
Real interest rate	1.071%		
Nominal interest rate	3.092%		
Pre-tax return rate	20%		

The table displays the economic assumptions of the Devereux/Griffith methodology. To incorporate DEBRA, Pillar Two or to display sensitivity analyses, we adjust specific parameters as outlined in Chapters 4.1 and 4.2

we use both indicators, with tax base regulations being the main drivers of the CoC and profit tax rates being the main drivers of the EATR.

The main economic assumptions and tax parameters considered in our analyses are presented in Table 1. For the most part, we rely on standard assumptions of previous work (Spengel et al., 2020). However, we have adjusted the nominal interest rate to a more contemporaneous level as it is particularly relevant for measuring the effects of DEBRA. Thus, we use the ten-year risk-free interest rate published by EIOPA as of 31 December 2022 as our nominal interest rate. We discuss the impact of the economic assumptions on the effective tax levels in Chapter 3.2.

To measure the impact of the new tax regulations, we compare the CoC and the EATR before and after a deemed implementation of DEBRA and Pillar Two in two sets of analyses. First, to identify the mechanisms how DEBRA, Pillar Two, and their interaction impact effective tax levels, we analyse the CoC and EATR of a hypothetical country. The hypothetical country has a combined profit tax rate equal to the average combined profit tax rate in our country sample, which is 22%. In contrast, we assume a combined profit tax rate of 10% for the analyses where we apply Pillar Two. This combined profit tax rate consists of the corporate income tax, surcharges, and local business taxes, considering their interactions where applicable. We assume that there are no non-profit taxes.[11] Moreover, the hypothetical country

[11] In our sample, the only form of non-profit taxes are real estate taxes. 21 out of the 25 sample countries have a real estate tax, with an average combined tax rate of 0.5%. As the combined tax rate is low and only increases the underlying tax rate for the CoC and EATR of buildings, non-profit taxes have only a small impact on the results. For completeness, we include the non-profit taxes in the country heterogeneity analysis in Chapter 5.

has no national ACE or interest deduction limitation in place. With respect to depreciation, we apply the BEFIT rules for buildings, machinery, and intangibles. BEFIT implies a straight-line depreciation over 28 years for buildings and over five years for intangibles (Article 22 BEFIT). For other tangible assets, BEFIT refers to the useful life in accordance with either IFRS or national GAAP (Article 7 BEFIT). Hence, we follow previous work and assume a useful life of seven years as a depreciation period for machinery (Spengel et al., 2020). For inventories, we choose the weighted average cost method (Article 29 BEFIT).

Second, we conduct country heterogeneity analyses, where we evaluate the country-specific impact of DEBRA, Pillar Two, and their interaction on the EU Member States' effective tax levels. We obtain the underlying data on the EU Member States' tax regulations from the Mannheim Tax Index (Spengel et al., 2024). The Mannheim Tax Index provides the CoC and EATRs for all EU Member States and additional countries on an annual basis. In our analyses, we use the tax parameters for the 2022 tax year. Our sample consists of all EU Member States except Estonia and Latvia, as they have fundamentally different corporate income tax systems to which DEBRA cannot be applied. Moreover, we deviate from the Mannheim Tax Index with respect to Malta's corporate tax rate. Although the statutory corporate tax rate in Malta amounts to 35%, the system of tax refunds effectively reduces the tax rate to 5% upon profit distribution (Cassar Torregiani, 2023). While the Mannheim Tax Index applies the statutory rate, we employ the rate after the refund.

Finally, for robustness, we consider two different cases for the tax base in our country heterogeneity analyses. In our baseline analysis, we use the countries' national regulations to determine the tax base. In addition, we implement a common tax base, which is in line with the BEFIT depreciation rules for buildings, machinery, and intangibles (in the following referred to as the "common tax base"). The latter offers two valuable pieces of insight. First, a harmonised corporate tax base was envisioned several times by the EU (Nicolay & Spengel, 2017), most recently by BEFIT. Implementing the BEFIT tax base in our computations allows us to examine the impact of such a harmonised tax base on effective tax levels. Second, by including an EU-wide harmonised tax base calculation, we eliminate potential distortions from differing tax bases and show the pure tax rate effects of DEBRA and Pillar Two. Thus, the harmonised tax base allows us to better isolate the effects of the two directives across the EU Member States.

3.2 Impact of economic assumptions

Before analysing the impact of DEBRA and Pillar Two on the effective tax levels, we conduct sensitivity analyses to illustrate the impact of the different modelling assumptions on our results. For the sake of clarity, we conduct these analyses for the hypothetical country. As the effective tax burden under the Devereux/Griffith model is a weighted average of the CoC and EATRs across five assets and three financing options, i.e. 15 investments in total, the weighting schemes applied to assets and sources of financing affect the results.

The asset weighting is relevant for the overall findings as each of the five assets is subject to varying effective tax burdens due to differences in the generosity of tax depreciation and inventory valuation. Capital allowances, i.e. tax depreciations, shield the return on asset from taxation. The value of this tax shield is firstly determined by the tax rate that would otherwise hit returns. Second, the depreciation method and the associated time pattern of depreciation allowances determine the value of the tax shield, as accelerated depreciation, relative to true economic depreciation of the respective asset, implies an interest-free tax deferral into future periods. Moreover, the inventory valuation method determines the extent to which the cost of inventories can be deducted in the period under review, thereby also providing a tax shield on the income derived from the asset. Assuming inflation, the valuation of inventories is most tax favourable under the last-in-first-out (LIFO) method, followed by the weighted average method, and least favourable under the first-in-first-out (FIFO) method. Panel A of Appendix 2. Table 8 highlights those tax base effects. Our calculations suggest that financial assets have the highest CoC and EATRs as they are generally non-depreciable. The remaining assets benefit from accelerated capital allowances, resulting in a lower effective tax burden. Unless otherwise specified, we apply an equal weighting of the five investment assets in our model computations, as discussed in Chapter 3.1.

In addition to the asset weighting, the financing mix affects the effective tax burden. In contrast to equity financing, debt financing is associated with tax-deductible interest expenses and therefore provides a tax shield. The value of the tax shield depends on the tax rate and the nominal interest rate, with higher tax and interest rates resulting in a larger tax shield. However, since the CoC assumes a lower return than the EATR, the relative importance of the tax shield is higher for the CoC than for the EATR. Panel A of Appendix 2. Table 8 illustrates these financing effects. The highest effective tax burden occurs for equity financing,[12] while the CoC is significantly lower and EATRs are slightly lower for debt financing due to the tax shield provided by the tax deductibility of interest. In our standard investment project outlined in Table 1, we assume a lower proportion of debt (35%) than equity financing (65%), in line with empirical evidence (Kristofik & Medzihorsky, 2022; Rajan & Zingales, 1995) and pecking order theory.

A further important non-tax factor influencing our results is the real interest rate. The real interest rate is essential as it reflects the investor's opportunity costs. Thus, a higher (lower) real interest rate leads *ceteris paribus* to higher (lower) CoC. On the other hand, the EATR shows a moderately negative relationship with the real interest rate, all other things held constant. This is because the relative importance of nominal taxes in financial metrics decreases with increasing discount rates (Spengel et al., 2016). Appendix 2, Fig. 9 shows the relationship between the real interest rate

[12] The Devereux/Griffith model distinguishes between equity in the form of new shares and retained earnings. Differences in the effective tax treatment between these two variants of equity financing may occur at the shareholder level. However, in our analysis, we only take into account the corporate level, where there are no tax differences between both types of equity financing. Therefore, in the following, we subsume both new equity and retained earnings under the term "equity".

and, respectively, the CoC and EATR for our hypothetical country. Although for a single country the CoC and EATR depend on the chosen interest rate, the ranking among countries is not very sensitive to varying interest rates, with respect to neither the CoC nor the EATR.

4 Analysis of effective tax levels under DEBRA and Pillar Two

4.1 DEBRA

We integrate DEBRA into the Devereux/Griffith model by essentially modifying two parameters but otherwise stick to the hypothetical country described in Chapter 3.1. First, to correctly reflect DEBRA's interest deduction limitation (IDL), we reduce interest deductibility in the case of debt financing to 85% of the net interest expense.[13] Overall, the less favourable tax treatment of debt under the IDL leads to a higher CoC and EATR in the case of debt financing as shown in Column (2) of Table 2.

Second, the ACE element of DEBRA is incorporated into the Devereux/Griffith model by considering a notional interest deduction on equity. As described in Chapter 2.1, the tax-deductible notional interest is determined as the product of the incremental equity times the notional interest rate. DEBRA uses a broad definition of the term "equity", which includes the two types of equity that are considered in the model, namely retained earnings and new equity. The applicability of DEBRA's ACE to incremental equity only is accounted for in the model by design, since it considers a hypothetical incremental investment and corresponding incremental increases in equity or debt capital.[14] As the notional interest rate, we use a rate of 4.092%, comprising the nominal interest rate of 3.092% and a risk premium of 1%.

The equity tax shield resulting from the ACE increases the after-tax NPV of the equity-financed investment relative to the results prior to DEBRA. Therefore, the ACE leads to a lower CoC and EATR in the case of equity financing as depicted for our hypothetical country in Column (3) of Table 2. Thereby, in relative terms, the impact of the ACE on the CoC is larger than on the EATR. The reasoning is similar as for the tax shield resulting from debt financing. The absolute size of the ACE is the same for the CoC and the EATR. But since the CoC assumes a marginal investment, the ACE shields a larger proportion of the return from taxation than in the case of a more profitable investment assumed for the EATR.

[13] We assume that the interest deduction limitation rule of the ATAD has no effect as the excess borrowing costs do not exceed 30% of the company's EBITDA. Therefore, under the status quo, interest deductibility is not limited by the ATAD and under DEBRA, the IDL is applied according to the priority of rules described in Chapter 2.1.

[14] We assume that the model company generates sufficient income besides the return on the incremental investment to fully deduct the ACE in the first period. This assumption of no tax exhaustion is particularly applicable to the well-established, large companies that derive income from diverse investment projects we consider (see Devereux et al., 2002). Therefore, no carryforwards of excess notional interest arise.

Table 2 Impact of IDL, ACE, and DEBRA on the effective tax levels

	Status quo (1)	IDL (2)	ACE (3)	DEBRA (4)	Δ (4)-(1) (5)
Panel A: CoC					
Equity	1.64%	1.64%	0.50%	0.50%	− 1.14pp.
Debt	0.78%	0.91%	0.78%	0.91%	0.13pp.
Δ Equity-Debt	0.86pp.	0.73pp.	− 0.28pp.	− 0.41pp.	− 1.27pp.
Financing mix	1.34%	1.38%	0.60%	0.64%	− 0.70pp.
Panel B: EATRs					
Equity	23.02%	23.02%	18.61%	18.61%	− 4.41pp.
Debt	19.69%	20.19%	19.69%	20.19%	0.50pp.
Δ Equity-Debt	3.33pp.	2.83pp.	− 1.08pp.	− 1.58pp.	− 4.91pp.
Financing mix	21.85%	22.03%	18.99%	19.16%	− 2.69pp.

The table displays the impact of the IDL, ACE, and DEBRA on the CoC (Panel A) and on the EATR (Panel B) of a hypothetical country. Column (1) shows the CoC and EATR in the status quo, i.e. without any adjustments. Column (2) shows the effect of the IDL and Column (3) the effect of the ACE. Column (4) includes both, IDL and ACE, to illustrate the impact of DEBRA. Column (5) depicts the difference between the CoC and EATR under DEBRA relative to the status quo in percentage points (pp.). The hypothetical country has a combined profit tax rate of 22%, no non-profit taxes, no national ACE or IDL, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. For all simulations, we employ the asset weighting of our standardised investment project. The financing mix consists of 65% equity and 35% debt

The impact of both DEBRA elements, i.e. IDL and ACE combined, on the effective tax burden of our hypothetical country is depicted in Columns (4) and (5) of Table 2. Compared to the status quo (Column (1)), the CoC and EATRs under DEBRA (Column (4)) decrease in the case of equity financing but increase in the case of debt financing, as shown by the respective differences shown in Column (5). While the inferences above rely on an investment consisting of a specific asset mix as depicted in Table 1, the results are robust to considering alternative asset weightings.[15]

Overall, our stylised example shows that the CoC and EATRs are still unequal for equity and debt financing when DEBRA is applied. This means that DEBRA does not achieve financing neutrality. However, the absolute gap between the CoC (EATR) under equity and debt financing decreases under DEBRA from 0.86 pp. (3.33 pp.) to 0.41 pp. (1.58 pp.), as shown in Table 2. Thus, DEBRA achieves its goal of reducing the debt-equity bias, although not to zero. The remaining debt-equity bias under DEBRA indicates a more favourable tax treatment of equity financing compared to debt financing. This can be seen in the lower CoC and EATR of equity financing relative to debt financing in Column (4) of Table 2. Notably, in the status quo it is the other way around. The main reason for this change in preferential tax treatment is the reduction in the debt tax shield and the introduction of an equity tax shield. Finally, our results show that the distortion between debt

[15] See Appendix 2. Table 8 for a granular overview of the effects of DEBRA on specific asset types.

and equity is lower under DEBRA than under the IDL alone, but higher than under the ACE alone. DEBRA therefore reduces, but does not minimise, the debt-equity distortion.

The overall impact of DEBRA on the effective tax burden of investments obviously depends on the chosen financing mix. The financing mix used in the stylised example consists of 65% equity and 35% debt. Therefore, DEBRA's effect on equity financing dominates the effect on debt financing, resulting in an overall lower CoC and EATR. However, this net reduction in the effective tax burden may reverse to a net increase if a company is predominantly debt-financed.

4.2 Pillar Two

To integrate Pillar Two into the Devereux/Griffith model, we model the QDMTT[16] including the substance-based income exclusion. Under Pillar Two, residual profit that is subject to an ETR of less than 15% is taxed with a top-up tax. The top-up tax rate is calculated as the difference between the minimum tax rate of 15% and the ETR. As a proxy for the ETR, we use the combined profit tax rate. Thus, if the combined profit tax rate amounts to at least 15%, we assume Pillar Two does not apply.[17] However, if the combined profit tax rate amounts to less than 15%, a top-up tax is levied according to the mechanisms under Pillar Two.[18] Moreover, a substance-based income exclusion is granted in order to carve-out normal returns on local substance from the top-up tax. Specifically, 8% of the carrying value of tangible assets and 10% of employment expenses are exempt from the top-up tax. Within ten years after the implementation of Pillar Two, the substance-based carve-out is continuously reduced to 5%. The value of the tax shield generated by given carved-out returns, which we are able to model,[19] corresponds to the difference between the 15% minimum tax rate and the local combined profit tax rate. It thus reflects the top-up tax that would otherwise apply to the carved-out income.

In the following, we investigate the effects of Pillar Two on the EATR.[20] Table 3 shows the EATRs before and after the implementation of Pillar Two for the hypothetical country described in Chapter 3.1, but with a combined profit tax rate of 10%. Under Pillar Two, the EATR increases from 9.94 to 14.12%. Hence, the EATR

[16] We assume that the model company is located in a low-tax country that chooses to implement a QDMTT. As described in Chapter 2.2, the QDMTT takes precedence over the IIR and the UTPR.

[17] In reality, tax incentives may reduce the ETR significantly and lead to a situation where Pillar Two would be applicable even under a combined profit tax rate exceeding 15% (OECD, 2022). We exclude such particular cases from our analysis.

[18] In our calculations, we generally assume that the model company exceeds the size threshold of annual consolidated revenues above 750 million EUR.

[19] As the Devereux/Griffith model does not take into account employment expenses, we solely include the asset-based carve-out.

[20] As Pillar Two mandates a carve-out for normal returns on substance, its effects become fully apparent only if we consider an infra-marginal investment. Moreover, levelling up the ETR by means of a top-up tax should be most impactful in the context of high profitability. We therefore focus on the EATR in the main text but provide results also for the CoC in Appendix 2. Table 9.

Table 3 Impact of Pillar Two on the EATRs

	Status quo (1)	Pillar Two (2)	Δ (2)-(1) (3)
Industrial buildings	9.64%	12.50%	2.86pp.
Intangibles	9.64%	14.47%	4.83pp.
Machinery	9.98%	13.01%	3.03pp.
Financial assets	10.45%	15.67%	5.22pp.
Inventory	9.96%	14.94%	4.98pp.
Asset mix	9.94%	14.12%	4.18pp.

The table displays the asset-specific impact of Pillar Two on the EATR of a hypothetical country. Column (1) shows the EATR in the status quo, i.e. without any adjustments. Column (2) shows the effect of Pillar Two on the effective tax burden. Column (3) depicts the difference between the EATR under Pillar Two relative to the status quo in percentage points. The hypothetical country has a combined profit tax rate of 10%, no non-profit taxes, no national ACE or IDL, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. For all simulations, we employ the financing mix of our standardised investment project. The asset mix assumes an equal weighting (i.e. 20%) of the five assets.

does not necessarily increase to 15%. To explain this finding, we will elaborate in more detail on the drivers of the Pillar Two effects on the EATR.

First, the resulting profit tax rate is effectively a weighted average of the minimum tax rate applied to residual profits and the country's combined profit tax rate applied to carved-out normal profits. The carve-out percentage determines the fraction of profits that are subject to the lower combined profit tax rate instead of the minimum tax rate of 15%. Panel A of Fig. 2 shows a negative linear relationship between the carve-out percentage and the EATR, i.e. the higher the carve-out percentage, the lower the EATR. Moreover, with profitability increasingly exceeding the carve-out percentage, a lower fraction of the profits is taxed at the regular combined profit tax rate. Thus, while the absolute value of the carve-out is unchanged, increasing excess profitability reduces the relative impact of the carve-out on the weighted average tax rate, which is then more heavily driven by the minimum tax rate. This relationship is illustrated in Panel B of Fig. 2, where a higher profitability is associated with a higher EATR.

Second, the asset composition of the investment affects the carve-out. The higher the weight of tangible assets in the asset mix, the more important is the substance-based carve-out. Therefore, the EATR decreases with an increasing proportion of tangible assets in the asset mix. This relationship is illustrated in Panel C of Fig. 2. Moreover, Column (3) of Table 3 shows a smaller effect of Pillar Two on the EATR for buildings and machinery compared to the other assets, which is due to the substance-based carve-out for tangible assets.

Third, the value of the carve-out depends on the profit tax rate in a country since the carve-out is exempt from the top-up tax and instead taxed at the regular combined profit tax rate. Thus, the larger the differential between the minimum tax rate of 15% and the combined profit tax rate, the higher is the value of the carve-out. Panel D of Fig. 2 shows the EATRs of three hypothetical countries with different combined profit tax rates, i.e. 5%, 10%, and 12.5%. Although the top-up tax

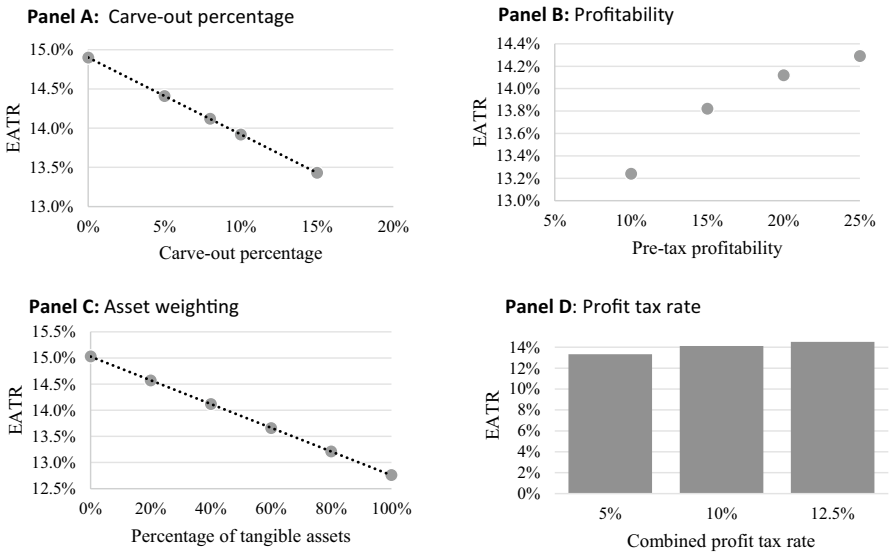


Fig. 2 Impact of carve-out percentage, profitability, asset weighting, and profit tax rate on the EATR under Pillar Two. *Notes:* The figures show the effect of the carve-out percentage (Panel A), the pre-tax profitability (Panel B), the asset weighting (Panel C), and the combined profit tax rate (Panel D) on the EATR of a hypothetical country under Pillar Two. The hypothetical country has a combined profit tax rate of 10%, no non-profit taxes, no national ACE or IDL, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. In Panel C, the percentage of tangible assets consists equally of buildings and machinery, the remaining part is divided equally between intangibles, financial assets, and inventory. For all simulations, we employ the financing mix of our standardised investment project

increases the tax rate to 15% in all countries, the EATR in the country with a combined profit tax rate of 5% is still the lowest, as the substance-based carve-out is taxed at 5% only and therefore more valuable than in the other countries.

4.3 Interaction

In addition to their stand-alone implementation, our analysis examines the interaction effect of DEBRA and Pillar Two. The interaction of both provisions is only relevant if the combined profit tax rate lies below the Pillar Two threshold of 15%. Correspondingly, if the combined profit tax rate lies above the Pillar Two threshold, only DEBRA impacts the effective tax level. The interaction effect then corresponds to the results in Chapter 4.1.

To understand the interaction effect of DEBRA and Pillar Two, it is important to disentangle the different mechanisms of both provisions. DEBRA affects the tax base by reducing the interest deductibility to 85% through the IDL and by

introducing a notional interest deduction on equity through the ACE. Hence, both DEBRA elements influence the ETR calculated under Pillar Two as follows. On the one hand, the IDL increases the tax base and, thus, also the amount of covered taxes. While interest is generally deductible for accounting and tax purposes, the IDL is applied for tax purposes only and, therefore, does not affect the net qualifying income, which is based on financial statements. Consequently, the IDL increases the ETR under Pillar Two and reduces the top-up tax rate compared to a scenario without IDL. Thus, DEBRA's IDL implies no definite tax penalty under Pillar Two as it is compensated by reduced top-up taxes and, ultimately, the ETR is levelled up to the minimum rate of 15%. On the other hand, the ACE reduces the tax base and, thus, the amount of covered taxes, while the net qualifying income remains unaffected. As a result, the ACE is a tax incentive that reduces the ETR calculated under Pillar Two and increases the top-up tax rate correspondingly.[21] In return, the top-up tax under Pillar Two eliminates the tax benefit of DEBRA's ACE by levelling the ETR back up to the minimum rate of 15%. Only for carved-out returns no top-up taxation applies and the effect of DEBRA prevails. Therefore, the effective tax burden on carved-out income is the same as in the DEBRA scenario in Chapter 4.1. Overall, under both directives, DEBRA's ability to reduce the debt-equity bias is constrained.

Table 4 shows the interaction effects for the hypothetical country with a combined profit tax rate of 10%. The results for the sole implementation of DEBRA and Pillar Two are in line with Chapters 4.1 and 4.2. While the EATR decreases by 1.23 pp. under DEBRA, it increases by 4.18 pp. under Pillar Two compared to the status quo. In the interaction case, the EATR increases by 4.02 pp. and, thus, lies between the results of DEBRA and Pillar Two. These findings for the interaction case can be explained as follows: Compared to the sole implementation of DEBRA (Column (2)), the effective tax burden is higher, as the top-up tax increases the combined profit tax rate and the tax-reducing effect of DEBRA is limited to the carved-out profits. On the other hand, when comparing the interaction case (Column (6)) to the sole implementation of Pillar Two (Column (4)), the effective tax burden decreases, as the carved-out profits are subject to a lower effective tax rate due to DEBRA. Finally, when comparing the interaction case to the status quo, the EATR increases due to the prevailing effect of the top-up tax, which levels up the combined profit tax rate.

The effects on the CoC are similar to the results presented for the EATR. While the CoC decreases by 0.28 pp. under DEBRA, it increases by 0.04 pp. under Pillar Two. However, in contrast to the EATR, the CoC decreases by 0.07 pp. in the interaction case compared to the status quo. This is because tax rate adjustments are less strongly reflected in the CoC than tax base adjustments. Thus, the more

[21] For a detailed discussion on how different tax incentives affect the ETR under Pillar Two, see OECD (2022). We acknowledge that there may be cases where changes in the ETR caused by a limitation of interest deductibility or an ACE could lead to the application or non-application of Pillar Two. We exclude such highly specific cases from our analysis.

Table 4 Impact of DEBRA, Pillar Two, and their interaction on the effective tax levels

	Status quo (1)	DEBRA (2)	Δ (2)-(1) (3)	Pillar Two (4)	Δ (4)-(1) (5)	Interaction (6)	Δ (6)-(1) (7)
EATR	9.94%	8.71%	− 1.23pp.	14.12%	4.18pp.	13.96%	4.02pp.
CoC	1.18%	0.90%	− 0.28pp.	1.22%	0.04pp.	1.11%	− 0.07pp.

The table displays the EATRs and CoC of a hypothetical country under the status quo, under the application of DEBRA, Pillar Two, and their interaction, i.e. the simultaneous application of DEBRA and Pillar Two. Column (1) shows the CoC and EATR in the status quo, i.e. without any adjustments. Column (2) shows the impact of DEBRA and Column (4) the impact of Pillar Two. Column (6) includes both, DEBRA and Pillar Two, to illustrate the impact of their interaction. Columns (3), (5), and (7) depict the difference between the CoC and EATR under DEBRA, Pillar Two, and their interaction relative to the status quo in percentage points. The hypothetical country has a combined profit tax rate of 10%, no non-profit taxes, no national ACE or IDL, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. For all simulations, we employ the financing mix and asset weighting of our standardised investment project

valuable carve-out due to the ACE tax shield outweighs the effect of the top-up tax and reduces the CoC marginally compared to the status quo.

5 Country heterogeneity analysis

5.1 DEBRA

So far, we demonstrated the effect of DEBRA on the effective tax level of a hypothetical country. In the following, we show the effect of DEBRA for the EU Member States, taking into account their respective national tax laws.[22] Fig. 3 illustrates the impact of DEBRA on the countries' CoC. Panel A shows that under the current tax law of the EU Member States (in the following referred to as "status quo"), the CoC ranges from − 1.13% in Malta to 2.01% in Spain. DEBRA reduces the spread of the CoC, resulting in a range from 0.32% in Malta to 1.23% in Hungary.

For the majority of EU Member States, the CoC is lower after the implementation of DEBRA than under the status quo. Figure 3 Panel B shows that the reduction caused by DEBRA ranges from 0.16 pp. in Poland to 1.43 pp. in Spain.[23] This negative effect on the CoC is in line with our results in the stylised setting shown in Chapter 4.1. The net effect is composed of the tax level-increasing impact of the IDL that is superseded by the tax level-decreasing effect of the ACE. The resulting decrease of the CoC implies that DEBRA increases the optimal level of corporate investment.

[22] Appendix 3. Table 10 provides detailed results for the effects of IDL, ACE, and DEBRA on the EU Member States' effective tax levels.

[23] In countries with high tax rates, such as Spain or Germany, the additional deduction from the ACE is worth more than in countries with lower tax rates, resulting in larger relative net negative effects in the former countries.

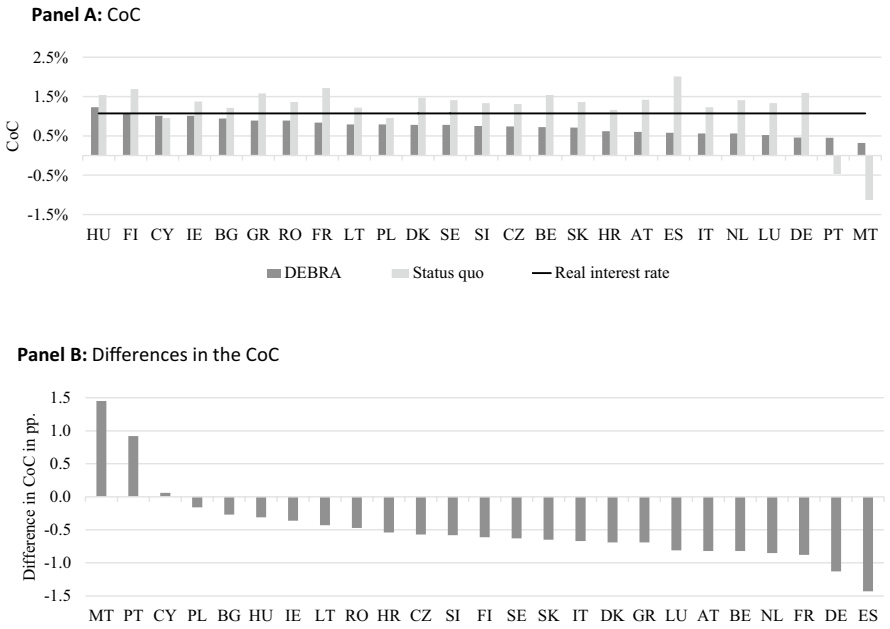


Fig. 3 Impact of DEBRA on the EU Member States' CoC. *Notes:* The figures show the impact of DEBRA on the EU Member States' CoC. Panel A compares the CoC under the status quo (light grey bars) and under the application of DEBRA (dark grey bars). The real interest rate is 1.071%, indicated by the horizontal black line. Panel B shows the difference between the CoC under DEBRA and the status quo. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

However, for three countries, namely Cyprus, Malta, and Portugal, we find a positive effect of DEBRA on the CoC. These countries already have an ACE in their national legislation that is more generous than the ACE under DEBRA.[24] Cyprus, Malta, and Portugal grant notional interest rates of 5.629%, 8.04%, and 7%, respectively, under their tax laws of 2022. With its notional interest rate of 4.092%, the ACE under DEBRA provides for a lower deduction from the tax base. Thus, DEBRA increases the CoC in the aforementioned countries and reduces the optimal level of corporate investment. In contrast, for countries whose national tax law provides for a less generous ACE than DEBRA, we find a negative effect of DEBRA on the CoC. In Belgium, Italy, and Poland, DEBRA decreases the CoC because the existing national laws provide for notional interest rates of 0%, 1.3%, and 2.75%, respectively, which are lower than the 4.092% granted under DEBRA. By implementing a uniform ACE provision across all countries, DEBRA contributes to its goal of harmonising national tax provisions and ensuring a level playing field.[25]

[24] See Appendix 1. Table 6 for an overview of the existing allowances on equity in the EU.

[25] Since DEBRA applies only to entities subject to corporate taxation, unincorporated businesses would generally be excluded from its scope, limiting the directive's potential to harmonise ACE regimes across EU Member States and potentially introducing new distortions into national tax systems. For a detailed discussion, see Spengel et al. (2021).

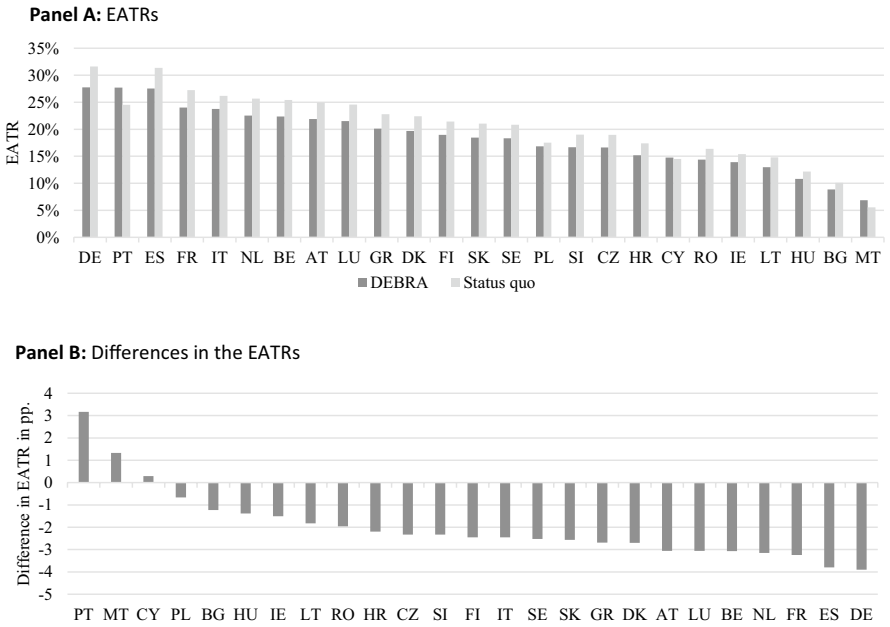


Fig. 4 Impact of DEBRA on the EU Member States' EATRs. *Notes:* The figures show the impact of DEBRA on the EU Member States' EATRs. Panel A compares the EATRs under the status quo (light grey bars) and under the application of DEBRA (dark grey bars). Panel B shows the difference between the EATRs under DEBRA and the status quo. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

If we compare the CoC of the EU Member States with the real interest rate of 1.071%, we can draw conclusions about the attractiveness of the corporate investment compared to an alternative investment on the capital market. Figure 3 Panel A shows that under the status quo, the CoC, which reflects the minimum pre-tax rate of return required by the investors, is higher than the real interest rate in almost all countries. This implies that under the status quo, an alternative investment on the capital market is more attractive than the corporate investment. Exceptions are Cyprus, Malta, Poland, and Portugal, where the CoC under the status quo is below the real interest rate due to the ACE implemented in their national law. As a result of DEBRA, however, the CoC falls below the real interest rate in most countries. Only in Finland and Hungary the CoC remains above the real interest rate even under DEBRA.

The impact of DEBRA on the EU Member States' EATRs is illustrated in Fig. 4. Panel A shows that the EATRs under the status quo range from 5.53% in Malta to 31.64% in Germany. Under DEBRA, the EATRs range from 6.86% in Malta to 27.74% in Germany. The implementation of DEBRA has a negative impact on

Fig. 5 Differences in the EU Member States' EATRs under DEBRA compared to the status quo. *Notes*: The figure shows the differences between the EU Member States' EATRs under DEBRA and under the status quo. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project.

the EATR for the majority of countries, which is in line with the effects found for countries' CoC. Figure 4 Panel B shows that the decrease in the EATR ranges from 0.66 pp. in Poland to 3.90 pp. in Germany. As the EATR reflects the countries' location attractiveness from a tax perspective, a decrease in the EATR due to DEBRA implies that the proposed directive makes countries more attractive for profitable investment. However, this does not hold true for countries with a more favourable ACE in their national tax laws. The EATRs increase in Portugal, Malta, and Cyprus (by 3.17 pp., 1.33 pp., and 0.29 pp., respectively), making these countries less attractive as an investment location.

Overall, DEBRA reduces the effective tax level in most EU Member States. Figure 5 shows that the EATR decreases most in the Western European countries with the highest statutory tax rates (e.g. France, Germany, Spain). This is plausible because the value of the equity tax shield that comes with the ACE element of DEBRA increases with the tax rate. The decline in tax levels is smallest in the Eastern European countries, which also tend to have lower statutory tax rates. Only the three Member States with more generous national ACE regimes in place experience a tax level increase due to DEBRA. In summary, DEBRA would make corporate investment in most Member States more attractive, and it would increase their tax attractiveness. Whether the increased tax attractiveness ultimately leads to a stimulation of economic growth is a question that goes beyond this simulation study.

For simplicity, we assumed the same notional interest rate for all countries based on the Eurozone's risk-free interest rate. However, according to DEBRA, the notional interest rate should be based on the national currency-specific interest rate

(Article 4 DEBRA). As of 2022, eight of our sample countries did not use the euro as their currency.[26] We show the effect of using currency-specific instead of euro-specific notional interest rates on the CoC and EATRs for those countries in Appendix 3, Fig. 10. In Bulgaria, Denmark, and Sweden, the currency-specific interest rate is very close to the euro rate. Accordingly, the CoC and EATRs under DEBRA remain almost the same regardless of which interest rate is used. In contrast, in countries where the currency-specific interest rate is higher than the euro rate (Croatia, Czech Republic, Hungary, Poland, and Romania), we observe a decrease in the CoC and EATR when implementing DEBRA based on the currency-specific interest rate. The decrease can be explained by the fact that the notional interest rate increases when using the higher currency-specific interest rate, resulting in higher deductions from the tax base.

To ensure that our country-specific results are not distorted by variations in countries' national tax base regulations, we implement a common tax base across countries which is adapted from BEFIT as outlined in Chapter 3.1. First, we compare EU Member States' CoC and EATRs under their national tax base and under the application of the common tax base. Appendix 3, Fig. 11 illustrates the effects of implementing a common tax base under the status quo. Overall, the impact of the common tax base on countries' CoC and EATRs is negligible. Relative to the national tax bases, the common tax base leads to an increased CoC for 13 countries, decreased CoC for ten countries, and no change for two countries. The increases range from 0.23 pp. in Belgium to 0.01 pp. in Austria and Bulgaria, while the decreases lie between 0.20 pp. in Malta and 0.01 pp. in Portugal. Thus, the changes are small relative to the countries' CoC. Similar to the results for the CoC, the effect of implementing the common tax base on Member States' EATRs is marginal.

Second, we examine the impact of the common tax base on the CoC and EATRs of EU Member States under application of DEBRA. The results are presented in Appendix 3, Fig. 12. The impact of the common tax base on the effective tax burden under DEBRA is again only marginal. Thus, our findings on the effects of DEBRA on Member States' effective tax levels do not seem to be driven by country-specific tax base regulations.

5.2 Pillar Two

Next, we investigate the country-specific effects of Pillar Two in the EU. First, we identify EU Member States where Pillar Two is likely to apply. In line with our explanations in Chapter 4.2, we refer to the combined profit tax rate as the best proxy for the ETR under Pillar Two. Thus, we assume Pillar Two to apply if the combined

[26] Appendix 1. Table 7 provides an overview of the national currency-specific interest rates as of 2022.

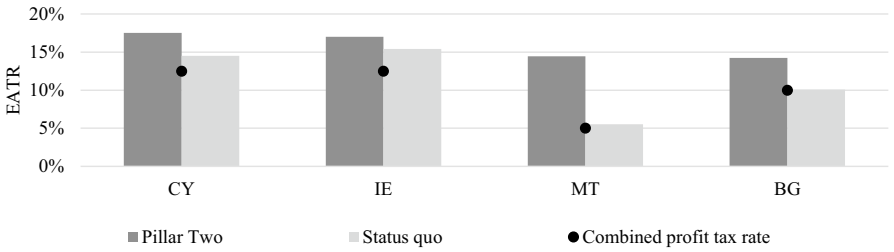


Fig. 6 EU Member States' EATRs under the status quo and under Pillar Two. *Notes*: The figure shows the four EU Member States' EATRs under the status quo (light grey bars) and under Pillar Two (dark grey bars). The black dots indicate the combined profit tax rate that triggers the application of Pillar Two in the displayed countries. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

profit tax rate amounts to less than 15%.[27] This is the case for Bulgaria, Cyprus, Ireland, and Malta, which is why we simulate Pillar Two for these four countries.[28]

Figure 6 displays the EATRs in the aforementioned countries under the status quo and after the introduction of Pillar Two.[29] Under the status quo, the EATRs range from 5.53% in Malta to 15.42% in Ireland. After the implementation of Pillar Two, the EATRs increase in all four countries. The increases range from 1.59 pp. in Ireland to 8.90 pp. in Malta. Due to the very low EATR under Malta's status quo, Pillar Two significantly increases the effective tax burden. In contrast, the EATRs in the remaining countries increase only moderately since their combined profit tax rates are relatively close to the threshold of 15%. Nevertheless, the effect of Pillar Two on the EATR differs across countries. For example, the EATRs in Cyprus and Ireland increase by 3.04 pp. and 1.59 pp., respectively, although both countries have the same combined profit tax rate of 12.5%. The larger increase in Cyprus is due to the very generous ACE regime, which reduces the EATR under the status quo significantly, while under Pillar Two, the tax shield of the ACE is limited to the substance-based carve-out only.

Overall, the increase in the EATR leads to a decrease in the location attractiveness of the four sample countries relative to their status quo. Figure 7 shows that the EATRs of low-tax countries under Pillar Two (displayed by the dark grey bars) approach the effective tax burden of countries not affected by Pillar Two. Notably, they even exceed the EATRs of a few countries where Pillar Two is unlikely to

[27] We acknowledge that companies' actual ETRs might differ due to additional aspects like other taxes paid, loss carryforwards, or tax credits. The number of countries most probably affected by Pillar Two does not change when also taking into account non-profit taxes and existing allowances on equity.

[28] Hungary levies a business tax on revenues in addition to its corporate income tax on profits. According to our calculation and assumptions on the impact of the business tax, the combined profit tax rate in Hungary is around 11%. However, the Hungarian government expects the effective tax burden to exceed 15%. See https://abouthungary.hu/news-in-brief/navracsics-hungary-s-adoption-of-global-minimum-tax-does-not-mean-taxes-will-increase (19.01.2024). We, therefore, do not simulate Pillar Two for Hungary.

[29] The results for the effect on the CoC are shown in Appendix 4, Fig. 13.

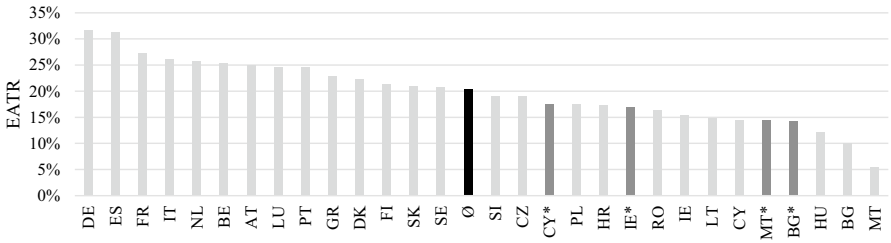


Fig. 7 Ranking of the EU Member States' EATRs after the introduction of Pillar Two. *Notes*: The figure shows the EU Member States' EATRs after the introduction of Pillar Two. In case Pillar Two is not applicable in a country, the EATR under the status quo is displayed (light grey bars). The medium grey bars display the EATRs of countries affected by Pillar Two before applying the directive (status quo). The EATRs of countries marked with an asterisk (dark grey bars) incorporate the Pillar Two provisions. The black bar represents the unweighted average EATR in the sample countries under the status quo. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

apply in our simulation, but which have a combined profit tax rate slightly above 15%.[30] The spread between the highest EATR (i.e. Germany) and the lowest EATR (i.e. Malta under status quo, Hungary after introduction of Pillar Two) is reduced from 26.11 pp. under the status quo to 19.45 pp. when Pillar Two applies. Bulgaria, Cyprus, and Ireland become slightly less attractive from a tax perspective compared to the status quo, but they are still among the nine countries with the lowest EATRs in our country sample. Moreover, Malta still ranks among the three countries with the lowest EATRs although its EATR increases significantly in contrast to the status quo. In sum, Fig. 7 suggests that Pillar Two establishes a floor on international tax competition. However, the EATR does not necessarily increase to 15% due to the substance-based carve-out.

To prevent country-specific results from being distorted by differences in national tax base regulations, we also analyse the results using a harmonised tax base across countries. Thus, we incorporate the common tax base for the Pillar Two sample countries based on the assumptions outlined in Chapter 3.1. As the pure effect of a common tax base on the CoC and EATRs has already been investigated in Chapter 5.1, we focus on the interaction effect of a common tax base and Pillar Two on the EU Member States' EATRs. Appendix 4, Fig. 14 Panel B presents the EATRs after the application of Pillar Two and compares the results under the national tax base with those under the common tax base.[31] Applying the common tax base results in marginally lower (higher) EATRs in Cyprus, Ireland, and Malta (Bulgaria). The change in EATRs by including the common tax base ranges from −0.87 pp. in Malta to 0.10 pp. in Bulgaria. Overall, the effect of implementing Pillar Two is very

[30] As mentioned above, we exclude Hungary from the Pillar Two simulation. Thus, after the introduction of Pillar Two, Hungary has the lowest EATR of all sample countries, as we assume a combined profit tax rate of around 11% and do not simulate a top-up tax.

[31] The results for the CoC are shown in Appendix 4, Fig. 14 Panel A.

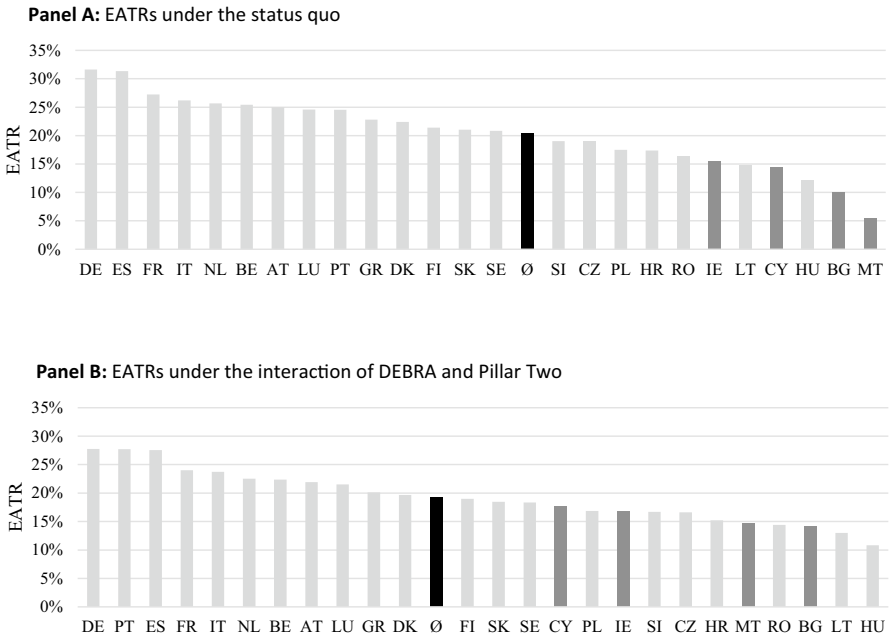


Fig. 8 Ranking of the EU Member States' EATRs under the status quo and under the interaction of DEBRA and Pillar Two. *Notes*: The figures display the EU Member States' EATRs in the status quo (Panel A) and after the introduction of Pillar Two and DEBRA (Panel B). In case Pillar Two is not applicable in a country (light grey bars), the EATR under DEBRA is displayed in Panel B. The EATRs of countries where Pillar Two is applicable (dark grey bars) incorporate the Pillar Two provisions. The black bar represents the sample countries' unweighted average EATR under the status quo in Panel A and under the application of DEBRA and Pillar Two in Panel B. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

similar under both tax base definitions: Under the common tax base (national tax base), the increase in EATRs ranges from 1.57 pp. (1.59 pp.) in Ireland to 8.99 pp. (8.90 pp.) in Malta.

5.3 Interaction

Having discussed the separate impact of DEBRA and Pillar Two on EU Member States' effective tax levels, we now turn to the interaction between both directives. Figure 8 depicts the EATRs of the EU Member States in the status quo (Panel A) and under the application of both DEBRA and Pillar Two (Panel B). In the status quo, the Member States' EATRs range from 5.53% in Malta to 31.64% in Germany. Under the application of DEBRA and Pillar Two, the EATRs range from 10.81% in Hungary to 27.74% in Germany. The average EATR across all sample countries declines from 20.48% in the status quo to 19.26% under the interaction of both

directives.[32] Based on the above numbers, we can draw two conclusions. First, the range of EATRs among EU Member States decreases if both directives apply. Second, the average EATR shifts downward due to two directives. These outcomes can be attributed to DEBRA lowering the tax levels in high-tax EU Member States and Pillar Two raising the tax levels in low-tax EU Member States. This more level playing field contributes to the objectives of DEBRA and Pillar Two.

The downward shift of EATRs is driven by DEBRA, which applies to all countries and has a negative effect on most Member States' tax levels as laid out in Chapter 5.1. In contrast, Pillar Two, which increases the Member States' tax levels, applies to only four countries: Bulgaria, Cyprus, Ireland, and Malta. Thus, in our simulation, the two directives interact only in those four before-mentioned countries. In all other countries, the interaction of both directives boils down to the sole application of DEBRA.

The four countries affected by DEBRA and Pillar Two experience an overall increase in EATRs. Under the status quo, Bulgaria, Cyprus, Ireland, and Malta are amongst the six countries with the lowest EATRs (Fig. 8 Panel A). If both directives apply, these countries move more towards the centre of the EATR distribution (Fig. 8 Panel B). Table 5 shows the results of DEBRA, Pillar Two, and their interaction on the effective tax levels of the four countries. Columns (2) and (3) depict the results under the sole application of DEBRA. The CoC and EATRs in Cyprus and Malta (Bulgaria and Ireland) are higher (lower) under DEBRA than under the status quo. The increase in the tax burden in Cyprus and Malta is a result of their more generous national ACE compared to DEBRA's ACE. Columns (4) and (5) show that Pillar Two increases the CoC and EATRs in all four countries. The simultaneous application of DEBRA and Pillar Two is shown in Columns (6) and (7). The CoC and EATRs of Bulgaria and Ireland lie between the sole application of DEBRA and Pillar Two. This result is in line with the effect found for the hypothetical country in Chapter 4.3. However, for Cyprus and Malta, the CoC and EATRs are even higher than under the sole application of Pillar Two. The reason is that both DEBRA's ACE and IDL as well as Pillar Two's top-up tax increase the effective tax level of both countries.

Overall, our results for Bulgaria, Cyprus, Ireland, and Malta show that the effect of Pillar Two dominates DEBRA's effect. This dominance is demonstrated by the fact that the CoC and EATRs under the interaction of both directives are closer to the tax levels under the sole application of Pillar Two than under the sole application of DEBRA. Thus, the effect of DEBRA is largely reversed by the application of Pillar Two. As a result, the effective tax levels increase in the four Member States if both directives apply.

To provide evidence for the robustness of our results, we examine the interaction between DEBRA and Pillar Two under a common tax base, which is outlined in Chapter 3.1. Appendix 5, Fig. 15 Panel B shows that the simultaneous application of DEBRA and Pillar Two under a common tax base relative to the national

[32] For an overview of the average, median, and standard deviation of the sample countries' CoC and EATRs, see Appendix 5. Table 11.

Table 5 Impact of DEBRA, Pillar Two, and their interaction on the EU Member States' effective tax levels

	Status quo (1)	DEBRA (2)	Δ (2)-(1) (3)	Pillar Two (4)	Δ (4)-(1) (5)	Interaction (6)	Δ (6)-(1) (7)
Panel A: CoC							
BG	1.21%	0.94%	−0.27pp.	1.26%	0.05pp.	1.15%	−0.06pp.
CY	0.95%	1.01%	0.06pp.	1.18%	0.23pp.	1.24%	0.29pp.
IE	1.37%	1.01%	−0.36pp.	1.38%	0.01pp.	1.24%	−0.13pp.
MT	−1.13%	0.32%	1.45pp.	0.55%	1.68pp.	1.13%	2.26pp.
Panel B: EATRs							
BG	10.08%	8.85%	−1.23pp.	14.23%	4.15pp.	14.07%	3.99pp.
CY	14.49%	14.78%	0.29pp.	17.53%	3.04pp.	17.68%	3.19pp.
IE	15.42%	13.91%	−1.51pp.	17.01%	1.59pp.	16.80%	1.38pp.
MT	5.53%	6.86%	1.33pp.	14.43%	8.90pp.	14.71%	9.18pp.

The table displays the impact of DEBRA, Pillar Two, and their interaction on the CoC (Panel A) and on the EATR (Panel B) of the four countries where Pillar Two is applicable. Column (1) depicts the status quo. Columns (2), (4), and (6) show the impact of DEBRA, Pillar Two, and their interaction. Columns (3), (5), and (7) depict the difference between the CoC and EATR under DEBRA, Pillar Two, and their interaction relative to the status quo in percentage points. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. For all simulations, we employ the financing mix and asset weighting of our standardised investment project

tax bases leads to an increase in EATRs in 14 countries and a decrease in eleven countries. The increases range from 0.01 pp. in the Czech Republic to 0.86 pp. in Belgium, while the decreases lie between 0.02 pp. in Poland and 0.87 pp. in Malta. As a result, the average EATR increases slightly by 0.04 pp. We find similar results for the CoC, which are shown in Appendix 5, Fig. 15 Panel A. Overall, the impact of the common tax base on countries' CoC and EATRs is minor. It therefore seems unlikely that our findings on the impact of the interaction of DEBRA and Pillar Two on the effective tax levels of Member States are driven by country-specific tax base rules.

6 Conclusion

In this simulation study, we analyse the impact of DEBRA, Pillar Two, and their interaction on countries' effective tax levels. To measure the directives' impact, we apply the well-established Devereux/Griffith methodology and calculate the CoC and EATRs before and after the (potential) implementation of DEBRA and Pillar Two. Our analysis first illustrates the general mechanisms of the policy reforms that drive the changes in effective tax levels using a hypothetical country. We then assess the country-specific changes in effective tax levels and the extent to which they distort companies' investment decisions in the EU Member States. Moreover, we demonstrate that our results remain robust under a common tax base, applying BEFIT's harmonised rules for depreciation and inventory valuation. Based on our simulation results, we evaluate DEBRA and Pillar Two against their own objectives.

Our analysis of DEBRA reveals that in the hypothetical country, the CoC and EATRs decrease. Moreover, DEBRA reduces the debt-equity bias, providing a tax incentive for more equity financing. These effects result from the interaction of the IDL, which raises the tax burden on debt-financed investments, and the ACE, which lowers the tax burden on equity-financed investments. This overall trend is reflected in our country heterogeneity analysis. Under DEBRA, effective tax levels decrease in most EU Member States. The only exceptions are countries with more favourable ACE regimes under their national laws, where DEBRA leads to an increase in effective tax levels. In summary, the harmonisation of ACE regimes reduces the heterogeneity of national tax regimes with respect to notional interest deductions for corporations.

When examining Pillar Two in the hypothetical country, we find that the directive raises the EATR, but not up to 15%. This is due to the substance-based carve-out under which parts of the profits remain subject to the lower national tax level. In the country-specific analysis, we simulate Pillar Two only for the EU Member States with a combined profit tax rate below 15%, namely Bulgaria, Cyprus, Ireland, and Malta. Across all four countries, the EATRs increase due to Pillar Two, but not exactly up to 15%, as carved-out profits are subject to the national tax level. However, as the deviations from the 15% minimum effective tax level are small, Pillar Two mostly succeeds in setting a floor on international tax competition.

Finally, we find that the interaction between DEBRA and Pillar Two leads to higher effective tax levels in the hypothetical country. This is because the tax-reducing effect of DEBRA only applies to carved-out profits, while Pillar Two's top-up tax increases the tax burden on residual profits to 15%. Therefore, the effect of DEBRA is largely reversed by the application of Pillar Two and its ability to reduce the debt-equity bias is constrained. In the country-specific analysis, this interaction effect can be observed in the four countries where Pillar Two raises the effective tax levels. For the remaining countries, the interaction of both directives results in the sole application of DEBRA, leading to lower effective tax levels. Overall, the interaction of DEBRA and Pillar Two results in a reduced average EATR and a convergence of tax levels across the EU, creating a more level playing field in terms of corporate taxation between EU Member States.

While the empirical literature on this topic is still emerging, our study provides policy-relevant insights using forward-looking effective tax rates. When interpreting these findings, it is important to acknowledge that our simulation focuses on corporate taxation and therefore does not capture the full complexity of national tax systems. Furthermore, it does not account for tax planning responses of companies or tax-policy reactions of countries. Although this simplification may overlook certain dynamics, our analysis offers valuable initial insights into the impact of the policy reforms on the tax attractiveness of EU Member States and their success in achieving their own objectives. Overall, our findings highlight the importance for policymakers to evaluate both the individual and combined effects of policy measures within the broader context of the overall tax system.

Appendices

Appendix 1. EU Member States' selected economic and tax parameters

See Tables 6, 7.

Table 6 Allowances on equity in the EU Member States as of 2022

Country	Legislation since	Base of allowance on equity	Determination of notional interest rate	Notional interest rate of 2022	Deduction limitations and carryforwards
DEBRA	Forthcoming	Difference between equity at end of tax year and equity at end of previous tax year	Risk-free interest rate with maturity of ten years, as published by EIOPA plus 1% risk premium	1.205% (+0.5% for SMEs)[1]	30% of EBITDA, nine years carryforward
Belgium	2006	One fifth of positive difference between equity at end of taxable period and fifth preceding taxable period	Applicable rate is equal to the average of the benchmark indices (ten-year linear bonds) published monthly by the Pension Fund	0% (+0.5% for SMEs)	No limitation for taxable income below 1 million EUR, above deduction cannot exceed 70% of taxable income; no carryforward
Cyprus	2015	New equity, which has been brought into business on or after 31.12.2014, but which does not include amounts from capitalisation of pre-existing reserves	Ten-year government bond yield rate of the country where new equity is employed/ invested increased by 5 pp.	5.629%	Amount of deduction cannot exceed 80% of taxable income; no carryforward
Italy	2011	Increase in equity defined as equity contributions and retained earnings (except profits allocated to a non-disposable reserve) less reductions of the net equity, investments in controlled companies and certain intra-group business acquisitions and transactions after 31.12.2010	Rate determined by decree of Minister of the Economy and Finance on 31 January of each year, considering returns of public bonds, which can be increased by a further 3 pp.	1.3%	Deduction cannot exceed 90% of taxable income; unlimited carryforward
Malta	2018	Equity for accounting period ending in year preceding year of assessment less any equity directly employed in form of non-Maltese securities, interest in a partnership, contributions, and any other loans or debts	Risk free rate set by reference to yield to maturity on Malta Government Stocks with remaining term of approximately 20 years plus a premium of 5%	8.04%	Amount of deduction cannot exceed 90% of the taxable income; unlimited carryforward

Table 6 (continued)

Country	Legislation since	Base of allowance on equity	Determination of notional interest rate	Notional interest rate of 2022	Deduction limitations and carryforwards
Poland	2019	Equity as additional payments made to company in manner and on terms specified in separate regulations or profits transferred to company's reserve or supplementary capital	Reference rate of National Bank of Poland applicable on last working day of year preceding tax year, increased by 1 pp.	2.75%	Deductible amount capped at 250,000 PLN (55,000 EUR) and limited to three consecutive years; unlimited carryforward
Portugal	2008	Equity as amount of contributions made by cash payments or through conversion of shareholders' equity or loans, within scope of incorporation of a company or an increase in share capital	Fixed rate	7%	Deductible amount capped at 140,000 EUR; carryforward limited to five consecutive years

The table displays key elements of the allowances on equity implemented in the EU Member States as of 2022 and DEBRA for comparison. The information was obtained from Council of the European Union (2018), Deloitte (2022), European Commission (2022), Hohlwegler et al. (2023), PwC (2024), https://www.centralbankmalta.org/malta-government-stocks (03.08.2023), https://research.ibfd.org/#/ (03.08.2023), and https://nbp.pl/en/historic-interest-rates/ (03.08.2023)

[1]The notional interest rate of 1.205% is derived following Article 4 (2) DEBRA and is therefore the correct notional interest rate for 2022. In order to provide more relevant results given the current rising interest rates in the EU, our analysis is based on a notional interest rate of 4.092%, which is the correct notional interest rate for 2023

Table 7 EU Member States' risk-free interest rates

Currency (Country)	Ten-year currency-specific risk-free interest rate as of 31.12.2022
Euro	3.092%
Lev (BG)	3.042%
Kuna (HR)	4.151%
Koruna (CZ)	4.602%
Krone (DK)	3.082%
Forint (HU)	8.609%
Złoty (PL)	6.648%
Leu (RO)	8.556%
Krona (SE)	3.010%

The table displays the ten-year currency-specific risk-free interest rates published by EIOPA as of 31.12.2022. The information was obtained from https://www.eiopa.europa.eu/tools-and-data/risk-free-interest-rate-term-structures_en#risk-free-rates-previous-releases-and-preparatory-phase (03.08.2023).

Appendix 2. Impact of DEBRA and Pillar Two on the hypothetical country

See Tables 8, 9, Fig. 9.

Table 8 Impact of asset and financing mix on the effective tax levels under status quo and DEBRA

CoC EATR	Industrial buildings	Intangibles	Machinery	Financial assets	Inventory	Asset mix
Panel A: Status quo						
Equity	1.47%	1.47%	1.66%	1.93%	1.65%	1.64%
	22.37%	22.38%	23.13%	24.16%	23.08%	23.02%
Debt	0.61%	0.62%	0.81%	1.07%	0.79%	0.78%
	19.04%	19.05%	19.80%	20.82%	19.74%	19.69%
Financing mix	1.17%	1.17%	1.36%	1.63%	1.35%	1.34%
	21.20%	21.22%	21.96%	22.99%	21.91%	21.86%
Panel B: DEBRA						
Equity	0.34%	0.34%	0.53%	0.79%	0.52%	0.50%
	17.96%	17.97%	18.72%	19.74%	18.67%	18.61%
Debt	0.74%	0.74%	0.94%	1.20%	0.92%	0.91%
	19.54%	19.55%	20.30%	21.32%	20.24%	20.19%
Financing mix	0.48%	0.48%	0.67%	0.94%	0.66%	0.65%
	18.51%	18.52%	19.27%	20.30%	19.22%	19.16%
Panel C: Differences between status quo and DEBRA (Panel B-Panel A)						
Equity	− 1.13pp.	− 1.13pp.	− 1.13pp.	− 1.14pp.	− 1.13pp.	− 1.14pp.
	− 4.41pp.	− 4.41pp.	− 4.41pp.	− 4.42pp.	− 4.41pp.	− 4.41pp.
Debt	0.13pp.	0.12pp.	0.13pp.	0.13pp.	0.13pp.	0.13pp.
	0.50pp.	0.50pp.	0.50pp.	0.50pp.	0.50pp.	0.50pp.
Financing mix	− 0.69pp.	− 0.69pp.	− 0.69pp.	− 0.69pp.	− 0.69pp.	− 0.69pp.
	− 2.69pp.	− 2.70pp.	− 2.69pp.	− 2.69pp.	− 2.69pp.	− 2.70pp.

The table displays the asset-specific, financing-specific, and weighted CoC (upper number) and EATR (lower number) of a hypothetical country under the status quo (Panel A) and under the application of DEBRA (Panel B). Panel C shows the differences in the CoC and EATRs between the status quo and DEBRA in percentage points. The hypothetical country has a combined profit tax rate of 10%, no non-profit taxes, no national ACE or interest deduction limitation, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. The financing mix consists of 65% equity and 35% debt. The asset mix assumes an equal weighting (i.e. 20%) of the five assets

Table 9 Impact of Pillar Two on the CoC

	Status quo (1)	Pillar Two (2)	Δ (2)-(1) (3)
Industrial buildings	1.11%	1.11%	0.00pp.
Intangibles	1.11%	1.13%	0.02pp.
Machinery	1.19%	1.19%	0.00pp.
Financial assets	1.29%	1.42%	0.13pp.
Inventory	1.18%	1.25%	0.07pp.
Asset mix	1.18%	1.22%	0.04pp.

The table displays the asset-specific impact of Pillar Two on the CoC of a hypothetical country. Column (1) shows the CoC in the status quo, i.e. without any adjustments. Column (2) shows the effect of Pillar Two on the effective tax burden. Column (3) depicts the difference between the CoC under Pillar Two relative to the status quo in percentage points. The hypothetical country has a combined profit tax rate of 10%, no non-profit taxes, no national ACE or interest deduction limitation, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. We employ the financing mix of our standardised investment project. The asset mix assumes an equal weighting (i.e. 20%) of the five assets

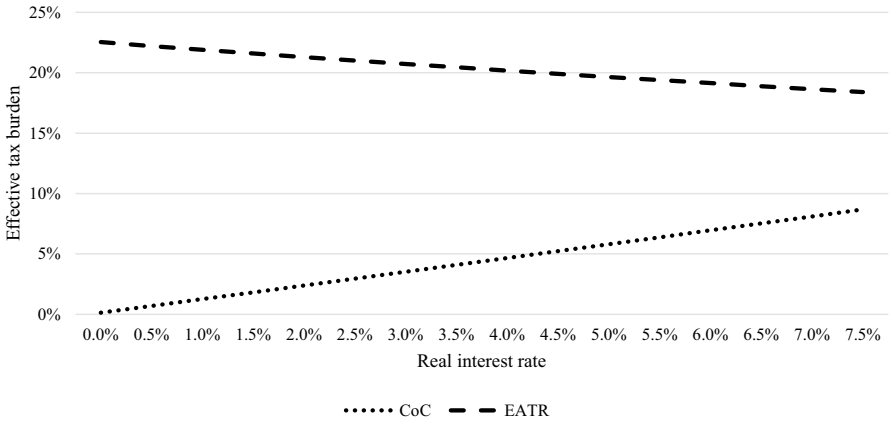


Fig. 9 Impact of the real interest rate on the effective tax levels. *Notes:* The figure shows the impact of the real interest rate on the CoC (dotted line) and EATR (dashed line) of a hypothetical country. The real interest rate ranges from 0 to 7.5%. The hypothetical country has a combined profit tax rate of 22%, no non-profit taxes, no national ACE or interest deduction limitation, and the depreciation rules follow the BEFIT rules outlined in Chapter 3.1. We employ the financing mix and asset weighting of our standardised investment project

Appendix 3. DEBRA country heterogeneity analysis

See Table 10, Figs. 10, 11, 12.

Table 10 Impact of IDL, ACE, and DEBRA on the EU Member States' effective tax levels

Country	Status quo		DEBRA		ACE only		IDL only	
	CoC	EATR	CoC	EATR	CoC	EATR	CoC	EATR
AT	1.42%	24.97%	0.60%	21.91%	0.55%	21.71%	1.47%	25.17%
BE	1.54%	25.43%	0.72%	22.36%	0.67%	22.16%	1.60%	25.63%
BG	1.21%	10.08%	0.94% [0.94%]	8.85% [8.87%]	0.92%	8.78%	1.22%	10.16%
HR	1.16%	17.39%	0.62% [0.47%]	15.19% [14.58%]	0.58%	15.04%	1.19%	17.53%
CY	0.95%	14.49%	1.01%	14.78%	0.97%	14.65%	0.99%	14.62%
CZ	1.31%	18.96%	0.74% [0.51%]	16.63% [15.72%]	0.70%	16.48%	1.35%	19.11%
DK	1.47%	22.39%	0.78% [0.78%]	19.69% [19.7%]	0.74%	19.51%	1.52%	22.56%
FI	1.69%	21.42%	1.08%	18.97%	1.04%	18.81%	1.73%	21.58%
FR	1.72%	27.25%	0.84%	24.01%	0.78%	23.80%	1.77%	27.46%
DE	1.59%	31.64%	0.46%	27.74%	0.39%	27.52%	1.66%	31.86%
GR	1.58%	22.80%	0.89%	20.11%	0.84%	19.93%	1.62%	22.98%
HU	1.54%	12.19%	1.23% [0.79%]	10.81% [8.86%]	1.21%	10.74%	1.55%	12.26%
IE	1.37%	15.42%	1.01%	13.91%	0.98%	13.79%	1.40%	15.54%
IT	1.23%	26.20%	0.56%	23.75%	0.51%	23.57%	1.29%	26.39%
LT	1.22%	14.82%	0.79%	12.99%	0.76%	12.87%	1.25%	14.94%
LU	1.33%	24.59%	0.52%	21.53%	0.47%	21.33%	1.39%	24.79%
MT	− 1.13%	5.53%	0.32%	6.86%	0.23%	6.45%	− 1.04%	5.94%
NL	1.41%	25.68%	0.56%	22.53%	0.50%	22.32%	1.47%	25.89%
PL	0.95%	17.51%	0.79% [0.26%]	16.85% [14.70%]	0.75%	16.70%	0.99%	17.66%
PT	− 0.47%	24.53%	0.45%	27.70%	0.38%	27.45%	− 0.40%	24.78%
RO	1.36%	16.36%	0.89% [0.23%]	14.40% [11.61%]	0.86%	14.27%	1.39%	16.49%
SK	1.36%	21.04%	0.71%	18.47%	0.67%	18.30%	1.41%	21.21%
SI	1.33%	19.02%	0.75%	16.69%	0.71%	16.54%	1.36%	19.17%
ES	2.01%	31.35%	0.58%	27.55%	0.52%	27.35%	2.07%	31.55%
SE	1.41%	20.85%	0.78% [0.79%]	18.33% [18.38%]	0.73%	18.16%	1.45%	21.02%

The table displays the EU Member States' CoC and EATRs under the status quo and under DEBRA using a notional interest rate of 4.092% and a limitation of interest deductibility to 85%. Moreover, the table provides the CoC and EATRs under separate application of DEBRA's ACE and IDL. In the national currency scenario, the notional interest rates are 3.042% (BG), 5.151% (HR), 5.602% (CZ), 4.082% (DK), 9.609% (HU), 7.648% (PL), 9.556% (RO), and 4.01% (SE). The results of the national currency scenario are given in square brackets in the DEBRA columns. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

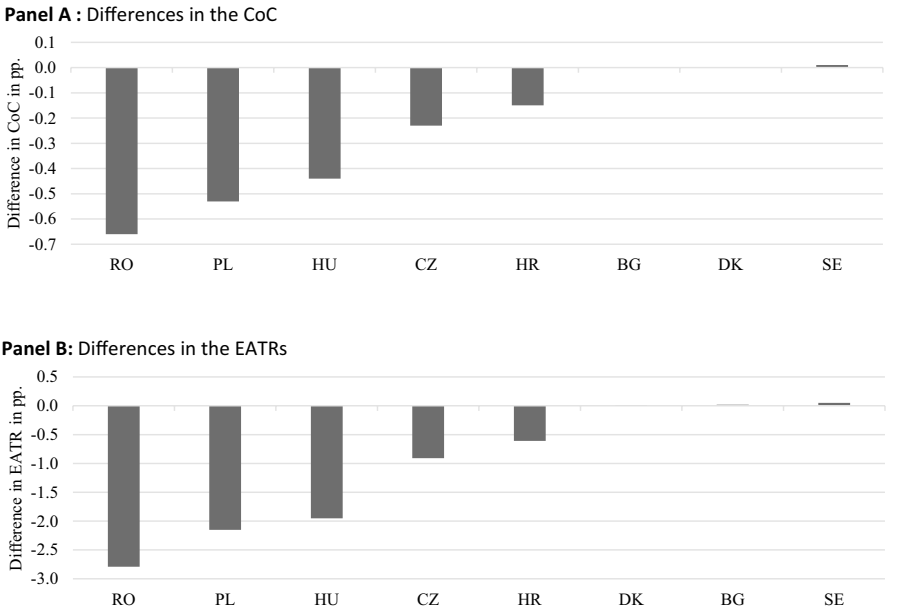


Fig. 10 Impact of country-specific notional interest rates on the EU Member States' effective tax levels under DEBRA. *Notes*: The figures show the impact of using country-specific notional interest rates instead of a standardised notional interest rate on the CoC and the EATRs of the eight EU Member States that did not use the euro as their currency as of 2022. Panel A depicts the difference in the EU Member States' CoC under DEBRA with country-specific notional interest rates compared to DEBRA with a standardised notional interest rate, while Panel B shows the same difference for the EATRs. The currency-specific notional interest rates amount to 3.042% (BG), 5.151% (HR), 5.602% (CZ), 4.082% (DK), 9.609% (HU), 7.648% (PL), 9.556% (RO), and 4.01% (SE). The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

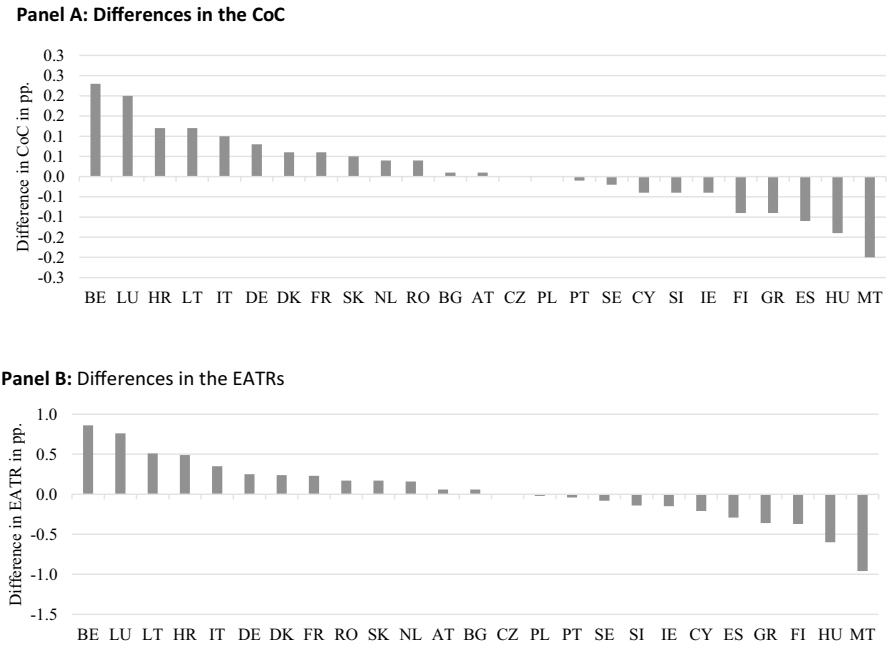
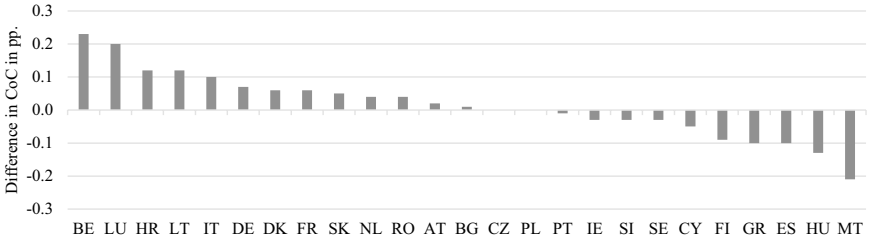


Fig. 11 Impact of a common tax base on the EU Member States' effective tax levels under the status quo. *Notes:* The figures show the impact of a common tax base on the EU Member States' CoC and EATRs. Panel A depicts the difference in the CoC under a common tax base compared to the status quo, while Panel B shows the same difference for the EATRs. Under the common tax base, straight-line depreciation of buildings (28 years), machinery (seven years), and intangibles (five years) is assumed. For inventories, the weighted average cost method is applied. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

Panel A: Differences in the CoC



Panel B: Differences in the EATRs

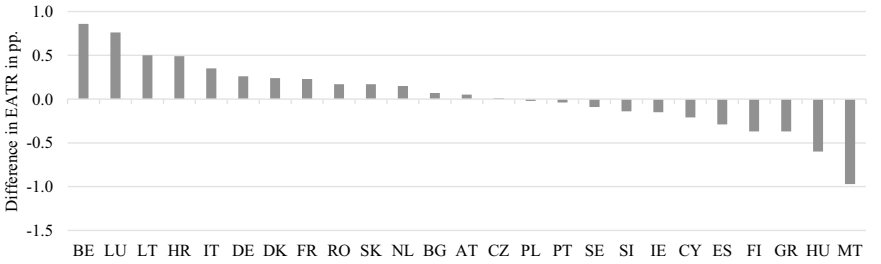


Fig. 12 Impact of a common tax base on the EU Member States' effective tax levels under DEBRA. *Notes*: The figures show the impact of a common tax base on the EU Member States' CoC and EATRs under DEBRA. Panel A depicts the difference in the CoC under DEBRA with a common tax base compared to the sole application of DEBRA, while Panel B shows the same difference for the EATRs. Under the common tax base, straight-line depreciation of buildings (28 years), machinery (seven years), and intangibles (five years) is assumed. For inventories, the weighted average cost method is applied. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

Appendix 4. Pillar Two country heterogeneity analysis

See Fig. 13, 14.

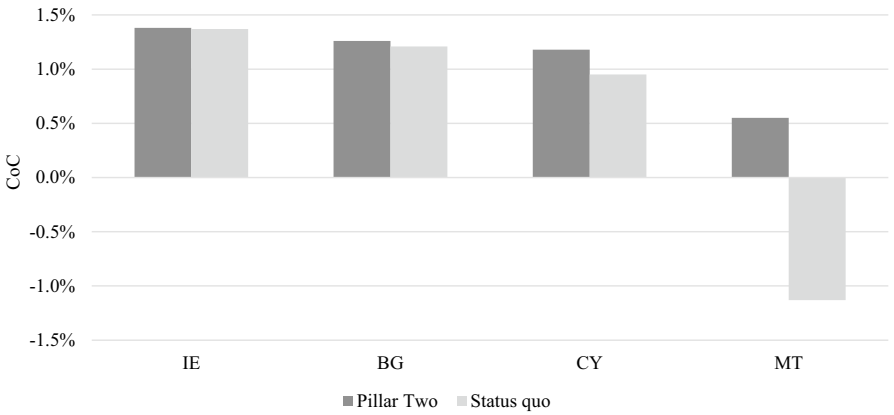


Fig. 13 EU Member States' CoC under the status quo and under Pillar Two. *Notes*: The figure shows the four EU Member States' CoC under the status quo (light grey bars) and under Pillar Two (dark grey bars). The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

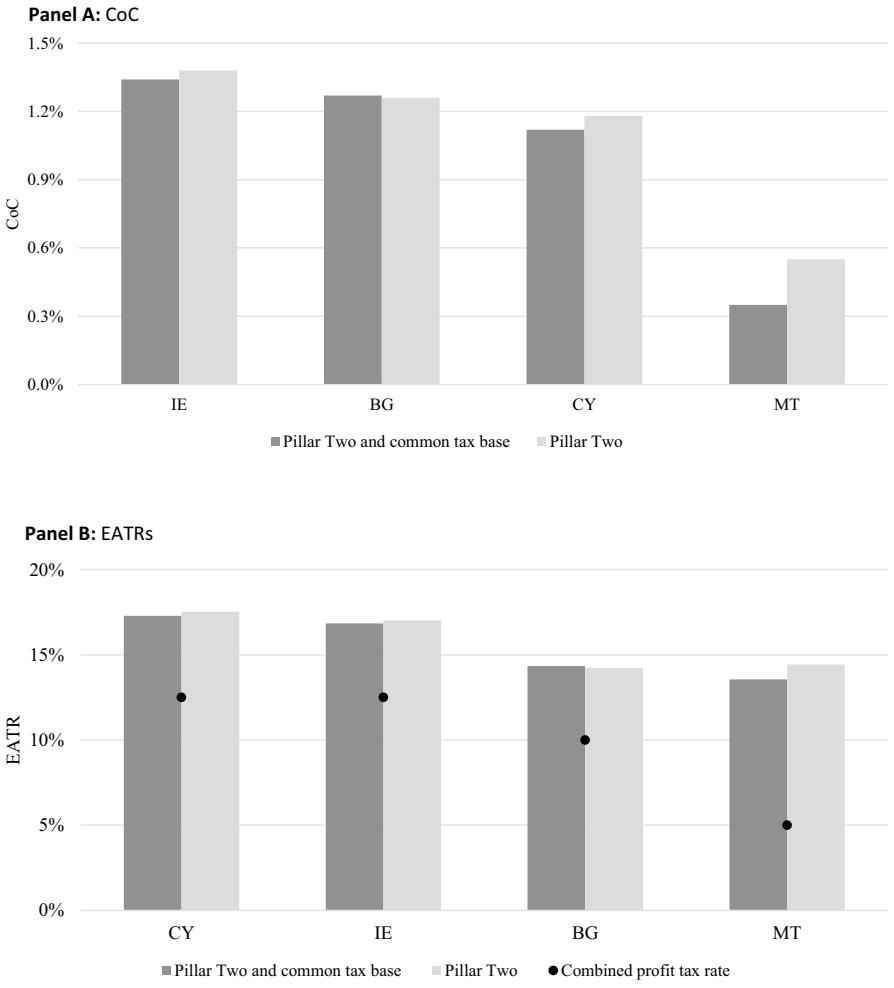


Fig. 14 Impact of a common tax base on the EU Member States' effective tax levels under Pillar Two. *Notes*: The figures show the EU Member States' CoC and EATRs under Pillar Two (light grey bars) and under Pillar Two with a common tax base (dark grey bars). Panel A depicts the CoC, while Panel B illustrates the EATRs. Under the common tax base, straight-line depreciation of buildings (28 years), machinery (seven years), and intangibles (five years) is assumed. For inventories, the weighted average cost method is applied. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

Appendix 5. Interaction country heterogeneity analysis

See Table 11, Fig. 15.

Table 11 Summary statistics of the EU Member States' effective tax levels

	Status quo	DEBRA	Pillar Two	Interaction
Panel A: Average				
EATR	20.48%	18.50%	21.18%	19.26%
CoC	1.22%	0.74%	1.30%	0.80%
Panel B: Median				
EATR	21.04%	18.47%	21.04%	18.47%
CoC	1.36%	0.75%	1.36%	0.78%
Panel C: Standard deviation				
EATR	6.23%	5.50%	5.14%	4.54%
CoC	1.22%	0.74%	1.30%	0.80%

The table displays the average (Panel A), median (Panel B), and standard deviation (Panel C) of all sample countries' CoC and EATRs under the status quo, DEBRA, Pillar Two, and the interaction of DEBRA and Pillar Two. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project

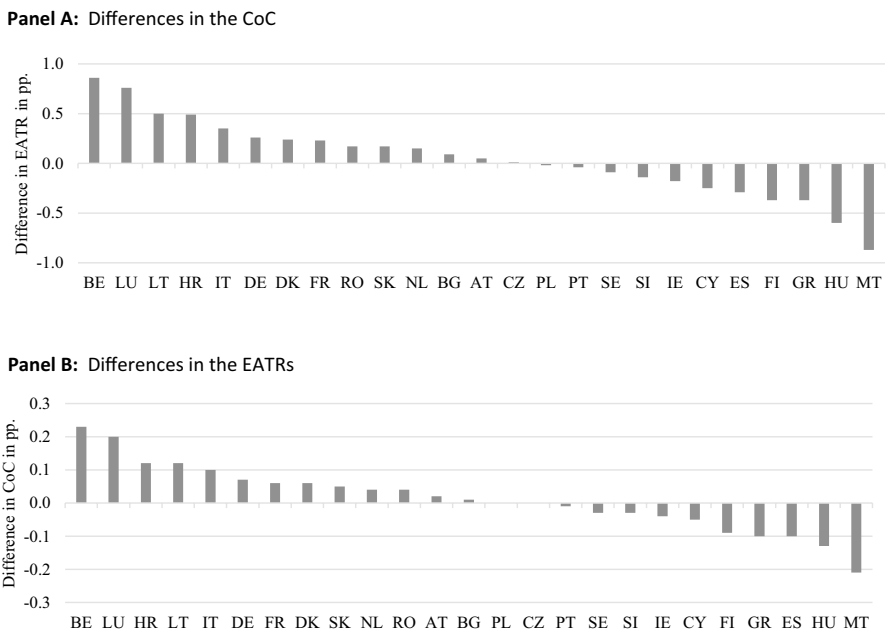


Fig. 15 Impact of a common tax base on the EU Member States' effective tax levels under the interaction of DEBRA and Pillar Two. *Notes*: The figures show the impact of a common tax base on the EU Member States' CoC and EATRs under the interaction of DEBRA and Pillar Two. Panel A depicts the difference in the CoC under the interaction of DEBRA and Pillar Two with a common tax base compared to the sole application of the interaction of DEBRA and Pillar Two, while Panel B shows the same difference for the EATRs. Under the common tax base, straight-line depreciation of buildings (28 years), machinery (seven years), and intangibles (five years) is assumed. For inventories, the weighted average cost method is applied. The underlying tax parameters for each country are based on the regulations for the 2022 tax year. We employ the financing mix and asset weighting of our standardised investment project.

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Data availability The data used in this study are available from Spengel et al. (2024) but restrictions apply to the availability of these data. Headline figures and certain input parameters are publicly available under https://www.zew.de/mannheim-tax-index. The full dataset, however, is only available from the authors upon reasonable request and with the permission of all authors of Spengel et al. (2024).

Declarations

Conflict of interest The authors declare no conflict of interest.

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