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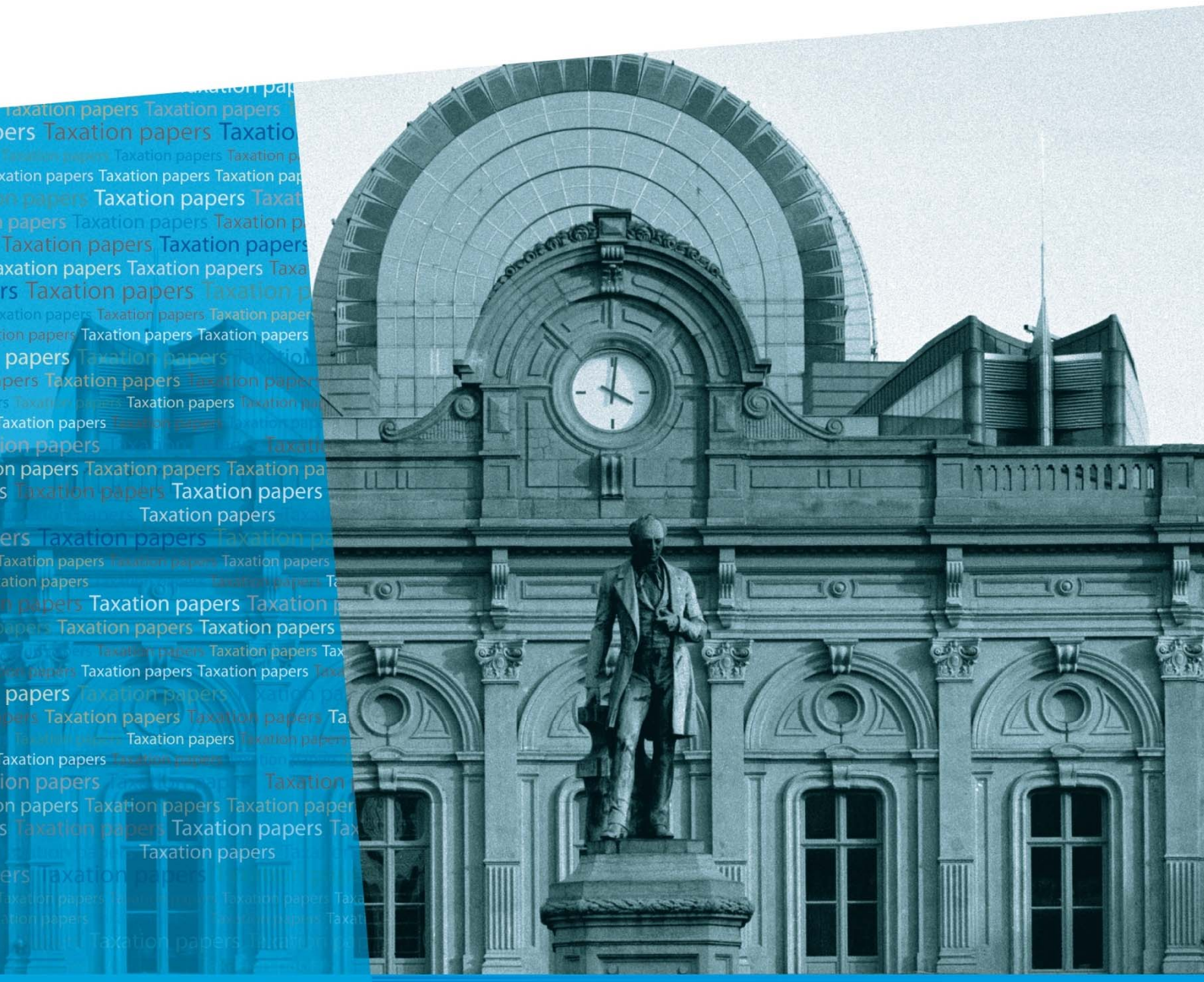

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Alternative Systems of Business Tax in Europe
An applied analysis of ACE and CBIT Reforms

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Abstract

This report explores the economic implications of an allowance for corporate equity (ACE), a comprehensive business income tax (CBIT) and a combination of the two in the EU. We illustrate the key trade-offs in designing ACE and CBIT in the presence of tax distortions at various decision margins of firms, such as its financial structure, investment, profit allocation and discrete location. Using an applied general equilibrium model for Europe, we quantitatively assess the effects of ACE, CBIT and combined reforms in EU countries. The results suggest that ACE is welfare improving as long as corporate tax rates are not used to cover the cost of base narrowing. CBIT typically reduces welfare by exacerbating marginal investment distortions. When governments adjust statutory corporate tax rates to balance their budget, however, CBIT reforms become more attractive while ACE reforms are welfare reducing in a number of countries. European coordination of reforms mitigates fiscal spillovers within the EU and renders ACE reforms more, and CBIT reforms less, attractive for welfare. A combination of ACE and CBIT reforms can be designed to be revenue neutral and welfare improving through smaller financial distortions.

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Executive summary

The comprehensive business income tax (CBIT) and the allowance for corporate equity (ACE) have recently gained interest in European policy debates as a way of restructuring corporate tax systems. Indeed, a number of countries have experimented or actually implemented reforms in the direction of an ACE. Others have put limitations to the deductibility of interest, which goes in the direction of CBIT. This report explores the economic implications of ACE and CBIT reforms in two different ways. First, we theoretically analyse ACE and CBIT in an open-economy framework capturing various behavioural responses. It sheds light on the key trade-offs in designing such reforms. Second, we adopt an applied general equilibrium model for Europe to quantitatively assess the effects of ACE and CBIT in EU countries. The model encompasses several decision margins of firms, such as marginal investment decisions, their financial structure and the choice of multinational companies with respect to foreign direct investment and international profit shifting.

The results suggest that ACE reforms in an individual country generally improve efficiency by removing the distortion between debt and equity finance and by reducing the cost of capital. As long as governments finance the ACE with higher taxes on labour or consumption or by lower transfers to households, welfare in Europe expands by between 0.4% and 0.8% of GDP. The ACE is particularly attractive in countries featuring high corporate tax rates and a broad tax base such as Germany, Italy and Spain. If ACE is accompanied by higher corporate tax rates to make up for the lost revenue, however, this erodes the corporate tax base through profit shifting and by adversely affecting the discrete location choice of multinationals. It illustrates the key trade-off for the ACE between a low tax on the normal return on capital and a low corporate tax rate on economic profit. If base erosion is strong, ACE tends to reduce welfare. This occurs in most Western European countries. Eastern European countries still benefit from ACE since they host a relatively small multinational sector. A joint European ACE is more likely to improve welfare since European cooperation eliminates fiscal spillovers within the EU, thus mitigating the erosion of the corporate tax base in response to higher corporate tax rates.

CBIT in an individual country yields a similar effect as ACE on the financial structure of companies. However, by disallowing a deduction for interest, it increases the cost of capital, thereby exacerbating investment distortions. When the extra revenues raised by CBIT are used for higher transfers or for reducing taxes on labour or consumption, welfare in the EU falls by between 0.3% and 1.2% of GDP. This holds most notably in countries with high corporate tax rates. If CBIT is combined with lower corporate tax rates, however, the corporate tax base expands through several channels, especially via inward profit shifting and by improving the location advantage for profitable investments. If these channels are strong, CBIT is found to raise welfare in a typical European country by around 0.8% of GDP. Countries featuring high corporate tax rates, such as Germany and France, and countries that are relatively sensitive to

profit shifting due to a large multinational sector, such as the Netherlands and the UK, gain most from a unilateral introduction of CBIT and lower corporate tax rates. Under a European CBIT, lower corporate tax rates exert smaller welfare gains since fiscal spillovers within Europe are mitigated. Still, CBIT tends to raise welfare as long as profit shifting *vis a vis* outside tax havens is sufficiently strong.

A revenue-neutral combination of ACE and CBIT reforms is able to improve efficiency by alleviating distortions in the debt-equity choice of companies. A higher cost of capital on debt-financed investment is now offset by a lower cost of capital on equity-financed investment. Aggregate investment slightly increases. Welfare is found to expand by 0.3% of GDP on account of a more efficient financial structure.

The results suggest that a policy of corporate tax base broadening and rate reduction is likely to continue if European countries will not cooperate. CBIT-like reforms fit into this direction. This is consistent with recent trends in corporate tax policy in the EU. If Europe succeeds in cooperation, it might be able to relax fiscal spillovers and thus allow countries to design more efficient corporate tax systems with higher statutory rates. An ACE might then become a more serious alternative.

1 Introduction

Corporate income tax systems in Europe follow general accounting principles by allowing a deduction of interest payments when determining taxable profits. Dividends paid to shareholders are not deductible. In economic terms, this creates a distortion in financial structures as both interest and the normal return on equity are a usual remuneration for the funds of financing a company's capital. The exemption of only interest from the corporate tax base therefore leads to excessive debt finance and discriminates against risky or volatile businesses that generally require low financial leverage.

To make corporation tax systems more neutral vis-à-vis the financing structure of companies, alternatives have been proposed. Among them are the comprehensive business income tax and the allowance for corporate equity. The comprehensive business income tax makes the corporation tax neutral towards the financing structure by *disallowing* the exemption of interest paid for corporate income tax purposes. The allowance for corporate equity system obtains the same result by granting equity holders an allowance equal to a notional risk-free return on equity (e.g. the market interest rate for long-term government bonds). Neither the comprehensive business income tax nor the allowance for corporate equity distorts the liability side of corporations. The difference is that the comprehensive business income tax has a wider tax base while the allowance for corporate equity features a narrower tax base than current corporate income tax systems. Hence, other things equal, the comprehensive business income tax allows for a lower statutory corporate income tax rate (or lower rates of other taxes) to generate the same amount of revenue while the allowance for corporate equity requires a higher statutory tax rate (or higher tax rates elsewhere).

Recently, the allowance for corporate equity and the comprehensive business income tax have received renewed interest from policy makers. For instance, Italy, Croatia and Austria experimented with allowance for corporate equity features in their corporate tax systems. Brazil and since 2006 Belgium have an allowance for corporate equity. At the same time, many European countries have introduced thin-capitalisation rules that limit interest cost deductibility. The Netherlands has introduced an interest box where both interest received and interest paid face a reduced rate of 5%. Such reforms go in the direction of a comprehensive business income tax.

This study assesses the merits of the allowance for corporate equity and comprehensive business income tax regimes, as well as a combination of the two systems in European countries. In principle, these systems should be analyzed in combination with personal taxation on income from capital. For instance, if interest and dividends are treated differently at the personal level, an allowance for corporate equity would not be fully neutral in a closed economy since domestic households – the ultimate owners of the firms – face different taxes on debt and equity. Personal taxes become less important in an open economy, however, as the

marginal provider of funds may not be subject to income tax. In this study, therefore, we ignore interactions with the personal taxation of capital income and focus entirely on the discrimination of taxes at the level of the firm.

The study starts in section 2 with an up-to-date theoretical overview of the properties of the allowance for corporate equity and the comprehensive business income tax systems. We provide a thorough discussion of the pros and cons of introducing them, either separately or as a combination. Section 3 discusses the CORTAX model and its calibration. The model is used to quantitatively assess the economic implications of allowance for corporate equity, the comprehensive business income tax and combinations between the two. Sections 4, 5 and 6 present our quantitative assessment of, respectively, the allowance for corporate equity, the comprehensive business income tax, and combined proposals using CORTAX. Section 7 demonstrates the sensitivity of our findings for a number of parameter choices. Finally, section 8 concludes.

2 Properties of ACE and CBIT

Most corporate tax systems in the world allow interest to be deductible as expenditure when calculating taxable profits. The normal return on equity is usually not deductible as a cost. Therefore, corporate tax systems discriminate against equity finance. It will cause higher debt shares by firms seeking the lowest cost of finance. This creates distortions in the risk profile of asset portfolios. Moreover, because young and innovative firms usually face more severe credit restrictions on credit markets, the tax favoured status of debt favours mature firms over start ups. Tax arbitrage also erodes the corporate tax base, all the more because firms today use hybrid capital structures where equity is classified as debt in the tax accounts, while in fact, it has many properties of equity. To avoid distortions and arbitrage, governments have introduced complicated anti-avoidance regulation and thin capitalization rules. A more straightforward alternative is to implement a more neutral treatment of debt and equity by means of an allowance for corporate equity (henceforth: ACE) or a comprehensive business income tax (henceforth: CBIT).

2.1 Financial distortions

How important is tax discrimination for a firms' financial policy? And what will be its welfare cost? The Modigliani-Miller theorem states that the debt-asset ratio will have no impact on the value of a corporation under certain conditions. Hence, tax-induced distortions might be immaterial. At the same time, Myers stated in his presidential address to the American Finance Association in 1984: "I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy". The two statements suggest that financial distortions are either unimportant or absent. More recent literature has challenged both the irrelevance theorem of Modigliani-Miller and the irrelevance of taxation for financial structure suggested by Myres.

First, there are several reasons why capital structure matters for efficiency. For instance, a high debt-asset ratio may increase the probability of bankruptcy and thus create a cost of financial distress. Moreover, asymmetric information between managers and shareholders create potentially high agency costs, which may be reduced if the firm increases its debt ratio. Indeed, debt may act as a disciplining device to managers and thus reduce the monitoring costs of shareholders. According to the pecking-order theory, a firms' financial policy has also a signalling effect in the presence of information asymmetry, namely about the value of the firm. Intuitively, equity issues might give a signal to the market that the firm is overvalued, thereby causing a decline in share values. To avoid such signals, firms find it attractive to finance investment by retained earnings, otherwise use debt, and only issue new shares as a final source of funds. Overall, financial theories thus suggest that several non-tax factors influence optimal

capital structures. Deviating from these structures due to tax discrimination may therefore cause adverse welfare implications (see e.g. Weichenrieder and Klautke, 2008).

Empirical studies since Myres' statement have reported several significant relationships between tax differentials and financial structures. For instance, a recent review of studies by Weichenrieder and Klautke (2008) concludes that 'from today's point of view, empirical studies reveal a measurable, abeit moderate effect on the capital structure' (p. 13). They suggest that an increase in the corporate tax rate by 10 percentage points will increase the debt-asset ratio by between 1.4 and 4.6 percentage points.

Both the welfare costs of financial distortions and empirical support for the impact of taxation on capital structure provide arguments for considering more neutral systems, i.e. the ACE and CBIT.

2.2 Allowance for corporate equity

The ACE system was originally proposed in 1991 by the Capital Taxes Committee of the Institute for Fiscal Studies (IFS, 1991, Devereux and Freeman, 1991). It was based on an earlier idea of Boadway and Bruce (1984), who suggested an allowance for corporate capital (ACC). Their idea was to abolish the deductibility of actual interest payments and to replace it by an allowance of the normal return, applied to the book value of all the firm's capital according to the tax accounts. The ACE is slightly different in that it maintains the current deductibility of actual interest payments. It adds to this a notional return on equity to be deductible against corporate profits. Since the tax advantage associated with the deduction for equity is certain, the appropriate notional return of the ACE is the risk-free nominal interest rate, e.g. the rate on government bonds (Bond and Devereux, 1995).

2.2.1 Properties of the ACE

The ACE is known to have several attractive features. First, it obtains neutrality between debt and equity finance. Thus the ACE makes thin capitalization rules redundant.

A second property of the ACE is that it is neutral with respect to marginal investment decisions. By allowing a deduction for both interest and the normal rate of return on equity, the ACE system leaves capital income untaxed. It thus reflects a tax on economic rents and no tax is charged on projects with a return that matches the cost of capital. Investment behaviour at the margin is therefore not affected.

A third property of the ACE is that it offsets investment distortions induced by differences between economic depreciation and depreciation for tax purposes. In particular, an increase in accelerated depreciation for tax purposes will reduce the book value of assets in the tax accounts, thereby also reducing the ACE in later years. This exactly offsets the benefits from earlier depreciation in present value terms. Indeed, the present value of the sum of the

depreciation allowance and the ACE allowance is independent of the rate at which firms write down their assets in the tax accounts.

While the ACE system is more neutral than current corporate tax systems to investment and to its financial structure, it has some potential drawbacks too. First, the narrower tax base implies a reduction in corporate tax revenue under an ACE as compared to current systems. It thus requires higher taxes elsewhere to balance the government budget. One obvious candidate to make up for the lost revenue is an increase in the corporate tax rate. The ACE would then shift the tax burden from the marginal return to capital towards economic rents. In a closed economy that features a perfect capital market, this renders the tax system non-distortionary. Indeed, higher corporate tax rates under an ACE leave investment unaffected. However, to the extent that economies are open, rents can be mobile. For instance, firm-specific rents associated with brand names or patents may well move across international borders. In that case, the shift from capital to rents will affect the location of production (Bond, 2000; Devereux and Griffith, 1998).

Profit taxes may also affect real investment decisions if firms face credit constraints. These constraints can arise from asymmetric information between creditors and investors on capital markets, e.g. about the risk of investment projects. Banks and investors usually have less information than firms about the chance that an investment project will yield a sufficiently high rate of return and will be reluctant to provide credit. This applies in particular to new and innovative firms who do not yet have a reputation. If such firms cannot obtain credit from banks or investors, they rely on retained earnings as a source of finance for new investments. A lower corporate income tax rate will increase the cash-flow and improve the liquidity position of firms. It allows them to finance more investments from retained earnings. Empirical evidence provides support for the impact of net internal funds on investments (see Hubbard, 1997, for an overview), suggesting that corporate taxes not only affect investment at the margin, but also inframarginal investment due to capital-market imperfections.

The ACE may also be unattractive in light of international profit shifting. Multinational firms have a variety of options to shift profits across their affiliates through tax planning activities. The incentives for international profit shifting are determined by differences in statutory tax rates. If an ACE is financed by an increase in these statutory tax rates, the government may lose revenue due to profit shifting towards other countries. Note that the ACE is not necessarily financed by an increase in the corporate tax rate. In particular, the ACE moves the tax system towards a consumption-based tax. A further increase in the tax on consumption may therefore be a natural candidate as well to cover the revenue cost of the ACE. The economic effects of an ACE may be markedly different under such an alternative way of balancing the government budget.

Tax planning via intracompany loans might change as well. Since debt and equity are treated similarly under an ACE, multinationals no longer have an incentive to adjust their

intracompany debt-equity structures if all countries would adopt such a system. However, if only one country adopts an ACE, multinationals may find it attractive to locate their equity in that location since returns will be at least partly untaxed. As long as dividend repatriations will be exempt in the parent country, it renders it particularly attractive for multinationals to channel equity to the ACE country and reduce its tax liability.

The short-run budgetary cost of an ACE system can be large if the notional interest deduction is applied to both new and existing capital. For existing capital, the allowance is simply a windfall gain. To limit this cost, the government may apply the ACE only to new investment. Still, in the long-term all capital will benefit from the ACE, so this is mainly an issue of transition. Table 2.1 summarises the main properties of an ACE system.

Table 2.1 Expected impact of ACE on decision margins

Effects of ACE on distortions in	
- Capital structure	Neutralised
- Marginal investments	Neutralised
- Fiscal depreciation	Neutralised
- Tax planning via intragroup financial structure	Increased equity finance in ACE country
Effects of corporate tax rate increase on	
- Investment by credit constrained firms	Reduced investment
- Discrete location of profitable investment	Reduced investment
- Tax planning via transfer pricing	Outflow of profits

2.2.2 Experience with ACE systems

There are a number of experiences with ACE-type reforms in various countries, although each of these experiences had its own special properties. The ACE experiences refer to Austria, Croatia, Italy, Brazil and recently Belgium (see Klemm, 2007 for an overview). We discuss these regimes and economic assessments thereof briefly.

Italy

Between 1997 and 2003, Italy applied what they called a dual income tax (DIT) system, a restricted version of the ACE. In particular, a reduced corporate income tax rate (19% instead of 37%) was applied to notional interest for post-reform equity stocks. Hence, the notional return on capital already installed was not subject to the reduced rate, which clearly mitigated the short-term budgetary cost of the Italian DIT (which would have been a windfall gain for equity). The notional rate started off at 7% and was applied to the book value of new equity. In 2000 and 2001, the book value was raised to 120% and 140% of the new equity stock, respectively, in order to converge more quickly to a system where the entire capital stock is counted. In 2002, it was cut back again to 100%. Until 2001, Italy applied a minimal average tax burden of 27%, i.e. an average of the reduced and the high rate. In 2001, the notional rate

was reduced from 7 to 6%. In 2004, Italy abolished the DIT and reduced its statutory corporate tax rate from 37 to 34%.

At the time that the central Italian government introduced a system with clear features of an ACE, local governments in Italy introduced a source-based value added tax. These taxes are similar to a CBIT where interest is not deductible, although also wages are taxed at source. The considerable amount of changes in the Italian and the offsetting tax reforms of local governments make it difficult to identify its economic implications.

Bordignon et al. (1999) simulate the implications of the Italian reforms and find that it indeed reduces the cost of capital in most cases. Moreover, computations of effective tax rates by Bordignon et al. (2001) confirm that the reforms reduced the discriminatory impact of taxes on financial structures. Staderini (2001) empirically explores the financial structures of Italian firms during the DIT period using panel data. His evidence supports of the expected effect on debt-asset ratios. Oropallo (2005) explores whether during the Italian DIT the probability of firms issuing equity increased. He finds support for this hypothesis for large and profitable firms as compared to small and less profitable firms.

Croatia

In Croatia, a notional return on equity has been deductible for the corporate income tax between 1994 and 2000. The notional rate of 5 percent plus inflation was applied to the book value of equity. In 2001, Croatia abolished the ACE system when it reduced the corporate tax rate from 35% to 20%. The Croatian ACE comes close to the textbook version. A comprehensive empirical evaluation of its effects is problematic, however, due to a lack of data. Keen and King (2002) attempt to make a crude assessment by comparing Croatian developments with those in other transition countries in Central and Eastern Europe. They conclude that the Croatian ACE seems to have worked out well: corporate tax revenues in terms of GDP appeared to be similar to those in other transition countries while foreign direct investment in Croatia was relatively high.

Austria

Between 2000 and 2004, Austria applied a reduced corporate tax rate of 25% (instead of the usual 34%) on the notional return on equity. This return was determined by the book value of post-reform equity stocks, multiplied by the average return on government bonds plus 0.8%. The system came to an end in 2005 when Austria reduced its corporate tax rate for all profits. We are not aware of studies attempting to assess the implications of the Austrian reform.

Brazil

Since 1996 Brazil applies an ACE type system to distributed profits. A so-called remuneration of equity can be paid as interest and is deductible for the corporate income tax (but subject to the usual 15% withholding tax on interest). The remuneration applies to the book value of equity and the rate is equal to that on long-term loans. As the Brazilian ACE only applies to distributed returns and not to retained profits, the effects can be different from a full ACE. Klemm (2007) empirically assesses its implications of the Brazilian ACE and finds that it reduced debt shares, although not much. Dividend payouts increased, which is expected as dividends become more favourably taxed. Klemm's study is unable to identify clear positive effects on investment, but the results suggest that such effects cannot be ruled out either.

Belgium

Belgium introduced an ACE in 2006 (see e.g. Gerard, 2006ab). A notional return at the average monthly government bond rate (capped at 6.5 percent and 0.5% higher for small and medium-sized firms) applying to the book value of equity is deductible from the corporate income tax base. Using a microsimulation model for Belgium, OECD (2007) estimates the budgetary impact of the Belgian ACE at around 10% of the initial corporate tax yield. It is too early to draw conclusions about the economic implications of the Belgian ACE.

Overall, the empirical studies on the ACE do not give us clear-cut evidence on its economic implications, either because of lack of data or because the ACE was part of a multiple reform package, which renders it difficult to identify the impact of the ACE. So, we cannot infer from the introduction of ACE-type systems any effects on investment, debt ratios or the economy at large. Yet, a potentially important lesson from the experiences is that ACE-type reforms have not encountered major difficulties in their implementation, nor did they create outflows of foreign capital (Klemm, 2007).

2.2.3 Lessons from simulation studies

A number of simulation models have been used to numerically assess the economic consequences of the ACE. We summarize these outcomes in Table 2.2.

First, Keuschnigg and Dietz (2007) use a dynamic computable general equilibrium model to assess the ACE as part of a broader reform package in the taxation of capital income in Switzerland. They derive household decisions from an overlapping generations framework with endogenous labour supply and an endogenous portfolio composition of savings. At the firm side, the model distinguishes between domestically owned corporate and non-corporate firms, as well as domestic subsidiaries of home and foreign based multinational firms. Firms endogenously determine their debt share, dividend payout and investment behaviour. In the simulations, Keuschnigg and Dietz finance the ACE-part by an increase in the value-added tax

by 1.5%-points. The first column in Table 2.2 shows their outcomes. It reveals that the reform reduces the cost of capital for Swiss firms by 1.5%. This raises investment so that the capital stock rises by 7.8%. This comes along with a rise in employment and GDP. The more neutral treatment of debt and equity causes a decline in the debt/asset ratio by 3.8%-points. Welfare in their analysis is probably best reflected in the rise in private consumption by 1.4%.

Radulescu and Stimmelmayr (2007) use a computable general equilibrium model for Germany called IfoMod to perform a similar experiment as Keuschnigg and Dietz. The model describes two countries and is based on an infinitely lived agent who works in either of two sectors: a corporate or non-corporate sector. The model describes investment behaviour and financial behaviour of these firms. In the simulations, the ACE is financed by a higher value-added tax rate to balance the budget. The authors find that the ACE is rather costly and requires a 5.1%-point increase in the value-added tax rate to balance the budget for the government. The cost of capital falls by 6.3%, which causes an increase in investment by more than 20%. GDP expands by more than 9% in the long run. Somewhat remarkably, welfare rises by only 0.08%.

Fehr and Wiegard (1999) use a dynamic Auerbach-Kotlikoff overlapping generations model to assess the replacement of the German trade tax – a local tax on business income – by an equal revenue ACE. The model describes firm investment behaviour, where adjustment costs imply that the economy only moves gradually towards a new steady-state equilibrium. Short-run effects can be markedly different from the long-run effects. Fehr and Wiegard find that the ACE would raise the capital stock in Germany by more than 10% in the long run. It would cause an increase in GDP by 2.6%.

Table 2.2 Simulation outcomes from previous country studies on the ACE

		Keuschnigg & Dietz (2007)[a]	Radulescu & Stimmelmayr (2007)[b]	Fehr & Wiegard (1999)[c]
Country		Switzerland	Germany	Germany
Corporate tax rate	Level	23.2	38.3	n.a.
Value-added tax rate	Δ	1.5	5.1	n.a.
Cost of capital	Δ	– 1.5	n.a.	n.a.
	%Δ	n.a.	– 6.3	n.a.
Debt ratio	Δ	– 3.8	n.a.	n.a.
Employment	%Δ	0.4	1.7	– 0.1
Capital stock	%Δ	7.8	20.5	10.1
GDP	%Δ	2.6	9.1	2.6
Private consumption	%Δ	1.4	4.6	1.0
Welfare (in % GDP)	Δ	n.a.	0.08	0.07

[a] We take the results from table 3 of their study, in particular, the difference between the fourth and third column.

[b] We take the results from the first column of tables 3 and 4 of their study.

[c] We take the long-term results from Table 4 of their study.

2.3 Comprehensive business income tax

The CBIT seeks to eliminate the favourable fiscal discrimination of debt financed investment by disallowing a deduction for interest payments. The CBIT has been proposed by the US Treasury (1992). The precise design of CBIT requires careful consideration. In the US treasury proposal for a CBIT, a distinction is made between so-called CBIT entities and non-CBIT entities. Most firms will be CBIT entities (only small firms will not) who are disallowed interest deductibility. The same applies to financial companies, including banks. To avoid double taxation of interest, the interest received by firms or banks from other CBIT entities should be exempt or credited. The interest that firms or banks receive from non-CBIT entities, however, will be subject to tax. It includes interest from households or government bonds. Interest received from abroad will be subject to tax, although an exemption or credit can be applied if this interest comes from a CBIT entity, e.g. if other countries also introduce a CBIT.

2.3.1 Properties of CBIT

CBIT transforms the corporate income tax into a broad-based tax on capital at the level of the firm. As all capital income will thus be taxed at source. In the US treasury proposal, CBIT is accompanied by an abolition of personal taxes on capital. Thus, it avoids double taxation of some sorts of capital income – such as dividends – and broadens the base to currently exempt types of capital income – such as that earned by institutional investors.

A disadvantage of the CBIT is that it raises the cost of capital on debt-financed investments. Fewer investment projects will be profitable at the margin so that investment declines. This effect is opposite to the ACE. Yet, the broadening of the base under CBIT will raise corporate tax revenue. If the overall tax revenue is to be maintained, it allows for a lower corporate tax rate. This reduces the cost of capital on equity financed investments and may attract mobile economic rents or paper profits of multinationals.[3] This is opposite from the ACE: CBIT shifts the tax burden away from rents towards the marginal investment return. If mobile rents, credit constraints and multinational profit shifting are important relative to marginal investment decisions, then the CBIT might be attractive.

Sorensen (2007) notes that, on balance, the effect is ambiguous: the cost of capital on low-yielding investments financed by debt will probably rise, leading to lower investments. But highly profitable investments financed by equity will be taxed lighter so that these investments will expand. According to Bond (2000), the benefits from lower tax rates under CBIT are likely to outweigh the costs induced by a higher cost of capital.

[3] Note that the revenue effects of the CBIT depend on what happens to personal taxes. If these are abolished, the combined reform of CBIT and personal tax relief may not raise much extra revenue. However, the CBIT most likely requires a low corporate tax rate to prevent bankruptcies associated with the transition phase (Sorensen, 2007). It therefore probably will yield less revenue.

CBIT may also affect intracompany financial policies. If all countries adopt a CBIT system, multinationals no longer have an opportunity to shift profits by adjusting their intrafirm capital structure. However, if only one single country adopts a CBIT, firms will find it attractive to no longer finance investment in that country by debt. Table 2.3 summarises the main properties of CBIT.

Table 2.3 Expected impact of CBIT on decision margins

Effects of CBIT on distortions in	
- Capital structure	Neutralised
- Marginal investments	Exacerbated
- Tax planning via intragroup financial structure	Reduced debt finance in CBIT country
Effects of corporate tax rate reduction on	
- Investment by credit constrained firms	Increased investment
- Discrete location of profitable investment	Increased investment
- Tax planning via transfer pricing	Reduced outflow – increased inflow of profits

2.3.2 Experience with CBIT-type reforms

There are no real-world experiments of actual CBIT regimes. Yet, countries do have imposed reforms that limit the deductibility of interest in some way, usually through thin-capitalisation rules.

Thin capitalisation rules

These rules imply that the interest deduction of a company is not deductible from profits if the debt-to-equity ratio exceeds a certain threshold. In the US, for instance, interest paid by affiliates of non-US owned parents is limited if the debt-to-equity ratio is higher than 1½. Today, many countries in Europe adopt thin-capitalisation. Buettner et al. (2008) report that in 2005 approximately 60% of the European countries had thin-capitalisation in place, which is a doubling over the last decade. Between 1996 and 2005, 19 cases are reported where governments have tightened existing limitations. Buettner et al. (2008) find that (more stringent) thin-capitalisation rules are effective in reducing debt-to-equity ratios. Yet, these rules also tend to reduce the level of investment.

Germany introduced thin-capitalisation rules in 1994, tightened them in 2001 and 2004 and replaced it by an earnings-stripping rule in 2008. The latter regime disallows interest deductibility above 30% of earnings before interest, tax and depreciation. Weichenrieder and Wnidischbauer (2008) analyse the impact of the 2001 reform in Germany and find significant effects on the financial structure of corporations. They report a negligible impact on investment.

Dutch interest box

The Netherlands since 1997 had a special regime for the treatment of holding companies. In particular, 80% of the income received by Dutch holdings (including interest income), could be labelled as 'provisions'. These provisions were not taxed. Hence, only 20% of the income received was subject to Dutch corporate income tax. The Dutch regime for holdings was put on the list of harmful tax practices and will now be phased out in 2010. With the fundamental tax reform of 2007, the Dutch government proposed a new regime for the treatment of interest, the so-called interest box. It offers an option for Dutch multinationals to choose among two regimes regarding the tax treatment of interest. Under the ordinary regime, both interest received and interest paid is taxed/deducted at the general Dutch corporate tax rate of 25.5%. Under the optional interest box, both interest received and interest paid is taxed/deducted at a rate of 5%. The regime is not yet implemented as the Dutch government awaits the European Court decision about its consistency with EU law.

The Dutch interest box contains features of a CBIT regime, although interest paid is still deductible at a rate of 5%. Three Dutch fiscal scientists have recently proposed to move further in the direction of a CBIT in the Netherlands. They suggest to abolish the distinction between debt and equity for intragroup transactions altogether by disallowing the deductibility of interest and leaving interest received untaxed in the Netherlands (Engelen et al., 2008). It is reminiscent to a CBIT for intragroup transactions.

While thin-capitalisation rules or the Dutch interest regime are not the same as a CBIT, they have some commonalities. Indeed, thin-capitalisation rules have in common with CBIT that interest deductibility is restricted; the Dutch regime has in common that interest is deductible at a lower rate. Hence, these developments can be characterised as movements in the direction of CBIT.

2.3.3 Lessons from simulation studies

The economic effects of a CBIT in Germany have been analyzed with the Infomod model by Radulescu and Stimmelmayr (2007). Table 2.4 summarizes their findings. The revenue from base broadening is used to cut the value-added tax rate by 4.3% points. We see that the model predicts an increase in the cost of capital by almost 10%, which causes a similar reduction in investment. GDP falls by more than 5%, inducing welfare to drop by 0.7% of GDP.

Table 2.4	Simulation outcomes on the CBIT in Germany by Radulescu & Stimmelmayr (2007)[b]	
Corporate tax rate	Level	38.3
Value-added tax rate	Δ	– 4.3
Cost of capital	%Δ	9.7
Employment	%Δ	– 1.4
Capital stock	%Δ	– 10.2
GDP	%Δ	– 5.3
Private consumption	%Δ	– 4.7
Welfare (in % GDP)	Δ	– 0.7

[b] We take the results from the third column of tables 3 and 4 of their study.

2.4 ACE&CBIT combinations

In principle, reforms in the direction of ACE and CBIT can be combined. For instance, the experiments in Italy and Austria involve a reduced corporate tax rate on the normal return to equity but no full allowance. Thus, these systems can be characterized as partial ACE systems. Similarly, reforms that impose limitations to the deductibility of interest, such as thin capitalisation rules or income stripping regulations, can be characterized as partial CBIT reforms. Also the Dutch interest box can be characterized as a CBIT-type reform, applying to intragroup transactions.

A combined reform of a partial ACE and a partial CBIT mitigates the discrimination between debt and equity from both directions. At the same time, the implications for corporate tax revenue are offsetting. Therefore, one can design a reform package of a partial ACE and partial CBIT that is revenue neutral for the government and which is still more neutral with respect to the financial structure of companies. In the simulations of this study, we will analyse such combined ACE&CBIT reforms.

Determining an optimal combination of ACE and CBIT is a difficult task. Optimality as obtained from welfare maximisation may require not only that financial distortions are minimised, but also that other distortions of the corporate income tax are reduced, including investment distortions, location distortions and tax arbitrage due to profit shifting. The size of these distortions typically differs among countries. Thus there will be different optimality rules across countries. Moreover, these distortions depend on whether countries design their systems unilaterally or multilaterally.

Economic analysis of optimality conditions might well show that some countries will find it optimal to shift the tax burden away from corporations towards other tax bases. For instance, an ACE may be introduced and financed by an increase in consumption or labour taxes. Alternatively, countries may cut their corporate tax rates and cut back transfers, thereby improving efficiency. Whether such policies are indeed socially desirable depends, however, not only on efficiency, but also equity issues. A proper analysis of optimality therefore requires

a sufficiently rich framework which can assess key trade-offs between equity, efficiency and administrative feasibility. It should also incorporate the fundamental reasons why countries adopt corporate income taxes in the first place, which is often believed to be the backstop for the personal income tax, i.e. to prevent individuals from starting a small incorporated business in order to avoid paying tax. Such considerations are beyond the scope of our modelling framework. In fact, the CORTAX model discussed in the next section is designed to gain insight in the efficiency effects of budgetary neutral tax reform proposals, not for a fully-fledged optimal tax analysis. Therefore, our conclusions will be silent on the optimality of ACE and CBIT reforms, but still provide insight into its economic effects.

3 The CORTAX model

CORTAX is an applied general equilibrium model that describes the 27 countries of the European Union, plus the US and Japan. It is designed to simulate the economic implications of unilateral and multilateral corporate tax policies. The model is heavily inspired by the OECDTAX-model of Sørensen (2001; 2004ab; 2006). An earlier version of CORTAX was used for European tax policy analysis in Bettendorf et al. (2006, 2007) and Van der Horst et al. (2007). A detailed description of the structure and parameterisation of the model can be found in Bettendorf and van der Horst (2008).

This section starts with a demonstration of the general structure of CORTAX in a non-technical manner in subsection 3.1. Appendix A elaborates in more detail on the model of the firm to show how ACE and CBIT reforms will affect firm behaviour. Subsection 3.2 discusses the calibration of corporate tax systems while subsection 3.3 focuses on the key elasticities used in the model. Subsection 3.4 contains a discussion on methodology, sensitivity analysis and a guide how to the read CORTAX outcomes.

3.1 General overview of CORTAX

CORTAX describes the economies of 27 European countries, the US and Japan. The structure of each country is the same. Countries are linked to each other via trade in goods markets, international capital markets and multinational firms. Below, we discuss the model structure of each country and the international linkages.

3.1.1 Households

Following the overlapping generations model of Diamond, households are assumed to live for two periods. One may interpret one period to cover 40 years. We express all variables in annual terms to facilitate the interpretation of the outcomes in terms of national accounts data. Behaviour within each 40-year period is assumed to be constant.

Households make their decisions regarding work, consumption and saving by maximizing a life-time utility function subject to an intertemporal budget constraint. When young (i.e. the first period), households choose to allocate their time between leisure and work. When old (i.e. the second period) household do not work but only consume. Young households receive after-tax wage income and lump-sum transfers. This income at a young age is allocated over consumption and savings. Savings are invested in a mix of bonds and stocks, which are assumed to be imperfect substitutes and which yield different rates of return. In the second period, households are retired. Consumption at old age is financed by the assets saved from the first period plus an after-tax rate of return and by lump-sum transfers. Moreover, the older

generation is assumed to own the fixed factor used by firms. Therefore, the old receive the economic rents.

Household optimization yields expressions for labour supply, savings and the optimal asset portfolio. Asset returns are determined on world markets and we do not explore residence-based taxes on capital in this document. Therefore, saving distortions are not affected by the policies explored here. The most important distortions in household behaviour are related to the consumption/leisure choice. Labour supply behaviour in CORTAX is governed by the usual income and substitution effects. In particular, a higher income tends to raise the demand for leisure and thus reduces labour supply. A higher wage rate for a given level of income raises the price of leisure and thus tends to cause substitution from leisure into consumption. This increases labour supply. Most empirical studies suggest that substitution effects dominate income effects so that the uncompensated elasticity of labour supply is positive.

3.1.2 Firms

We briefly discuss the behaviour of the firm. A more detailed analysis is given in appendix A. CORTAX distinguishes between two types of firms: domestic firms and multinationals. One representative domestic firm and one representative multinational headquarter is located in each country. The multinational owns a subsidiary in each foreign country. With 29 countries in CORTAX, we thus have 30 different firms operating in each country, namely the representative domestic firm, the representative headquarter and 28 subsidiaries that are owned by the headquarters in the other countries.

Each firm is assumed to maximise its value subject to the accumulation constraints and a production function. Thereby, the multinational considers the sum of the values of its headquarter and all subsidiaries. The production function features three primary factors: labour, capital and a location-specific fixed factor (e.g. land). Labour is immobile across borders and wages are determined on national labour markets. Capital is assumed to be perfectly mobile internationally so that the return to capital (after source taxes) is given for each country on the world capital market. The location-specific fixed factor is supplied inelastically. Its income reflects an economic rent. Rents earned by subsidiaries accrue to the headquarter in the parent country, which is assumed to wholly own the subsidiary. The headquarters are assumed to be wholly owned by domestic households. It implies that countries can partly export the tax burden to households abroad.

In calibrating the model of the firm, capital and labour parameters are determined by national accounts data on labour- and capital income shares. The fixed factor is – somewhat arbitrarily – set at 2.5% of value-added in each country. This value ensures that CORTAX yields a reasonable value for the corporate tax-to-GDP ratio.

The initial size of subsidiaries in CORTAX is determined by data on bilateral foreign direct investment (FDI) stocks. In particular, these stocks determine the size of the fixed factor in each

subsidiary. Given the fixed factor, multinationals decide on how much capital and labour to employ in each of their foreign subsidiaries. Hence, if corporate tax changes in a certain location raise the cost of capital, this will reduce the amount of capital the multinational is willing to invest in that location. Thus, inward FDI in that location drops. The FDI response in the basic version of CORTAX is thus governed by the EMTR (see below for an extension to this approach with inframarginal firm mobility).

Firms finance their investment by issuing bonds and by retaining earnings (issuing new shares is excluded in CORTAX). The optimal financial structure depends on the difference between the after-tax cost of debt and equity. A corner solution is ruled out by including a financial distress cost associated with high debt positions. The marginal cost of debt finance increases in the debt share.

One important difference between production in a domestic firm and production in a multinational firm is that foreign subsidiaries need intermediate inputs in producing output. These intermediate inputs are supplied by the parent company. As there is only one homogeneous good in the model, the arms-length price for this intermediate input is equal to the market price of the numeraire good, i.e. equal to one. However, the parent company can charge a transfer price for intra-company deliveries that deviates from this arms-length price. In particular, a headquarter company has an incentive to set an artificially low (high) transfer price for supplies to subsidiaries in countries that feature a lower (higher) statutory corporate tax rate. In this way, the multinational is able to shift profits from high to low-tax countries, thereby reducing its overall tax liability. To ensure an interior solution, we specify a convex cost function to capture the costs associated with manipulated transfer pricing. Hence, profit shifting to countries with very low corporate tax rates becomes increasingly costly at the margin.

In CORTAX, profit shifting reduces the distortionary impact of the corporate tax system in high-tax countries by offering firms an opportunity to escape these high tax rates. Thus, profit shifting reduces the overall cost of capital for multinationals (see also Becker and Riedel, 2008; Overesch, 2008).

3.1.3 Government

Government behaviour in CORTAX is exogenous, Hence, the government does not optimize its policies and we simply modify exogenous tax and expenditure parameters. In performing simulations with CORTAX, we keep the government budget balanced, i.e. the government does not run a surplus or deficit after a reform. On the revenue-side of the government budget constraint, tax revenues consist of indirect taxes on consumption and direct taxes on various sources of income: corporate income, labour income, dividends, capital gains and interest. On the expenditure side of the constraint, we find government consumption, interest payments on public debt and lump-sum transfers. We keep government consumption and public debt constant as a fraction of GDP. The initial labour and consumption tax rates are calibrated by

using effective taxes computed from tax revenue data reported in European Commission (2008). The initial rates determine the distortions induced by changes in labour and consumption taxes. The calibration of corporate tax systems is described in section 3.3.

3.1.4 Equilibrium

Equilibrium must hold on each market. On the goods market, we assume a homogenous good that is traded on a perfectly competitive world market. Thereby, countries cannot exert market power so that the terms of trade is fixed. The goods price acts as a numeraire in the model. On asset markets, bonds of different origins are perfect substitutes and can be freely traded on world markets. Accordingly, the return to these assets is fixed for an individual country. The same holds for equity. Debt and equity are, however, imperfect substitutes. The current account equals the change in the net foreign asset position for each country (including rest of the world), due to Walras law.

As labour is immobile internationally, wages are determined nationally. In the version of CORTAX we use in this paper, the national labour markets are competitive so that wage adjustments ensure equality between labour supply and demand. In Bettendorf et al. (2007), we explore the importance of labour-market imperfections and involuntary unemployment for the implications of tax reforms. Empirical ambiguity on the wage equation for different countries, however, made us decide to adopt the competitive model.

3.1.5 Welfare

We compute the compensating variation to measure the welfare effects of policy changes. The compensating variation is equal to the transfer that should be provided to households to maintain their utility at the pre-reform level. A positive compensating variation implies a welfare loss, i.e. an excess burden from taxation. In presenting the welfare effects of reforms, we put a minus for the compensating variation so that a positive value denotes an increase in welfare. We denote this by the welfare effect and express it in terms of GDP.

The welfare effects of a tax reform differ from the impact on economic aggregates such as private consumption or gross domestic product. This is because utility depends also on leisure. More employment may raise income, consumption and gross domestic product, but the decline in leisure reduces these benefits in terms of welfare. Moreover, an increase in gross domestic product may be accompanied by an inflow of foreign capital, the return of which flows to foreign owners, rather than domestic residents. It is also why GDP differs from gross national income, which is generally perceived to be a better proxy for national welfare. Welfare may also be affected by multinational profit shifting which raises income but leaves the gross domestic product unchanged.

3.2 Extensions: tax havens and discrete location

In debates on ACE and CBIT, a crucial element is the distortionary impact of high statutory corporate tax rates. The basic CORTAX model captures the impact of corporate tax rates on transfer price manipulation of multinationals among the 29 countries. Yet, this may underestimate the extent to which high corporate tax rates erode corporate tax bases. The reason is first that high tax rates may affect the discrete location of profitable investment by multinationals. Recent literature stresses that this decision margin is relevant. Second, CORTAX ignores profit shifting *vis a vis* countries outside the group of 29, most notably outside tax havens. To capture these two mechanisms, we extend CORTAX by modelling outside tax havens and discrete location choices. This section discusses the main features of these two extensions. Appendix A shows the underlying theoretical assumptions in more detail.

3.2.1 Outside tax havens

Profit shifting in the basic version of CORTAX occurs via transfer pricing within multinational groups in the 29 countries in the model. This profit shifting is proportional to initial FDI stocks. Yet, not all forms of profit shifting are linked to FDI. Indeed, multinationals have a variety of other ways to shift profits to low-tax locations, such as via royalty payments or cost and income allocations. Moreover, CORTAX does not model tax planning via intrafirm capital structures. Still, this channel of profit shifting may be affected by ACE and CBIT reforms, as discussed in section 2. Profit shifting will also not be restricted to the 29 countries modelled in CORTAX. Especially shifting to outside tax havens might be relevant in practice.

To remedy some of these shortcomings of CORTAX in simulating ACE and CBIT reforms, we introduce a simple but straightforward extension of CORTAX by modelling an outside tax haven. The idea is that multinationals face an extra decision margin, namely how much effort to put in shifting profits to the tax haven. On the one hand, these efforts create a cost for the multinational, e.g. to set up a tax haven subsidiary, deal with tax haven authorities and settle possible disputes with the home fiscal authority. These costs are assumed to increase in a convex way with the tax differential *vis a vis* the tax haven. On the other hand, profit shifting yields a benefit to the firm that is proportional to the difference between the statutory corporate tax rate in the country where it operates and the corporate tax rate in the outside tax haven. This benefit is a proportional reduction in the tax base in the home country of the company. In the optimum, multinationals set the marginal benefit from profit shifting equal to its marginal cost. The inclusion of a tax haven implies that a higher corporate tax rate in a country induces a larger erosion of its corporate tax base via more substantial profit shifting.[4]

[4] .

3.2.2 Discrete location

In the basic version of CORTAX, FDI responds only to the EMTR. In particular, the fixed factors that create economic rents for multinationals are assumed to be location-specific. Thus, multinationals have no opportunity to move these factors to another country in response to taxes. Yet, the literature on firm mobility argues that companies can move entire plants to other jurisdictions in response to tax, i.e. it emphasises the inframarginal character of location decisions (see e.g. Devereux and Griffith, 1998; Becker and Fuest, 2005). These studies focus on economic rents that are not due to location-specific fixed factors but due to firms-specific capital, e.g. brand names, patents, market power and the like. Firm-specific rents may be earned and taxed everywhere and may thus move across borders. Accordingly, taxes on these rents may affect the location of capital. Empirical evidence supports this view by showing that effective average tax rates have larger and more robust impacts on FDI than effective marginal tax rates (see e.g. Devereux and Griffith, 1998; Devereux and Lockwood, 2006; De Mooij and Ederveen, 2008).

To capture the impact of taxes on location in CORTAX, we provide a straightforward extension. In particular, we make the size of the fixed factor owned by multinationals in each location dependent on the statutory tax rate. Indeed, it is the statutory tax rate that determines the tax burden on economic rents. Together with the effect of effective marginal tax rates that is captured in the basic version of CORTAX, the model captures the effect of corporate taxes on both marginal and discrete location choices. It is thus consistent with studies emphasising that the effective average tax rate influences FDI.[5]

In modelling the impact of tax rates on the location choice of multinationals, we assume that the firm-specific fixed factor of multinationals is fixed within the European Union, but it is not fixed for an individual country. Hence, non-European multinationals will invest in Europe, irrespective of the tax on rents, but the precise location within Europe is responsive to tax. The firm-specific rents are thus mobile within the EU but not between Europe and other parts of the world. One motivation for this assumption is that Europe is a relatively closed market where multinationals need to be present, irrespective of tax.

3.3 Calibration of corporate tax systems

CORTAX is calibrated for the 27 Member States of the European Union plus the US and Japan. We use data for 2005 to replicate national aggregates from national accounts data, such as consumption shares, labour-income shares, the average number of hours worked and foreign direct investment. A full description of the calibration process is given in Van der Horst et al. (2008). Here, we concentrate on parts of the calibration that are crucial for the outcomes of

[5] The effective average tax rate (EATR) can be computed as a weighted average of the effective marginal tax and the statutory tax (Devereux and Griffith, 2003).

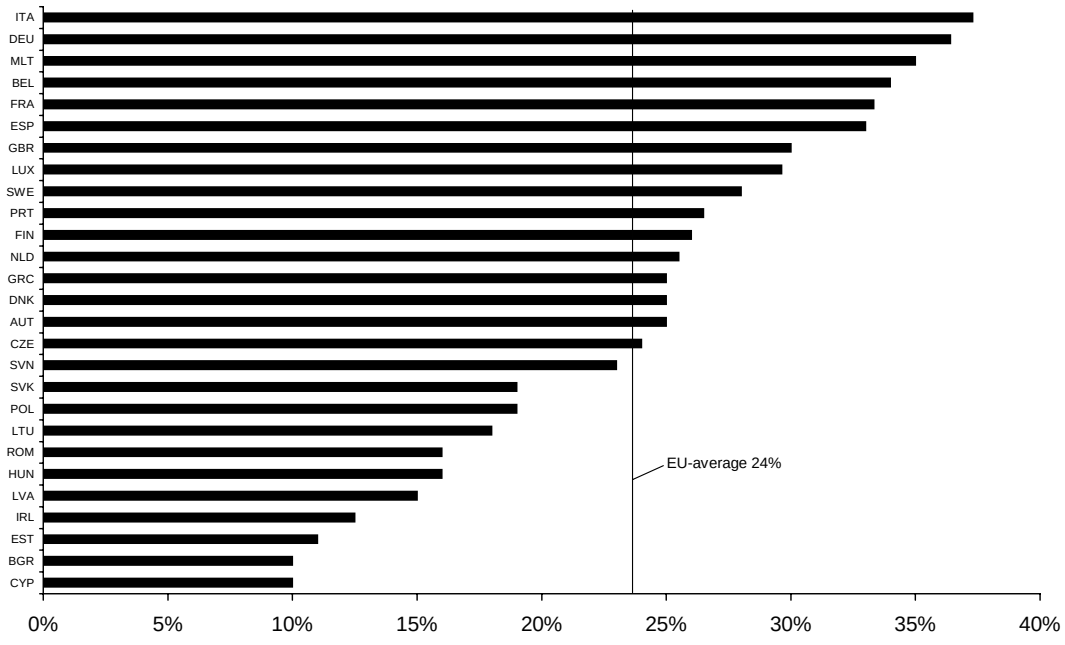
ACE and CBIT reforms. In the calibration of CORTAX, we make extensive use of the ORBIS database. More information about ORBIS can be found in e.g. Devereux and Loretz (2008).

The initial structure of corporate tax systems plays an important role for the outcomes of tax reforms. The model is calibrated on tax data for 2005. In the baseline of the model, we simulate corporate tax changes in 2006 and 2007. The reforms explored in this study are therefore imposed relative to the corporate tax systems in Europe in 2007. For that reason, we present data on corporate tax systems for the year 2007 in this section.

3.3.1 Corporate tax rates

Figure 3.1 shows the statutory corporate tax rates in Europe in 2007. These rates include local taxes and surtaxes that some countries have adopted. The unweighted average in the EU is 24% (compared to almost 26% in 2005). We see from Figure 3.1 that the variation across countries is large, with rates ranging from a low 10% in Cyprus and Bulgaria to over 35% in Germany and Italy. Overall, corporate tax rates are relatively high in the older member states of the EU and in Malta and relatively low in the new member states and Ireland.

Figure 3.1 Corporate tax rates in EU countries, 2007



Source: Taxation trends in the European Union, European Commission 2008 edition. Rates include surcharges and local taxes.

3.3.2 Fiscal depreciation

There is substantial variation in tax bases across European countries, partly due to differences in fiscal depreciation schemes and inventory valuations. Table 3.1 summarizes this information, based on the tax laws in 2007.[6]

Table 3.1 Depreciation schemes and inventory valuation in corporate tax systems in the EU, 2007[a]

Country	Buildings	Machinery	Intangibles	Inventory valuation
Austria	SL 3%	SL 14.3%	SL 12.5%	LIFO
Belgium	DB 10%, SL 5%	DB 40% SL 20%	SL 20%	LIFO
Bulgaria	SL 4%	SL 15%	SL 25%	LIFO
Cyprus	SL 4%	SL 10%	SL 8%	FIFO
Czech Republic	DB 30 years	DB 10 years	SL 16.7%	average
Germany	SL 3%	DB 30%, SL 10%	SL 20%	LIFO
Denmark	SL 5%	DB 25%	SL 100%	FIFO
Spain	SL 3%	DB 24%	SL 5%	LIFO
Estonia	n.a.	n.a.	n.a.	n.a.
Finland	DB 7%	DB 25%	SL 10%	FIFO
France	SL 5%	DB 32.2%	SL 20%	average
United Kingdom	SL 4%	DB 25%	DB 25%	FIFO
Greece	SL 8%	SL 14.3%	SL 10%	LIFO
Hungary	SL 2%	SL 14.3%	SL 8%	average
Ireland	SL 4%	SL 12.5%	SL 10%	average
Italy	SL 5%	SL 10%	SL 33.3%	LIFO
Lithuania	DB 25%	DB 40%	DB 66.7%	FIFO
Luxembourg	SL 4%	DB 30%	SL 20%	LIFO
Latvia	DB 10%	DB 40%	SL 20%	average
Malta	SL 10%, SL 2%	SL 20%	SL 8%	LIFO
Netherlands	SL 3%	DB 30%	SL 10%	LIFO
Poland	SL 2.5%	SL 10%	SL 20%	LIFO
Portugal	SL 5%	DB 31.3%	SL 10%	LIFO
Romania	SL 2.5%	SL 50%, SL 8.3%	SL 50%, SL 5.5%	average
Slovak Republic	DB 20 years	DB 6 years	SL 20%	average
Slovenia	SL 3%	SL 20%	SL 10%	LIFO
Sweden	SL 4%	DB 30% SL 20%	DB 30%, SL 16.3%	FIFO

[a] SL denotes a straight line depreciation and DB a declining balance system. Where a switch between declining balance and straight line is possible, or where there are more than one rate of depreciation we provide both rates.

[6] Compared to 2005, the value of both first-year tax depreciation and depreciation in subsequent years has slightly dropped in the EU. As these changes are included in our baseline between 2005 and 2007, we only present data for 2007.

Table 3.1 shows that there is substantial variation in the rates and systems of depreciation. This is less true for industrial buildings where a large number of countries allow for straight line depreciation with rates between 3 and 5 percent. In contrast, plant and machinery is more often allowed to be deprecated according to a declining balance schedule with rates between 25 and 40 percent. The depreciation rules for intangibles, which we measure through the deprecation rules for a patent, vary most with a spread from 5 percent straight line in Spain to immediate expensing in Denmark. A noteworthy exception is Estonia with its distribution tax only applicable on paid out dividends. For this reason, there is no depreciation scheme applicable as a tax base definition is not needed.

With the information contained in Table 3.1, we compute for each asset the net present value of the depreciation allowances as a percentage of the purchase price of investment. This value indicates how generous fiscal depreciation rules are for that particular asset. Using asset shares, we can also compute a weighted average of these values over all assets. In principle, asset structures differ across firms. Using firm-specific information from ORBIS, we can thus calculate for each individual firm the net present value of its fiscal depreciation allowances. For CORTAX, we use the country averages, which are reported in Table 3.2, along with the value of first-year tax depreciation. The net present values of allowances vary from 28.79 percent in Malta to almost fifty percent in Lithuania. Most countries lie in a range between 33 and 46 percent.

The values in Table 3.2 form the basis for the calibration of CORTAX. Thereby, we modify the tax base indicator for two countries: Estonia and Belgium. Belgium introduced in 2006 the ACE system. As we include reforms up to 2007, our baseline captures this Belgium ACE. In Estonia, the value of fiscal depreciation is zero as no depreciation allowances are available. However, Estonia does not tax retained profits. Indeed, it only levies a 22% tax rate on profit distributions. Hence, corporate profits in Estonia go untaxed as long as they are not repatriated to the parent or distributed to shareholders. To correct for this special feature of the Estonian tax system, we modify its corporate tax base by assuming a positive allowance. It is set so as to replicate the corporate-tax-to-gdp ratio for Estonia. We maintain the Estonian corporate tax rate at 22%.

Table 3.2 Summary information about the NPV of fiscal depreciation schemes in % of the purchase price

Country	First year tax depreciation	Net present value of allowances
Austria	5.31%	36.83%
Belgium	13.50%	44.37%
Bulgaria	6.14%	39.93%
Cyprus	4.33%	41.78%
Czech Republic	4.32%	39.26%
Germany	8.80%	35.67%
Denmark	13.45%	45.72%
Spain	6.24%	32.95%
Estonia	0.00%	0.00%
Finland	8.80%	40.46%
France	9.64%	40.07%
United Kingdom	8.41%	39.28%
Greece	6.01%	41.09%
Hungary	5.19%	35.32%
Ireland	4.32%	35.79%
Italy	5.98%	38.04%
Lithuania	19.43%	49.53%
Luxembourg	9.45%	39.35%
Latvia	15.73%	46.17%
Malta	6.87%	28.79%
Netherlands	8.01%	35.70%
Poland	4.52%	37.41%
Portugal	10.48%	39.63%
Romania	20.18%	43.65%
Slovak Republic	6.81%	44.30%
Slovenia	8.65%	46.01%
Sweden	9.57%	39.68%
Weighted average EU	7.61%	37.87%

3.3.3 Effective marginal tax rates

In CORTAX, the effect of corporate taxation on investment is determined by the cost of capital. How corporate taxes affect the cost of capital is measured by the effective marginal tax rate (EMTR). It is defined as the difference in the cost of capital in the presence and in the absence of tax, in percentage of the tax-inclusive cost of capital. The EMTR depends on various parameters in the corporate tax system, such as depreciation allowances, inventory valuations, depreciation of financial costs and the statutory tax rate. Its value is positive if corporate taxes raise the cost of capital and vice versa (see Box "The user cost of capital and the EMTR").

The user cost of capital and the EMTR

The impact of corporate taxes on the user cost of capital depends on the initial corporate tax system. Tthis effect is best reflected by considering a simple tax system. Assuming equity-financed investment, the cost of capital (*c*) depends on the corporate tax (*τ*) in the following way

$$c = \frac{1-\tau A}{1-\tau}(r+\delta)$$

where *A* denotes the net present value of depreciation allowances in percent of the cost of an investment and r+δ is the pre-tax cost of capital. This expression shows that the corporate tax rate exerts no effect on the cost of capital if *A* = 1, which is the case under a cash-flow tax. Intuitively, the cash-flow tax turns the corporate tax into a tax on economic rent which is non-distortionary for investment. The smaller the tax allowances become (i.e. the smaller *A*), the more corporate taxes raise the cost of capital.

From the definition of the EMTR, we derive a direct relationship between the EMTR and the statutory corporate tax rate

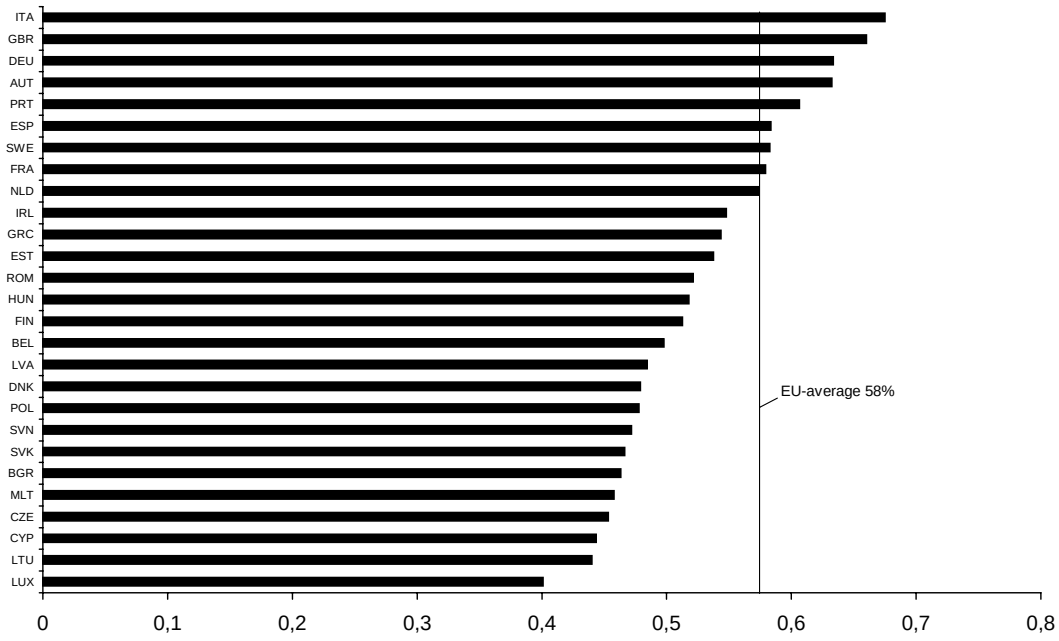
$$EMTR = \frac{c-(r+\delta)}{c} = \frac{1-A}{1-\tau A}\tau$$

This expression shows the positive relationship between the statutory corporate tax rate and the EMTR. This effect also depends on *A*. If *A* = 1, the EMTR is zero irrespective of the rate of corporate tax. It reflects the non-distortionary character of the corporate tax in this case. The lower A, the more *τ* raises the EMTR, i.e. the more distortionary the corporate tax rate becomes for investment. If *A* = 0, the EMTR equals the statutory corporate tax rate.

CORTAX computes the EMTR for each country separately for debt-financed and equity-financed investment. As nominal interest is deductible for the corporate tax base and fiscal depreciation is typically more generous than economic depreciation, the EMTR for debt-financed investment is usually negative. Hence, if we would assume that marginal investment is financed by debt, higher corporate taxes would stimulate investment as they increase the marginal subsidy. The EMTR for equity financed investment is positive since the cost of equity finance is not deductible from the corporate tax base. Hence, to the extent that marginal investments are financed by equity, higher corporate tax rates will reduce investment. The assumptions regarding the marginal source of finance are therefore crucial for the distortionary impact of corporate taxes on investment. We follow the convention in computations of EMTR's

by assuming a certain marginal debt/asset ratio for each country. In this way, we compute a weighted average of the EMTRs for debt and equity finance as a summary indicator of how distortionary the corporate tax system is for marginal investment decisions. As we have no information about marginal debt-asset ratio's for new investments, we take average debt shares as a proxy for marginal shares. Figure 3.2 shows these averages per country, which are based on the ORBIS database. These average debt shares are used in the calibration of CORTAX.

Figure 3.2 Average debt-asset ratio of firms in EU countries, 2007

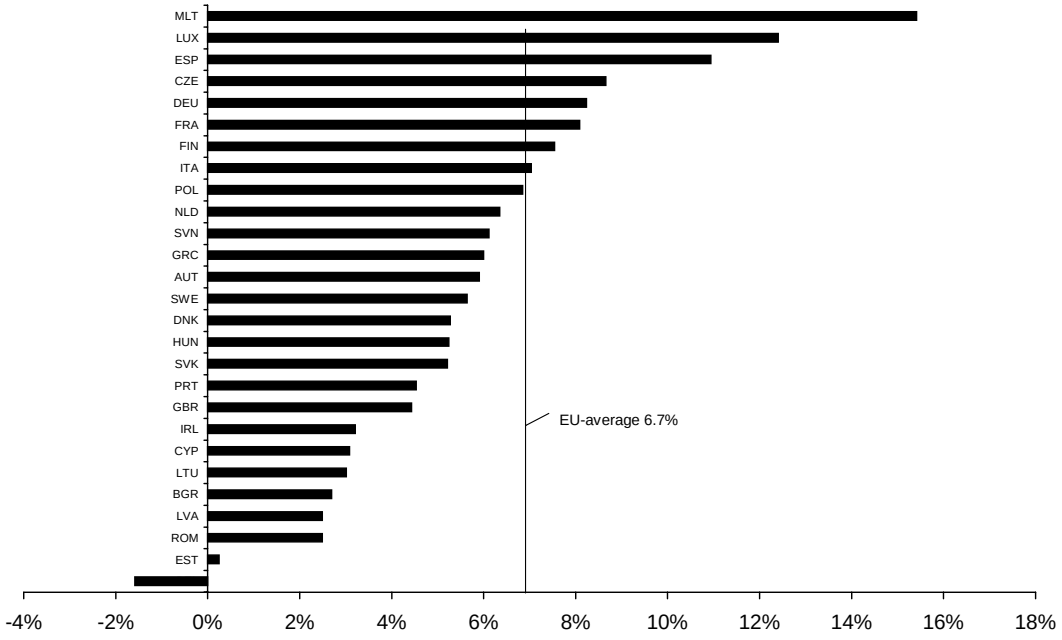


Source: Country averages obtained from the ORBIS database

The average debt/asset ratio in Figure 3.2 lies between a low 0.4 in Luxembourg and a high 0.67 in Italy. The ratio is positively correlated with statutory corporate tax rates (correlation coefficient of 0.5). It may reflect that multinationals finance their investments in high-tax countries by relatively high shares of debt. In particular, headquarters investing in subsidiaries abroad can choose between debt and equity finance. The tax burden on the income earned depends on the choice of finance. When financed by debt, the interest is deductible for the subsidiary in the host country and taxed in the home country of the parent. When financed by equity, the dividend of the subsidiary is taxed at the rate of the host country and repatriated dividends are untaxed in the country of the parent if that country uses an exemption system (which is the case in continental Europe). To minimize the tax liability, a parent company will therefore prefer debt finance for subsidiaries located in high-tax countries and equity finance for subsidiaries in low-tax countries.

The average values of the EMTRs are presented in Figure 3.3. The Belgium EMTR is negative, which is due to the Belgian ACE. In other countries, the EMTR is positive and ranges between a low 0.25% in Estonia to a high 15% in Malta. In general, the EMTR is relatively high in the old EU countries and low in the new member states.

Figure 3.3 Average EMTR in EU countries, 2007



Source: CORTAX computations

3.3.4 Corporate tax revenue

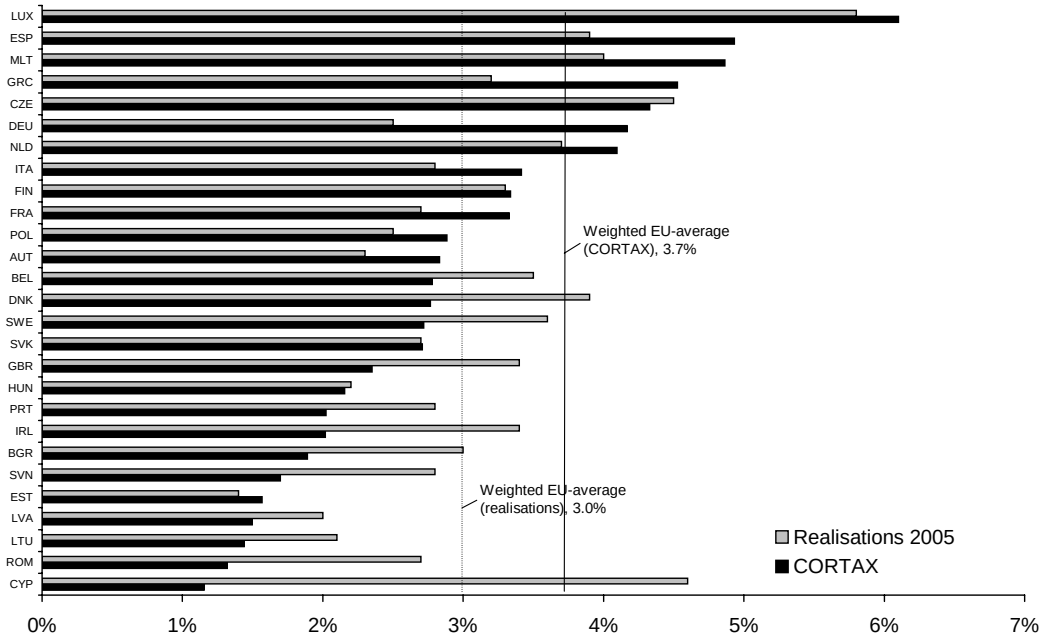
CORTAX predicts corporate tax revenues in each EU country. In determining the corporate tax base, we use national accounts data on gross value added minus total labour income, thereby correcting for the income from the self employed. The share of economic rents is set at 2.5% of value added. Regarding deductible costs, we use capital shares from national accounts, fiscal depreciation rates from Table 3.2, a nominal interest rate of 4.5% (real rate of 2% and 2.5% inflation) and debt shares from Figure 3.2. Figure 3.4 shows the corporate tax-to-gdp ratios predicted by CORTAX for 2005. They are compared to actual revenue data for 2005 as reported by the European Commission.

On average, CORTAX predicts a corporate tax-to-gdp ratio of 3.7 in 2005. The data for 2005 suggest a ratio of 3.0. Hence, CORTAX overestimates corporate tax revenue by 23%. One reason for this may be that CORTAX assigns a too large share of capital income to the corporate tax base while in practice part of this is taxed under the personal income tax as firms

are not incorporated. Another reason may be that CORTAX underestimates profit shifting from the European Union to outside tax havens.

The difference between predicted and actual corporate tax-to-GDP ratios in Figure 3.4 are positively correlated with statutory corporate tax rates (correlation coefficient 0.58). Hence, for countries with low statutory corporate tax rates (Cyprus, Bulgaria, Ireland) the model predicts too low corporate tax-to-gdp ratios. For countries with high corporate tax rates (Germany, Italy, Spain and Malta), the model predicts too high corporate tax-to-gdp ratios. It feeds the suspicion that the model insufficiently captures profit shifting from high to low tax countries.

Figure 3.4 Corporate tax revenue in % of GDP according to CORTAX and data 2005



Source: Taxation trends in the European Union, European Commission, 2008 edition (Table C.3.1.1) and CORTAX.

3.4 Calibration of key elasticities

An important part of the calibration of CORTAX involves parameters that determine the key elasticities in the model. This section discusses how we choose these parameters and how elasticities compare to empirical evidence. In presenting the elasticity values for countries in CORTAX, we do not report data for Luxembourg which is typically a severe outlier due to its deviating economic structure.

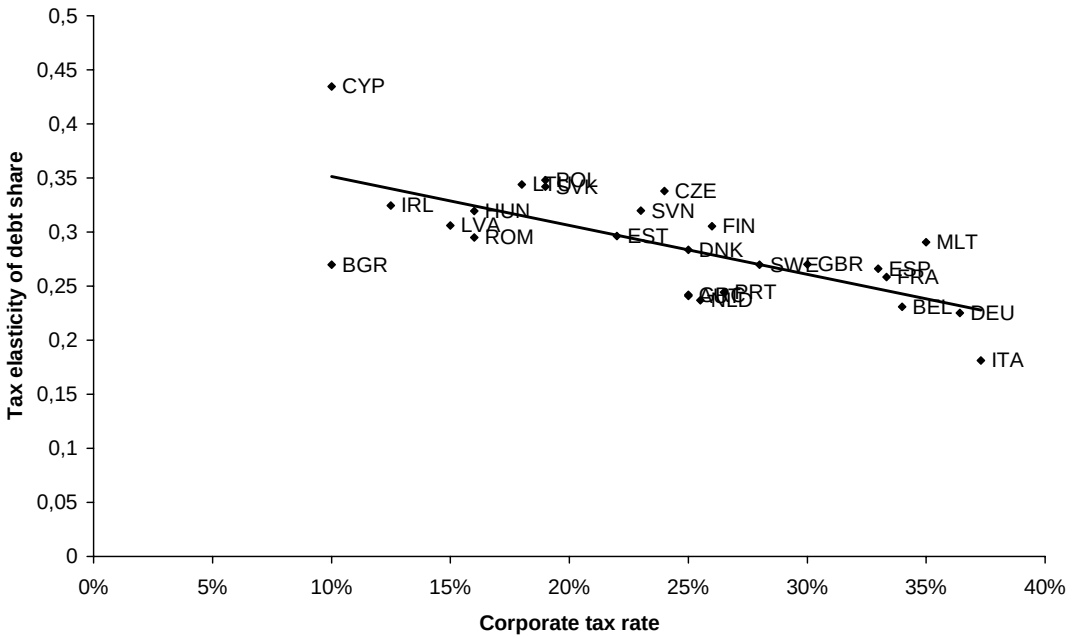
3.4.1 Labour-supply distortions

Taxes on income and consumption distort labour supply incentives. These effects are determined by the substitution elasticities in the utility function of households, together with preference parameters. For all countries, the intratemporal elasticity of substitution between consumption and leisure is set at 1.0; the intertemporal elasticity of substitution is set at 0.5. The preference parameters for leisure are chosen so as to replicate data on the average hours per worker in EU countries. On average across the EU, the uncompensated elasticity of labour supply is 0.19, which corresponds to the consensus in the empirical literature (see e.g. Evers et al., 2008).

3.4.2 Financial distortions

In CORTAX, the convexity of the financial distress cost determines the impact of corporate taxation is on a firms' financial policy. A number of studies aim to identify this impact. Graham (2004) reviews earlier studies using time series data and concludes that most report small tax effects. More recent studies using cross-section variation between companies typically report larger effects. For instance, Gordon and Lee (2001) find that a 1%-point reduction in the corporate tax rate reduces the debt/asset ratio at the margin by 0.36%-point. Another strand of this literature has explored the impact of taxation on the financial policies of multinationals, thereby using cross-country variation in tax rates. Altshuler and Grubert (2003) report a semi-elasticity of – 0.4. Desai et al. (2003) arrive at a semi-elasticity of – 0.25. In CORTAX, we set the parameters in the financial distress cost function so as to obtain a semi-elasticity of the debt share with respect to the corporate tax rate between 0.2 and 0.4. The mean value is 0.27. As the financial distress cost is a convex function of the debt share, the semi-elasticity falls in the corporate tax rate. Figure 3.5 shows this by presenting the elasticity of the debt share for all EU countries (each point representing a country).

Figure 3.5 Reduced-form elasticities of the debt share with respect to the corporate tax rate in CORTAX



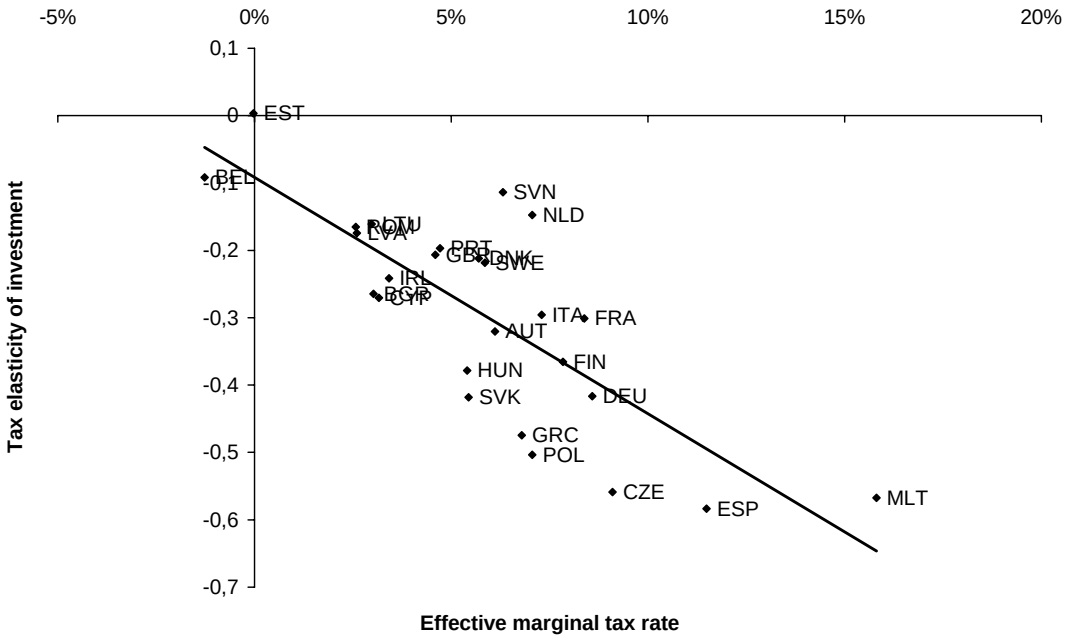
Source: CORTAX, 26 European countries, excluding Luxembourg

3.4.3 Investment distortions

To determine the size of corporate tax distortions on investment, we need to quantify two effects: (i) the impact of the corporate tax on the cost of capital and (ii) the impact of the cost of capital on investment. The effect of corporate taxes on the user cost of capital depends on the initial corporate tax system, as explained in the box on "The cost of capital and the EMTR". The second effect depends on the substitution elasticity between labour and capital. The US Joint Committee on Taxation (1997) reports a range of estimated elasticities in the literature between 0.2 and 1.0. Chirinko (2002) reviews recent empirical literature and concludes that a value of 0.4 is a central estimate for this elasticity, although he proposes a sensitivity analysis with values up to 0.6. Most general equilibrium models adopt slightly higher values, somewhere between 0.5 and 1.0. We use a value of 0.7 in the baseline simulations. This corresponds with an elasticity of investment to the user cost of – 0.9. Direct estimates on the elasticity of investment with respect to the cost of capital are consistent with this (Hassett and Hubbard, 2002).

To summarise the investment distortions induced by corporate taxes, we compute tax-rate elasticities of investment in CORTAX. They are depicted in Figure 3.6. On average, the tax-elasticity is – 0.3, i.e. a 1%-point higher corporate tax rate reduces investment by 0.3%. It ranges from zero in Belgium (due to the ACE system) to – 0.6 in Spain (with a high EMTR). Investment thus becomes more responsive to tax if the EMTR in a country is larger.

Figure 3.6 Reduced-form elasticities of investment with respect to the corporate tax rate in CORTAX

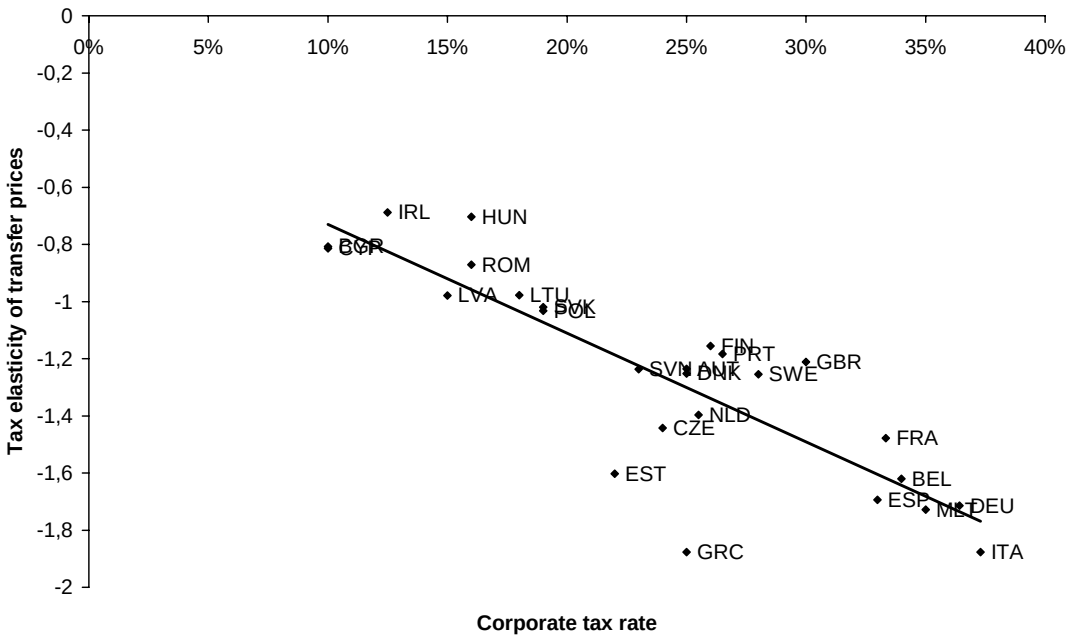


Source: CORTAX, 26 European countries, excluding Luxembourg

3.4.4 Transfer pricing distortions

The elasticity of transfer pricing with respect to the corporate tax rate is determined by the parameters in the convex cost function of transfer price manipulation. There exists some evidence on its size. Clausing (2003) exploits intra-firm trade data of US multinationals and finds that tax rates have a significant impact on transfer prices. In particular, a 10% point lower tax rate in a country results in a reduction in the intrafirm price that an affiliate in that country pays by 3 to 5%. In CORTAX, we adopt a somewhat larger tax elasticity of 1.2. The reason is that transfer pricing is only one channel that multinationals can use to shift their profits across borders. Other channels include income or cost reallocations, loss shifting or modification of corporate financial policy. Studies on the aggregate revenue implications of profit shifting therefore report more sizeable effects due to profit shifting (see e.g. Devereux, 2006). The larger tax elasticity of transfer pricing captures this to some extent. Figure 3.7 shows how the tax elasticity of transfer pricing varies with the corporate tax rate. Due to the convex function, it becomes increasingly costly at the margin to shift profits to countries that feature a low corporate tax rate. Figure 3.7 shows that the tax elasticity ranges between – 0.8 in low-tax countries and – 2 in high-tax countries.

Figure 3.7 Reduced-form elasticities of transfer prices with respect to corporate tax rate in CORTAX



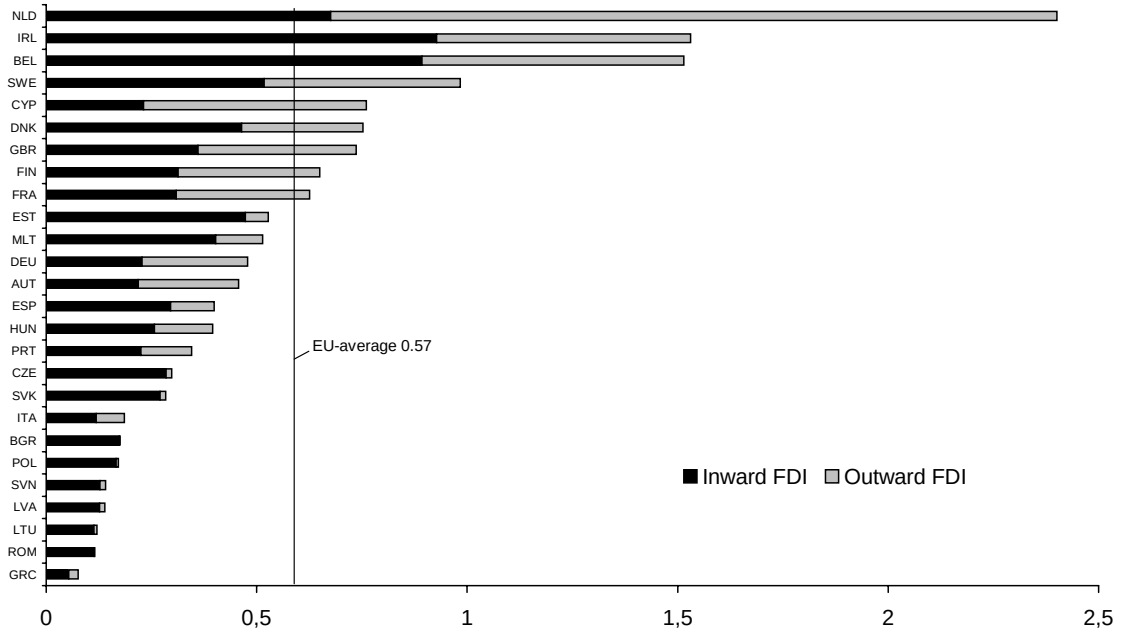
Source: CORTAX, 26 European countries, excluding Luxembourg

The extent to which transfer price manipulation affects the corporate tax base of a country depends on the size of the intrafirm exports of a countries' parent and the intrafirm imports of its subsidiaries. In CORTAX, intrafirm trade is proportional to the initial bilateral FDI stocks. Figure 3.8 shows these stocks in EU countries as a percentage of GDP. In the figure, we leave Luxembourg out because of its exceptional position.[7]

We see that the variation across countries is large. The Netherlands stands out with a sum of the inward and outward FDI stock of 2.4 times its GDP. Stocks are generally small in Central and Eastern Europe, especially the outward stocks. This has important implications for profit shifting. For instance, a small change in the transfer price for a Dutch multinational has serious implications for corporate tax payments. In contrast, a large change in the transfer price for a Romanian multinational will have a negligible impact for corporate tax revenue in Romania.

[7] Luxembourg features relatively large FDI positions vis a vis other countries. For an average EU country, the total sum of the inward and outward stock of FDI is 60% of GDP. The second-largest stock is found in the Netherlands which is 2.4 times its GDP. Luxembourg stands out with a stock of 9.4 times its GDP.

Figure 3.8 Inward and outward FDI in % of GDP in EU countries, 2005

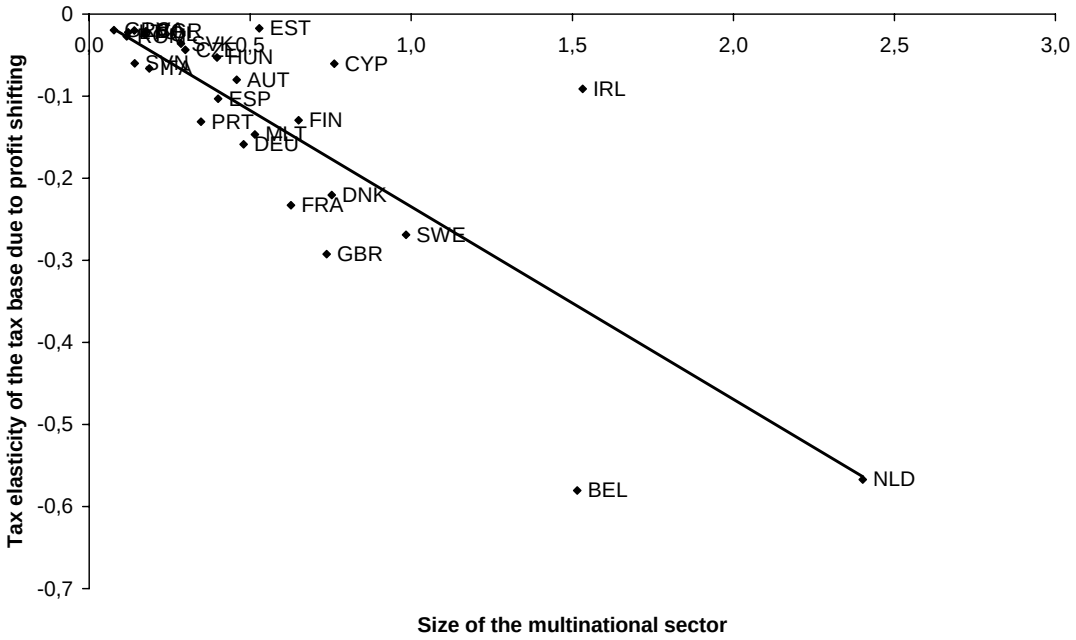


Source: OECD datastream, 26 European countries, excluding Luxembourg

Together, the elasticity of the transfer price (Figure 3.7) and the size of multinationals (Figure 3.8) determine the sensitivity of the total corporate tax base for changes in the corporate tax rate via transfer price manipulation. We summarize this effect in Figure 3.9, showing the tax elasticity of the corporate tax base. A value of – 0.2 means that the corporate tax base shrinks by 0.2% due to profit shifting if the corporate tax rate is increased by 1%-point. The average value of the tax base elasticity equals – 0.23. Figure 3.9 shows that it is smaller than this for the majority of countries as the multinational sector in many countries is relatively small.[8] The low elasticities in Cyprus and Ireland are due to the small elasticity of the transfer price with respect to the corporate tax rate. For countries where multinationals are important, elasticities are larger. The largest elasticities are reported in Belgium and the Netherlands which feature the largest multinational sectors. In the Netherlands, a 1%-point higher corporate tax rate reduces the tax base via profit shifting by 0.8%.

[8] Note that not only the total size of FDI, but also the country where it is located matters for the aggregate elasticity.

Figure 3.9 **Reduced-form elasticity of the tax base in % of GDP (due to profit shifting) with respect to the corporate tax rate according to CORTAX**



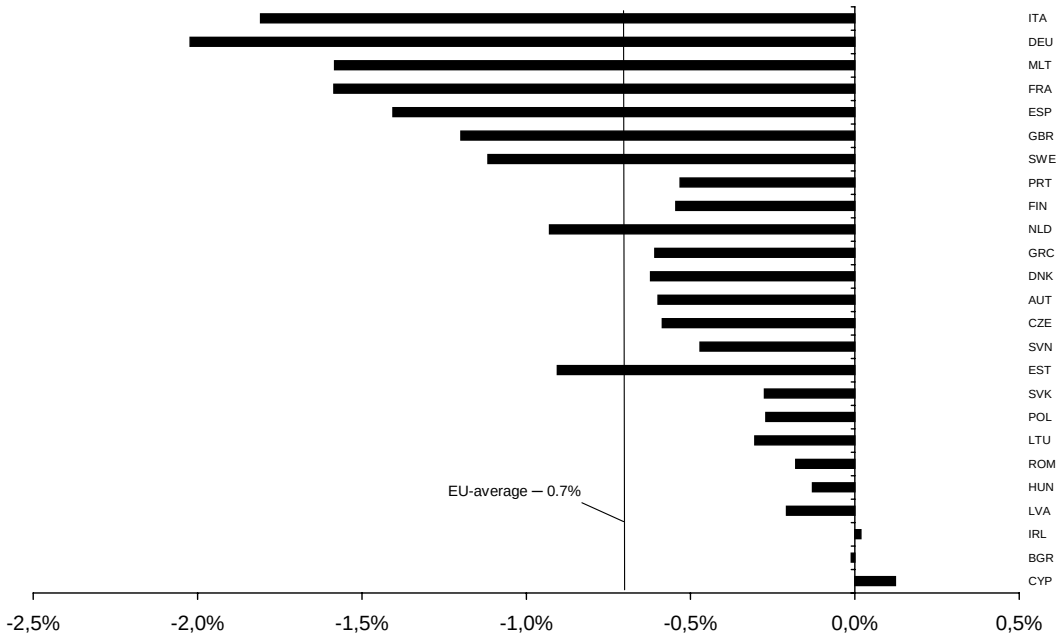
Source: CORTAX, 26 European countries, excluding Luxembourg

3.4.5 Profit shifting to tax havens

The size of profit shifting to the tax haven is determined by the convexity of the effort cost function. We set the parameters such that we obtain a semi-elasticity of the corporate tax base of – ½. It implies that a 10%-point tax differential *vis a vis* the average tax haven reduces the corporate tax base by 5%. The calibration is based on two pieces of evidence. First, empirical studies on profit shifting typically yield large elasticities of the tax base. For instance, De Mooij (2005) reports a tax-rate elasticity of the corporate tax base of – 1.0 on the basis of a selection of empirical studies on profit shifting. The elasticity captured by transfer pricing in CORTAX implies an average elasticity of approximately – ¼ on average (see Figure 3.9). Adding – ½ brings the total magnitude of profit shifting closer to these empirical estimates. A second piece of evidence is obtained from the revenue estimates. The predicted corporate tax revenues by CORTAX are approximately 1% of GDP higher than the observed revenues in European member states. One reason for this might be the underestimation of profit shifting. With the calibration of – ½, the corporate tax-to-GDP ratio falls by slightly more than 1% so that CORTAX properly reflects actual tax revenue in the EU. The size of this revenue effect differs across countries and depends on the initial corporate tax rate. In particular, the higher the rate, the more profits are shifted and the larger is the reduction in tax revenue. Figure 3.10 shows that

revenues fall up to 2% in high-tax countries like Germany and Italy and with a negligible amount in low-tax countries like Cyprus, Bulgaria and Ireland.

Figure 3.10 Revenue effect of the inclusion of an outside tax haven



Source: CORTAX simulations, 26 EU countries, excluding Luxembourg

3.4.6 Discrete location

The impact of corporate taxes on the location of firms can be obtained from two types of empirical studies. First, there are studies directly estimating the effect of corporate taxes on location, either measured by the probability of location (using micro data) or measured by the number of foreign locations (using count data). Second, a number of studies estimate the impact of effective average tax rates on foreign capital flows instead of effective marginal tax rates. De Mooij and Ederveen (2008) perform a meta analysis of a large number of empirical studies found in the literature and arrive at a consensus elasticity for both the extensive investment margin, i.e. the discrete location choice, and the intensive investment margin, i.e. the marginal investment. For the intensive margin, they report a semi-elasticity of – 4, i.e. a 1%-point increase in the effective marginal tax reduces foreign direct investment by 4%. For the extensive margin, they report a semi-elasticity of – 2 when measured by the statutory tax rate. The combined effect, measured by the semi-elasticity of FDI for the effective average effective tax rate is found to be – 6.

In the basic version of CORTAX, we only model the impact of the EMTR on FDI. The semi-elasticity that is consistent with the parameters in the production function implies a semi-

elasticity of FDI with respect to the EMTR of $-1\frac{1}{2}$. In the extended version with discrete location, we impose a response of fixed capital to the statutory tax rate so as to obtain a semi-elasticity of FDI with respect to the EATR of – 6, consistent with the outcomes from the meta analysis. Hence, in the extended version of CORTAX, the lion share of the impact on FDI is determined by effects on discrete location.

3.5 Methodology and sensitivity

CORTAX is an attractive tool to analyse corporate tax reforms. Yet, it also suffers from limitations that need to be taken into account when interpreting the outcomes. To shed light on some of these limitations, we discuss the role of sensitivity analysis .

3.5.1 Values of CORTAX

CORTAX is valuable for economic policy analysis as it combines three vital properties: theoretical rigour, empirical validity and institutional detail. First, CORTAX encompasses several behavioural margins of firms and households, including labour supply choices, saving behaviour, investment decisions, financial behaviour, and multinational profit shifting. By deriving these behavioural margins from microeconomic optimisation, CORTAX allows for easy interpretation of the results and relates macroeconomic outcomes to the underlying microeconomic responses of agents. The general equilibrium setting also allows for feedback effects of policies through market responses, such as the labour market. Exploring policies in such a comprehensive and consistent framework offers potentially important insights for policy makers. Indeed, the model forces one to discuss the main assumption that ultimately drive the outcomes the model. In this way, it supports communication and helps thinking about the most likely implications of policy changes.

A second valuable property of CORTAX for policy analysis is its empirical validation. Various share parameters are set so as to replicate true economic data in the EU. This adds to the realism of the model outcomes. Moreover, we use available evidence on the responses at various decision margins in the model. This determines the strength of various behavioural effects to tax reforms and, therefore, ultimately their economic and welfare effects. It makes CORTAX particularly relevant for policy makers as governments typically face trade-offs in designing institutions. By quantifying different sides of these trade-offs, it offers input to the debate on optimal government policy.

A third property of CORTAX is its attention to institutional detail. CORTAX pays due attention to the corporate tax systems in Europe by distinguishing corporate tax rates, alternative fiscal depreciation schemes, immediate expensing, different modes of finance, and opportunities for profit shifting. Especially the combination of CORTAX with information from

micro data on firm structures in different countries using the ORBIS database provides a unique methodology to both the calibration and the design of reforms analysed.

3.5.2 Limitations of CORTAX

Despite its values, the methodology adopted in this study also suffers from limitations. In particular, while assumptions driving the outcomes of the model are based on the best-possible empirical information and widely accepted economic theories, it is still an outcome of a simplified description of the real world. Like any CGE model, CORTAX ignores certain economic mechanisms, includes specifications that are not undisputed, and it cannot take away the uncertainty about the strength of certain behavioural effects to tax policies. For these reasons, numerical outcomes should be taken with proper care. It is also why we will perform a sensitivity analysis.

To facilitate a proper assessment of the CORTAX outcomes, we discuss some of its features that should be kept in mind when interpreting numbers. The first issue is CORTAX' treatment of risk. The model distinguishes between debt and equity and assumes different rates of return for these two assets, which is consistent with ex-post returns in real world observations. The equity returns contain a risk premium, however, which forms a compensation for the higher uncertainty of equity stakes as compared to risk-free government bonds. CORTAX does not explicitly model risk and thus ignores the uncertainty cost of holding equity. In fact, the CES function for the asset portfolio of households is an imperfect shortcut to obtain an interior solution for household asset portfolios, but does not account for the cost of risk taking.

A second qualification is that CORTAX does not consider distributional concerns. While various taxes in the model thus cause distortions in investment and labour supply, there is no explicit underlying distributional reason why the government does this. Indeed, the optimal tax structure in the model would be to simply raise lump-sum taxes and eliminate all other taxes. One therefore needs to be careful in interpreting simulations where the tax burden is shifted from distortionary taxes to lump-sum taxes, or between different distortionary taxes, as this may have distributional implications which are overlooked.

A third issue is that CORTAX assumes one homogenous good. The price of this good is determined on a competitive world market on which no country can exert market power. Therefore, the terms of trade is fixed for all countries. Large reforms like the ACE and CBIT, however, may well affect world markets, especially when the EU implements these reforms jointly.

A fourth point is that CORTAX assumes that the labour market is competitive. This is an unrealistic description of European labour-markets, which are characterized by equilibrium unemployment. Bettendorf et al. (2007) explore how labour-market imperfections modify the impact of corporate tax changes on the economy via its effect on structural unemployment. They find that the cost of capital is an important determinant of the equilibrium unemployment

rate. Therefore, policies that reduce the cost of capital (like the ACE) can help to fight European unemployment. It magnifies the positive welfare impact of these policies. However, there is considerable uncertainty about the parameters determining the impact on equilibrium unemployment. In light of this uncertainty, we decided to assume a competitive labour market in our analysis of the ACE and CBIT.

These caveats make us aware of the limitations of the CORTAX simulations. Yet, it also shows its value since the consistency of the framework provides common ground for a structured discussion about both the assumptions and the economic implications of corporate tax reforms. Sensitivity analysis further facilitates this by offering insight in how changes in certain assumptions affect the conclusions.

3.5.3 Sensitivity analysis

We perform a sensitivity analysis to three parameters in CORTAX that determine, respectively, the strength of investment responses, the debt-equity choice and multinational profit shifting. Moreover, we consider the sensitivity of our results to the size of the fixed factor. For the extended model with the outside tax haven and discrete location choice, we perform a sensitivity analysis on both of these margins. More specifically, we modify parameters in CORTAX in the following way:

- The substitution elasticity between labour and capital in production is reduced from 0.7 to 0.5. It is closer to the value proposed by Chirinko (2002).
- The convexity in the cost function of debt finance is captured by χ_0. By raising χ_0 from 0.015 to 0.03, we reduce the tax rate elasticity of the debt share from an average of – 0.27 to – 0.16. It is more in line with older studies on the tax effect on corporate finance as reported in Graham (2004).
- The convexity of the cost of transfer price manipulation is captured by ε_q. We halve ε_q from 1 to 0.5, implying that the elasticity of the transfer price with respect to the corporate tax rate falls on average from – 1.27 to – 0.28. The latter is consistent with the value reported by Clausing (2003).
- We double the fixed factor from 2.5% of value added to 5%. Empirical evidence on the importance of economic rents is not available, which justifies a sensitivity analysis.
- The elasticity of profit shifting to outside tax havens and discrete location choices is halved in the extended version of CORTAX.

The first two sensitivity analyses on the production function and debt policy are explored for reforms where the government budget is balanced by changes in the consumption tax rate. The other three sensitivity analyses are applied to a unilateral reform where the government budget is balanced ex-ante by changes in the corporate tax rate.

3.5.4 Reading CORTAX outcomes

CORTAX computes a new steady state equilibrium after a policy shock, which should be interpreted as the long-run effect of the policy change. Reforms always keep the government budget constraint balanced by adjusting other taxes or transfers. Government expenditures on public consumption or government debt remain unaffected. We concentrate on the following selection of variables in presenting CORTAX results:

- CIT-rate: the statutory corporate tax that is modified in some of the reforms;
- Rev_cit: the absolute change in corporate tax revenue as a share of GDP;
- Rev_tax: the change in total tax revenue as a share of GDP, excluding transfers.
- Debt: Absolute change in the debt / asset ratio;
- Shift_cit: relative change in the corporate tax base induced by profit shifting;
- Coc: Absolute change in the cost of capital. It is computed as a weighted average over debt and equity financed investment;
- Wage: relative change in the wage rate paid to domestic employees;
- Capital: relative change in total capital stock;
- Employm: relative change in total employment by firms;
- GDP: relative change in gross domestic product, which comprises the value added from capital, labour and the fixed factor, but not that of intermediate inputs in foreign subsidiaries.
- Welfare: absolute change in compensating variation expressed in % of GDP. It is the transfer provided to households to keep utility at the initial level. We put a minus sign for the compensating variation so that a positive value reflects a welfare gain.

The tables in appendix B report outcomes for all European countries. In the Figures presented in the main text, we do not always report the outcomes for all countries. For instance, Luxembourg is regularly an outlier due to its high foreign direct investment stocks, which blurs the main message that we want to highlight in the Figures. Belgium is often an outlier as it already has an ACE system in place. Estonia has a special regime for retained earnings, which gives sometimes different results. For Malta, we sometimes find different results as the country combines a high tax rate with a very broad base.

When we consider common European reforms, we present the impact on European averages, which represent GDP-weighted averages. For unilateral reforms, we do not present averages in the tables since these would ignore international spillover effects. Indeed, if a single country benefits from a certain reform, this may come at the expense of other countries due to profit shifting or capital reallocation. When we would compute an average, this ignores such spillovers and wrongly presents it as the average European effect. In the main text, we sometimes refer to unweighted averages, which then reflect the impact for a typical or average European country.

4 ACE reform in CORTAX

This section discusses simulation outcomes of ACE reforms in CORTAX. We start in section 4.1 with unilateral reforms where the government balances its budget by an adjustment of lump-sum transfers or alternative taxes. Section 4.2 compares ACE reforms that are implemented separately by single European countries with a joint European reform towards an ACE. Section 4.3 analyses ACE in extended versions of CORTAX where we model tax havens outside the EU and discrete location choices of profitable investment.

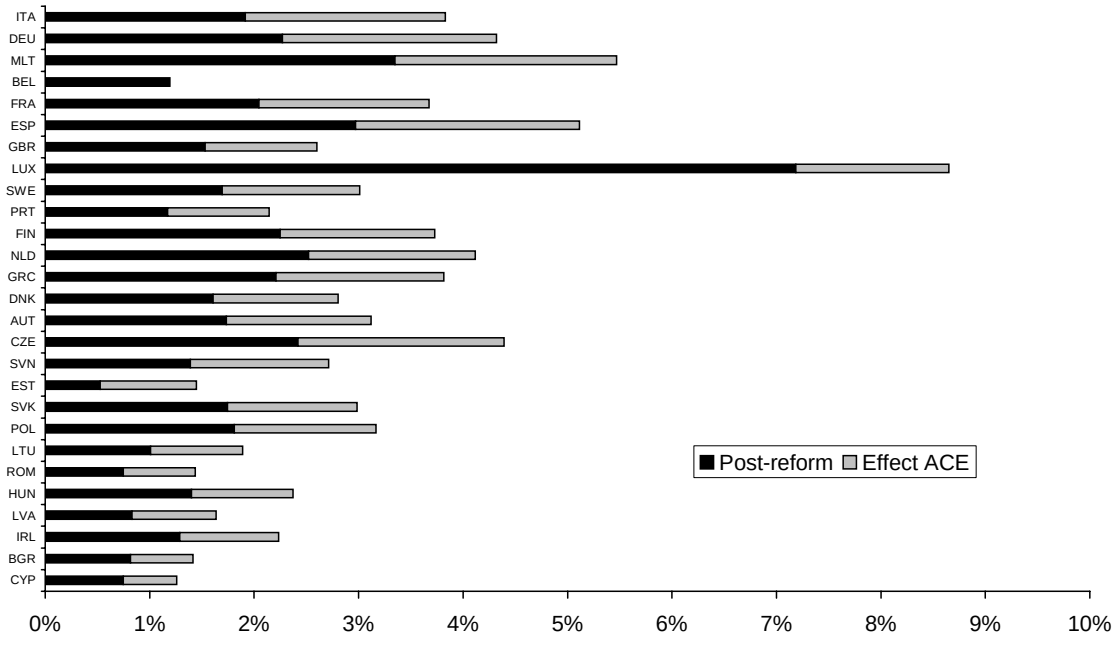
4.1 Unilateral ACE reform in EU countries

The ACE is modelled as a deduction for the equity share of capital in the tax accounts. We apply the nominal interest rate to compute the tax deduction. The simulation outcomes for a number of variables and all 27 EU countries are presented in Tables B.1 – B.4 in Appendix B.

4.1.1 Balanced budget with lump-sum transfers

By allowing a deduction for equity, ACE implies a narrowing of the corporate tax base which reduces corporate tax revenues. The government thus needs other sources of finance to meet its revenue requirement. Lump-sum transfers are the most natural starting point as they offset income effects. The analysis thus concentrates on the economic and welfare effects of substitution effects induced by changed relative prices.

Figure 4.1 Effect of ACE on corporate tax-to-gdp ratios in CORTAX



Source: CORTAX simulations

Figure 4.1 shows by how much an ACE reduces corporate tax revenues in EU countries according to CORTAX. The black bars reflect the post-reform corporate tax-to-GDP ratio; the grey parts reflect the reduction due to the ACE. Together, the bars add up to the current corporate tax-to-GDP ratios according to CORTAX. We see that, on average for the EU, the corporate tax-to-GDP ratio drops from 3.5 to 1.9, i.e. by around 44%. This decline applies more or less to all countries, except for Belgium that already has an ACE.

Table 4.1 summarises the economic implications of an ACE-system according to CORTAX for the GDP-weighted average in the EU. They are the result of two major responses by firms to the ACE: an effect on the financial structure of firms and an effect on investment behaviour. First, the ACE eliminates the tax-favoured status of debt over equity finance. Thus, it reduces the optimal debt share for firms. Table 4.1 suggests that, on average, the debt share falls by 5.4%.

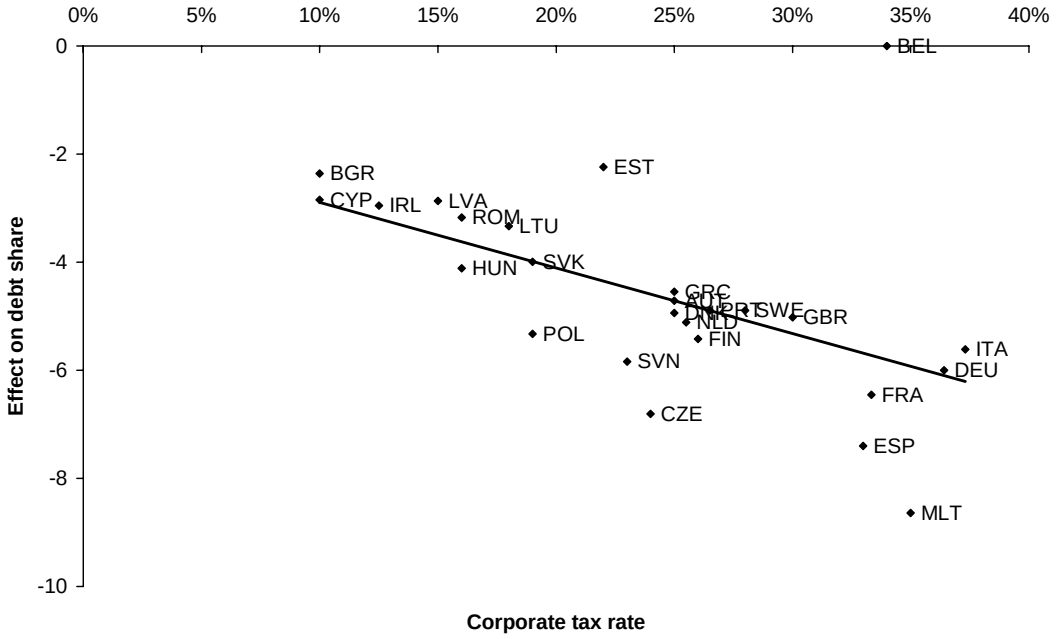
Table 4.1 Summary of results of ACE reforms with lump-sum adjustment[a]

Corporate tax revenue (ex-post) (% GDP)	– 1.6
Transfers (ex-post) (% GDP)	– 0.4
Debt share (Δ)	– 5.4
Cost of capital (Δ)	– 0.6
Wage (%)	2.7
Capital (%)	7.9
Employment (%)	1.0
GDP (%)	2.8
Welfare ((Δ in % GDP)	0.8

[a] GDP-weighted averages for EU 27.
Source: CORTAX simulations

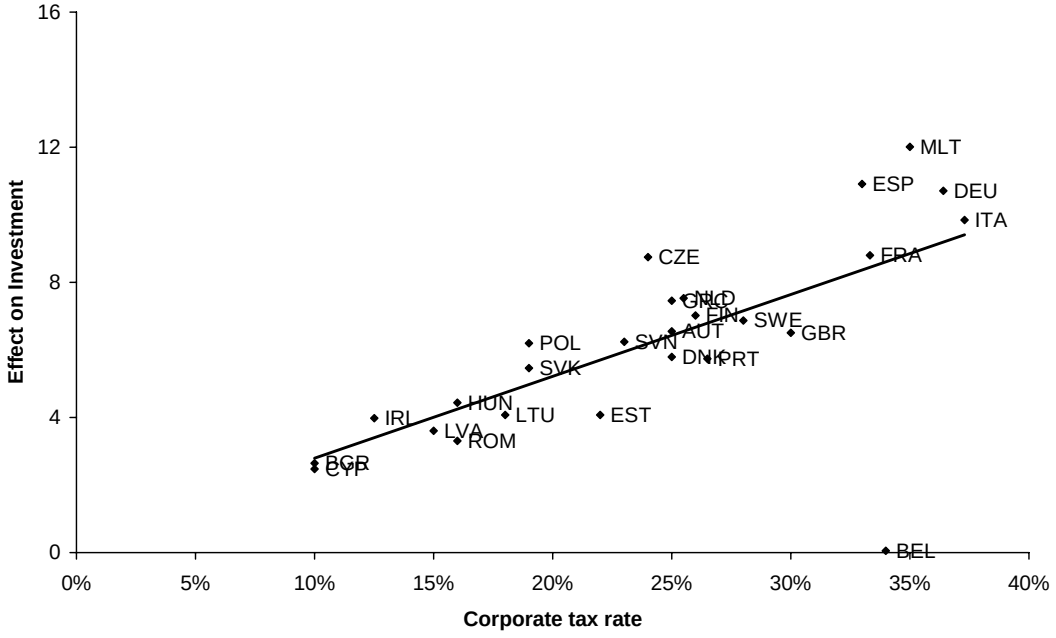
Figure 4.2 shows that, across countries (excluding Belgium), the impact on the debt share varies: it ranges between 2.4% in Bulgaria to 8.6% in Malta. The difference can be explained by the initial distortion in the financial structure, which is governed by differences in initial corporate tax rates. Indeed, the responsiveness of the debt share to the corporate tax declines in the corporate tax rate due to the convex agency cost.

Figure 4.2 Effect of ACE on debt shares



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 4.3 Effect of ACE on investment



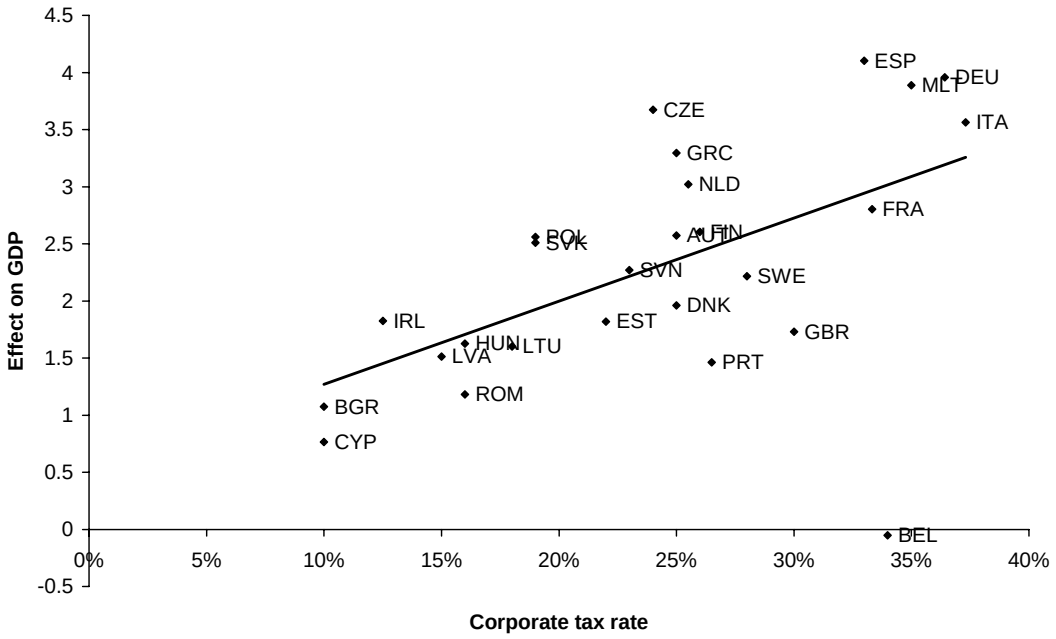
Source: CORTAX simulations, 26 European countries excluding Luxembourg

The second effect of the ACE is an expansion of investment by 7.9% on average in the EU. It is caused by the reduction in the cost of capital by 0.6%-points, which raises investment incentives. The effects on the cost of capital and investment differ across countries, as shown in Figure 4.3: capital expands by more than 10% in Malta, Spain and Germany but by less than 3% in Bulgaria and Cyprus. The differences are caused by the initial corporate tax systems, i.e. differences in corporate tax rates and corporate tax bases. In countries where the corporate tax system is more distortionary due small investment allowances and a high corporate tax rate, the ACE has more potential to reduce the cost of capital and to boost investment. Figure 4.3 shows that the corporate tax rate is a good proxy of the initial distortion.

The expansion of investment in light of the ACE has implications for the rest of the economy. The larger capital stock raises the productivity of labour. Firms will therefore increase their labour demand. This requires higher wages to stimulate workers to supply more labour as the uncompensated elasticity of labour supply is positive. The expansion of investment and employment increase GDP by 2.8% on average in the EU. Figure 4.4 shows that this GDP-effect ranges between approximately 1% in Cyprus, Bulgaria and Romania to more than 4% in Spain, Malta and Germany. Clearly, there is a positive correlation between the expansion of GDP and the initial corporate tax rate of a country.

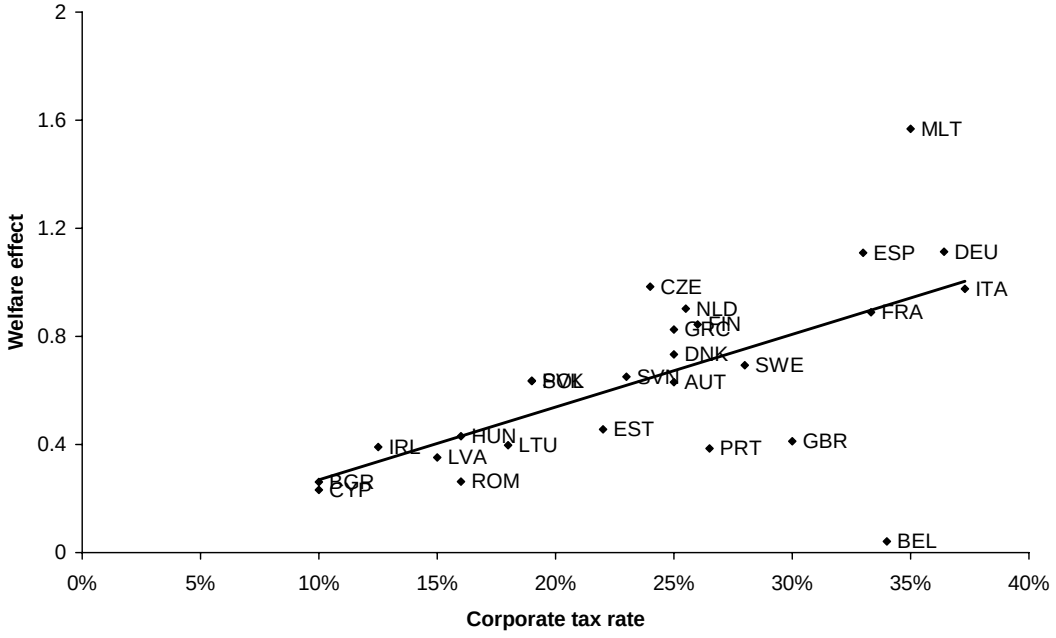
The expansion in capital, employment, wages and GDP imply that the ex-post revenue cost of the ACE are considerably smaller than the initial decline in corporate tax revenue. Indeed, while corporate tax revenue fall by 1.6% of GDP, the ex-post reduction in total tax revenue (and thus the necessary ex-post reduction in lump-sum transfers) is only 0.4% of GDP. Hence, the expansion of investment and employment and the rise in wages recover the aggregate tax base by approximately three quarter of the initial cost.

Figure 4.4 Effect of ACE on GDP



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 4.5 Welfare effects of ACE



Source: CORTAX simulations, 26 European countries excluding Luxembourg

The welfare effects of an ACE are smaller than the GDP effects. First, part of the additional production is due to more employment. This has a cost in terms of less leisure time, which is accounted for in the welfare effects. Second, the expansion of investment is due to capital imports from abroad. While this increases domestic production, it is accompanied by an increase in the net foreign asset position. This raises the difference between GDP and gross national income. Overall, welfare expands by 0.8% of GDP. Figure 4.5 shows that the effect ranges between a low 0.3% of GDP for Bulgaria and Romania to more than 1% in Germany, Italy and Spain. According to Figure 4.5, also the welfare effects of an ACE are positively correlated with initial corporate tax rates.

4.1.2 Adjusting corporate tax rates[9]

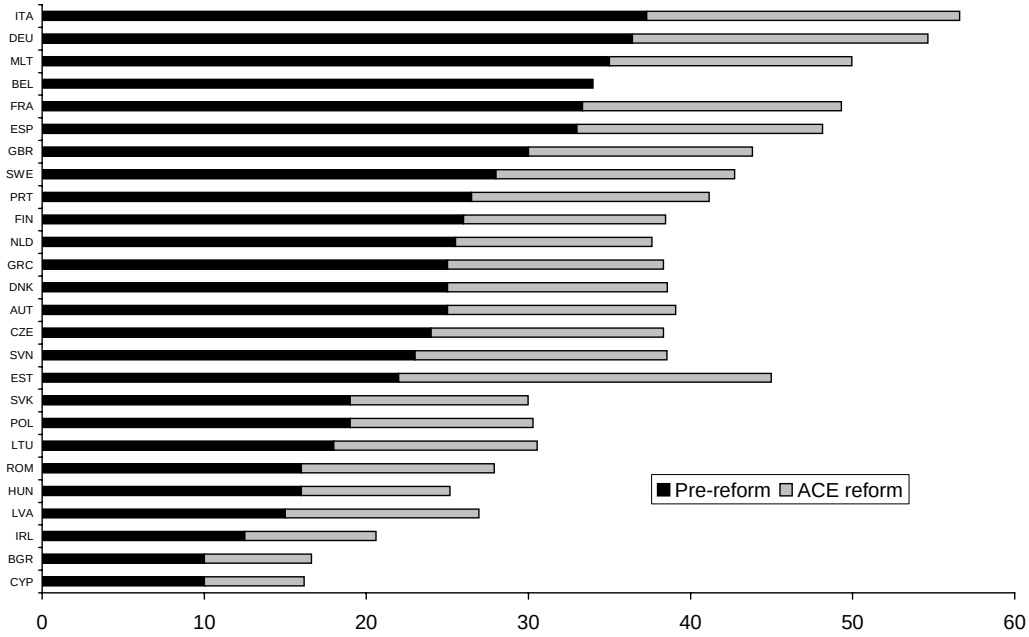
The previous section assumes that the government budget is balanced by adjusting lump-sum transfers to maintain a balanced government budget. This provides insight in the pure efficiency costs of corporate tax systems. The exercise is, however, artificial from a policy perspective as governments typically have no access to lump-sum taxes or transfers. Government will therefore use other distortionary taxes to finance an ACE. This section considers the case where the government budget is balanced by adjusting the statutory corporate tax rate. Hence, this experiment keeps the total tax burden on corporations unchanged, but modifies its structure. The rate is modified to balance the government budget ex-ante, i.e. before behavioural effects are taken into account. If government revenues change ex-post due to behavioural effects (such as changes in investment or employment), the budget is closed ex-post by an adjustment of consumption taxes.[10] To obtain feasible solutions in CORTAX, we put a cap on the maximum allowable corporate tax rate at 55% for all countries and of 35% for Estonia.[11] This rate becomes binding for Italy and Estonia. The economic effects of this ACE are presented in Table B.2 in Appendix B. This section discusses the main results and compares them with the outcomes of the previous subsection, i.e. where lump-sum transfers are used to balance the government budget. In the figures, we do not show the effects for Estonia, Malta, Belgium and Luxembourg which are outliers for their own specific reasons that we do not want to emphasise.

[9] Under an ACE system, fiscal depreciation rules are irrelevant for investment since accelerated depreciation reduces the equity allowance and vice versa (see section 2). We therefore do not consider an ACE combined with a simultaneous change in fiscal depreciation rules as the effects of such adjustments are immaterial.

[10] The reason for closing the budget ex-post with consumption taxes is that, for a number of countries, the model does not converge if corporate tax rates would be used to balance the budget ex-post. The effect on the consumption tax can now be interpreted as the ex-post revenue impact of the ACE reform.

[11] These are lowest caps for these countries, necessary to ensure a feasible solution with CORTAX.

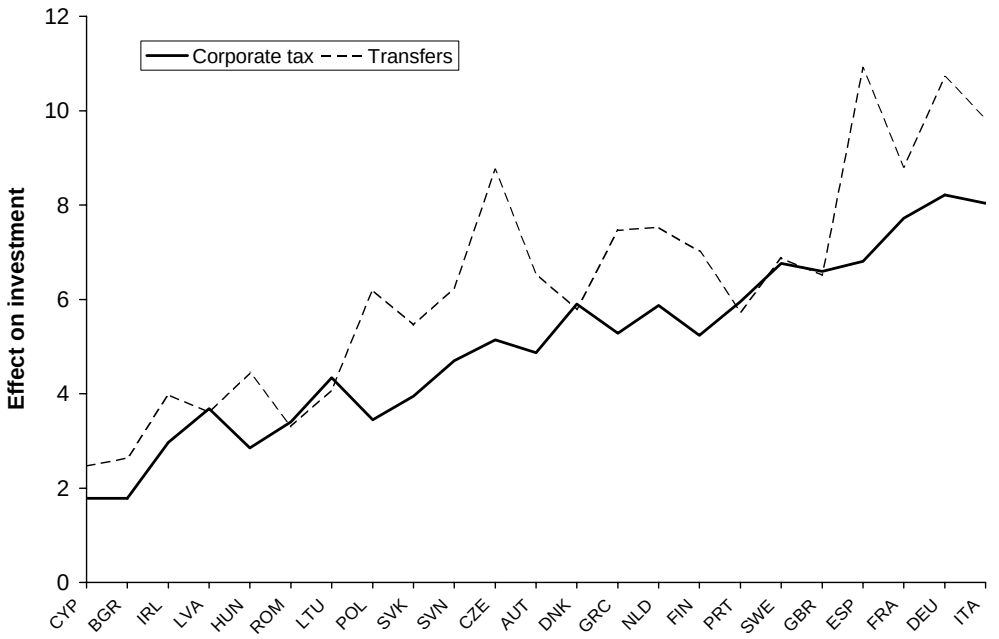
Figure 4.6 Increase in corporate tax rates necessary to balance the government budget ex-ante under ACE[a]



[a] Rates are capped at 55% in all simulations (binding for Italy). For Estonia, the maximum is set at 35%.
Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 4.6 presents the 2007 rates of corporate tax (black bars) and the necessary increase in these rates to ensure revenue-neutrality after the introduction of the ACE. The necessary increase in the corporate tax rate can be sizable: on average, the GDP-weighted corporate tax rate in Europe rise by 13%-points. The increase ranges between less than 10%-points in low-tax countries like Ireland, Bulgaria and Cyprus to more than 15% in Italy, Germany and France.

Figure 4.7 Investment effects of ACE under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

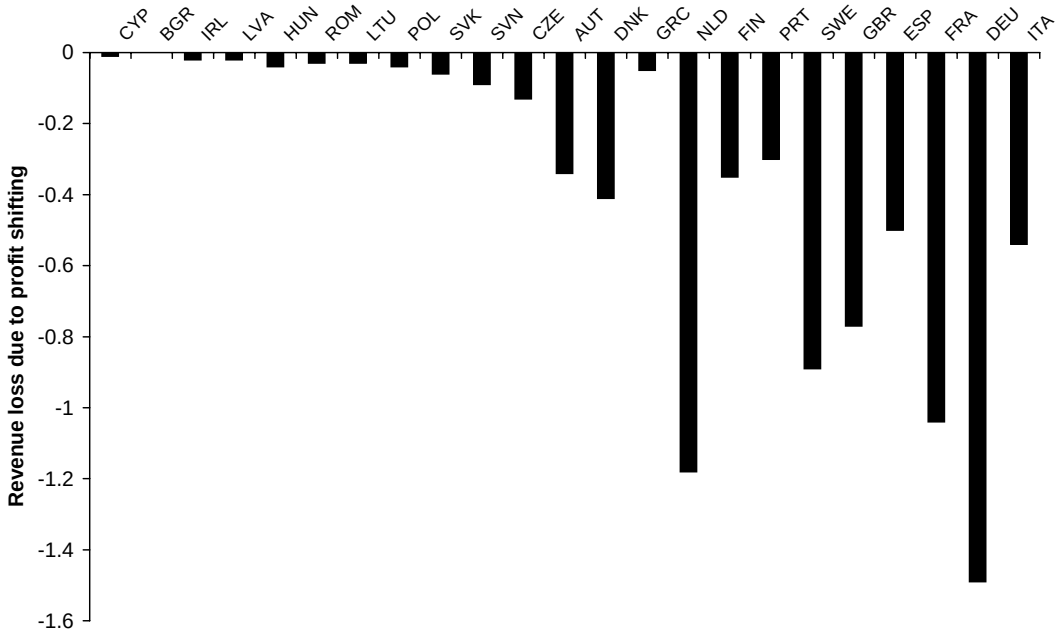
Figure 4.7 shows the effects of ACE on investment. To facilitate a comparison between the experiment with transfer adjustment and corporate tax rate adjustment, we draw lines between the points reflecting the country-effects. In the figures, countries are ranked according to their initial corporate tax rate.

We see that the investment effects of ACE do not differ much between the case of corporate tax rate adjustment and lump-sum transfer adjustment. In fact, by removing the tax on the normal return on capital, the ACE turns the corporate tax into a non-distortionary tax on economic rents. The corporate tax therefore has the same implications as a lump-sum tax. In CORTAX, however, corporate taxes still exert subtle income and incentive effects under an ACE. For instance, investment financed by debt is still affected by the corporate tax rate due to accelerated depreciation and nominal deductibility of interest. Moreover, economic rents earned in subsidiaries are ultimately repatriated to their foreign parents, which are subsequently owned by their domestic residents. Governments thus export the tax burden abroad when they raise the corporate tax rate under an ACE, making this policy more attractive for domestic residents than an adjustment of lump-sum transfers.

Figure 4.8 shows the effects on profit shifting. In CORTAX, a higher corporate tax rate in a country reduces the transfer price that parents charge for intermediate deliveries to their subsidiaries in other countries. Similarly, foreign parents charge a higher transfer price for intermediate deliveries with subsidiaries in the country that raises its tax rate. The modified transfer prices reduce the corporate tax base. The total effect depends on the importance of

multinationals in the economy. Figure 4.8 suggests that the effect of profit shifting is relatively small in Central and Eastern European countries. This is because inward and outward FDI stocks in these countries is relatively small. As a result, the increase in the corporate income tax rate exerts only small adverse revenue effects via profit shifting. Other countries in Figure 4.8 show larger adverse revenue effects from profit shifting, up to more than 1% of GDP in the Netherlands, Germany and the UK.

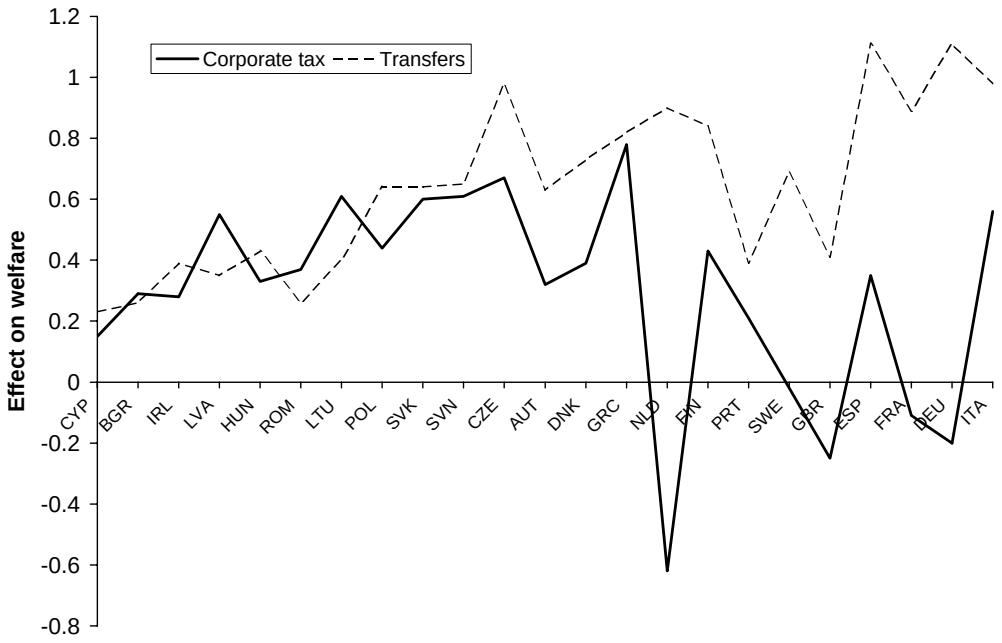
Figure 4.8 Effects of ACE on profit shifting under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

To arrive at the welfare effects of ACE, we combine the effects induced by profit shifting and the effects induced by the higher cost of capital. It illustrates the key trade-off for governments considering a unilateral introduction of an ACE. On the one hand, ACE reduces the cost of capital, stimulates investment and raises welfare. On the other hand, if ACE is financed by higher corporate tax rates, it erodes the tax base due to adverse profit shifting. Figure 4.9 shows the balance of these two effects for individual EU countries. We see that the negative welfare effect induced by higher rates dominates in four countries: the Netherlands, UK, France and Germany. In the other countries, the welfare gain associated with the lower cost of capital dominates.

Figure 4.9 Welfare effects of ACE under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

4.1.3 Adjusting labour or consumption taxes

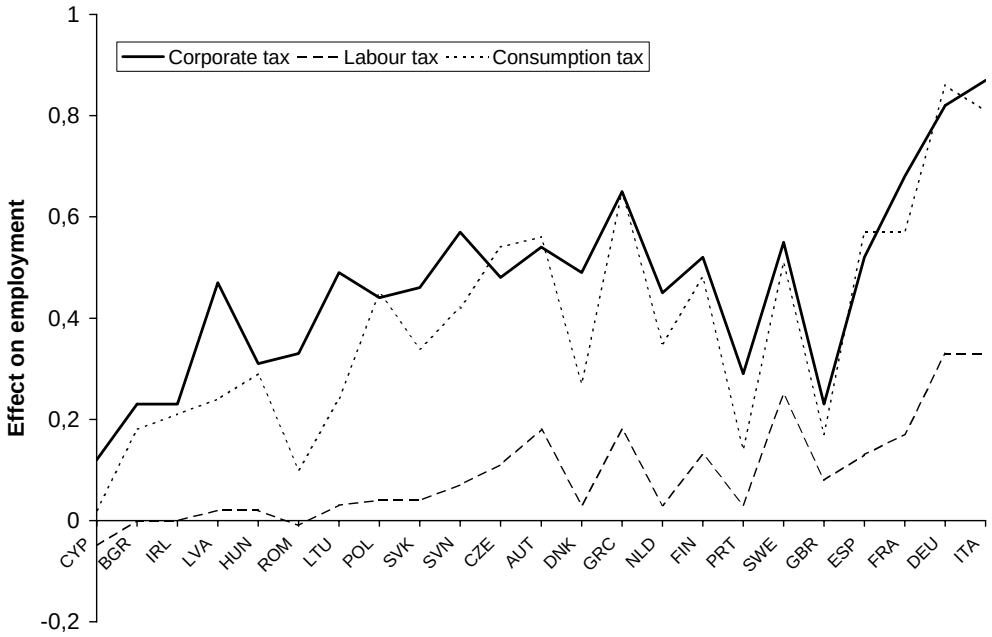
The revenue implications of ACE reforms may alternatively be compensated by adjustments in other taxes. One reason might be that an ACE is part of a reform whereby the government replaces an income-based tax system by a consumption-based tax system. It is not necessary under the consumption-based tax system to levy higher rates on economic rents, especially if these rates cause large effects on international tax planning and location. Thus, an alternative way to finance the ACE could be an increase in other taxes. Tables B.3 and B.4 in Appendix B show the effects of ACE if labour taxes and consumption taxes are adjusted, respectively. Here, we summarize the effects. Figure 4.10 shows the effects of ACE on employment if either corporate, labour or consumption taxes are used to balance the public budget. Figure 4.11 shows the effects on welfare.

Figure 4.10 shows that an ACE raises employment in almost all countries, even if labour taxes or consumption taxes are increased to balance the government budget. The positive effect on employment is considerably smaller in these cases, however, as compared to the adjustment in the corporate tax. The reason is that the incidence of the corporate tax falls on the fixed factor under an ACE, while higher consumption and labour taxes fall to a larger degree on labour and thus more strongly discourage labour supply.

The outcomes suggest that the consumption tax is less distortionary for labour supply than the labour tax. The reason is that the consumption tax applies to all income, both from labour

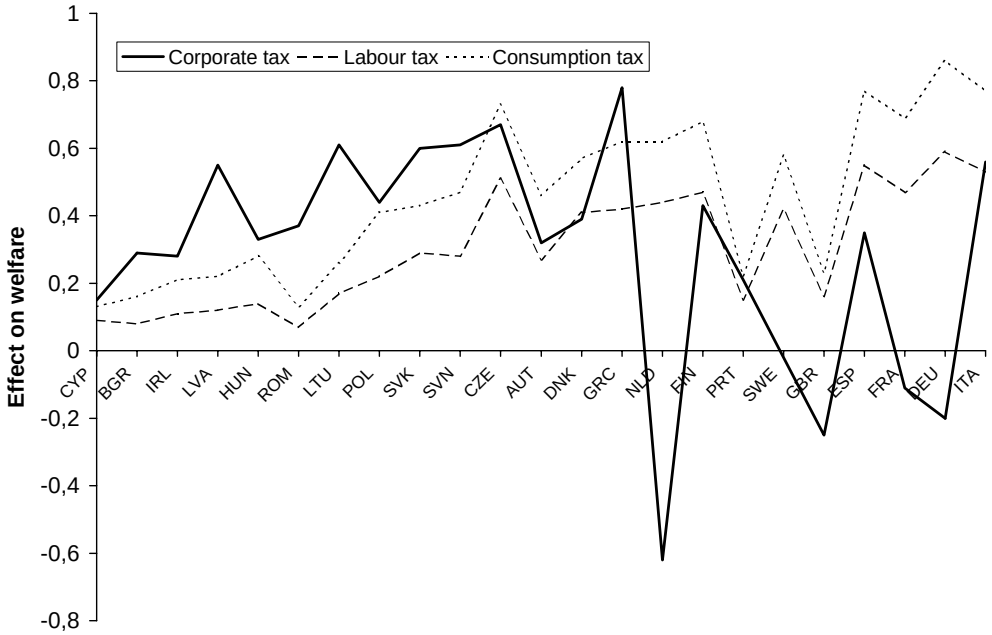
and profits. To the extent that its incidence is borne by the fixed factor, it mitigates the distortionary effect of the consumption tax on labour supply. The labour tax only applies to labour income. As a result, the labour tax features a narrower tax base than the consumption tax. It thus requires a more substantial increase in the marginal tax burden on labour to balance the budget, with larger adverse labour supply effects.

Figure 4.10 Effect of ACE on employment, alternative tax adjustments



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 4.11 Welfare effect of ACE, alternative tax adjustments



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

The welfare effects presented in Figure 4.11 suggest that some countries find it more attractive to finance the cost of ACE with an adjustment in corporate taxes, while others find it more attractive to raise consumption taxes. The former group of countries are on the left part of Figure 4.11, i.e. they feature low corporate tax rates. As these countries typically have a small multinational sector, a higher corporate tax rate is not so distortionary to finance the cost of an ACE. Therefore, the distortionary effect of a consumption tax exceeds that of the corporate tax. The group of countries on the right of Figure 4.11 feature higher tax rates and host a larger multinational sector. For these countries, higher corporate taxes are more distortionary than higher consumption taxes because of the adverse revenue effects via profit shifting.

4.2 European ACE reform

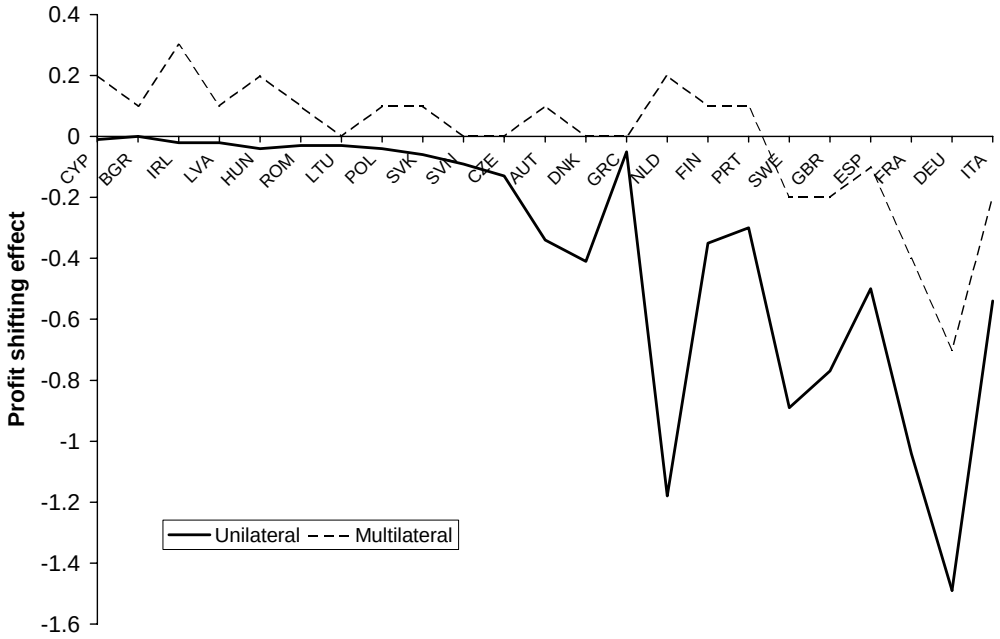
If countries would jointly implement an ACE, the implications will be different in the presence of international spillovers. This holds in particular if statutory corporate tax rates are adjusted, since these trigger fiscal spillovers via international profit shifting. Table B.5 in Appendix B shows the economic effects of a European introduction of ACE. Thereby, the government budget is balanced by an adjustment in corporate tax rates ex-ante.

Figure 4.12 compares the effect of the unilateral and the multilateral introduction of ACE on profit shifting. We see that the adverse effects on corporate tax-to-GDP ratios are smaller if

countries simultaneously increase their tax rates. Hence, whereas individual countries suffer from profit shifting if they unilaterally increase their corporate income tax rate, this effect is mitigated if other European countries do the same. Cooperation on corporate tax rates thus reduces the international spillovers through profit shifting and makes an ACE more attractive.

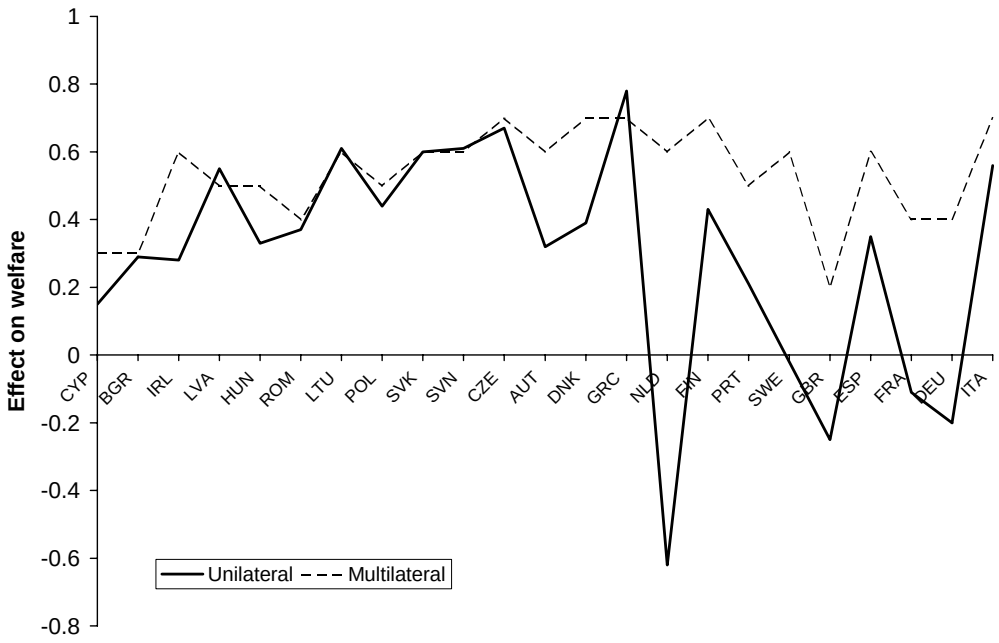
Figure 4.13 shows that a European-wide introduction of ACE yields a positive welfare effect for all EU countries, including the countries that suffer a welfare loss in case of a unilateral introduction of ACE. Indeed, the smaller international spillover via profit shifting render the ACE more attractive from a welfare perspective for all countries. The welfare gains from a reduction in the cost of capital now dominate the welfare loss induced by profit shifting. European coordination thus allows governments to design more efficient corporate tax systems by allowing more investment incentives and higher tax rates.

Figure 4.12 Effects of European and unilateral ACE on profit shifting



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 4.13 Effects of European and unilateral ACE on welfare



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

4.3 Outside tax havens and discrete location

The simulations so far take account of neither profit shifting by multinationals to tax havens outside the EU, nor discrete location decisions in presence of mobile economic rents. This section explores the impact of ACE if we include these channels. In the simulations, we assume that governments adjust statutory corporate tax rates to balance their budget, as both channels are triggered by changes in these rates. After discussing the impact of tax havens and discrete location choices separately, we present the combined impact of these two extensions.

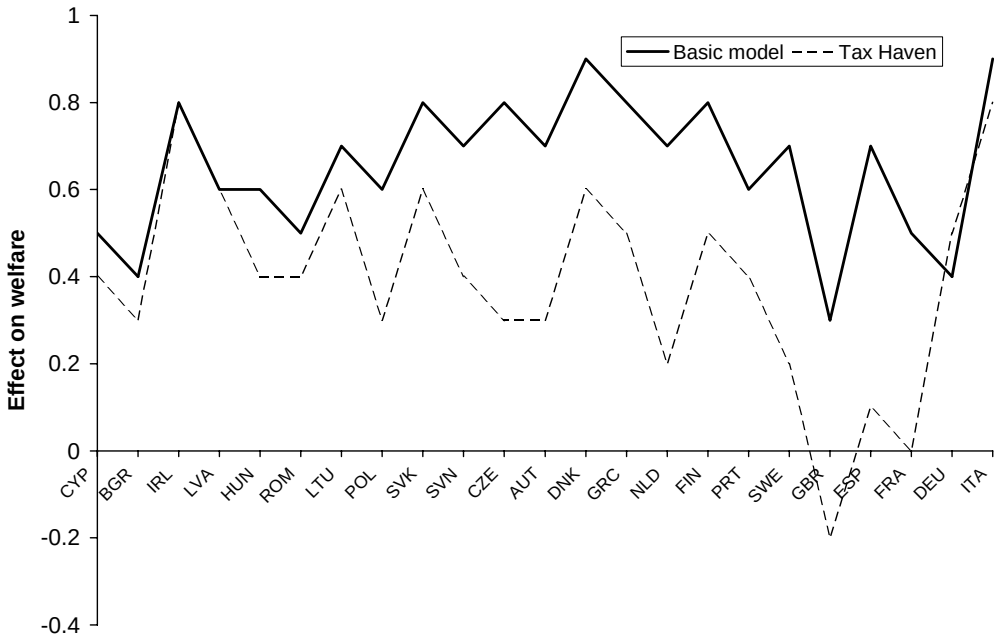
4.3.1 Outside tax havens

The impact of tax havens in CORAX does not depend on the unilateral or multilateral character of the ACE. Therefore, we only show the impact of tax havens in case of a European ACE. The effects are presented in Table B.6 of Appendix B.

Figure 4.14 shows the welfare effects of the ACE in the model with and without the tax haven. We see that the inclusion of the tax havens reduces the positive welfare effect of an ACE, especially in high-tax countries. On average, a European ACE raises welfare by approximately 0.6% of GDP if tax havens play no role, but by only 0.3% if tax havens are taken into account. The reason is that corporate tax rates increase by more than 18%-point, which is 4% more than in the absence of tax havens due to a smaller initial tax base. The higher rates

induce multinationals to shift more profits to the tax haven. In the UK and France, profit shifting even renders the welfare effect of a European ACE negative.

Figure 4.14 Welfare effect of a European ACE with and without outside tax havens



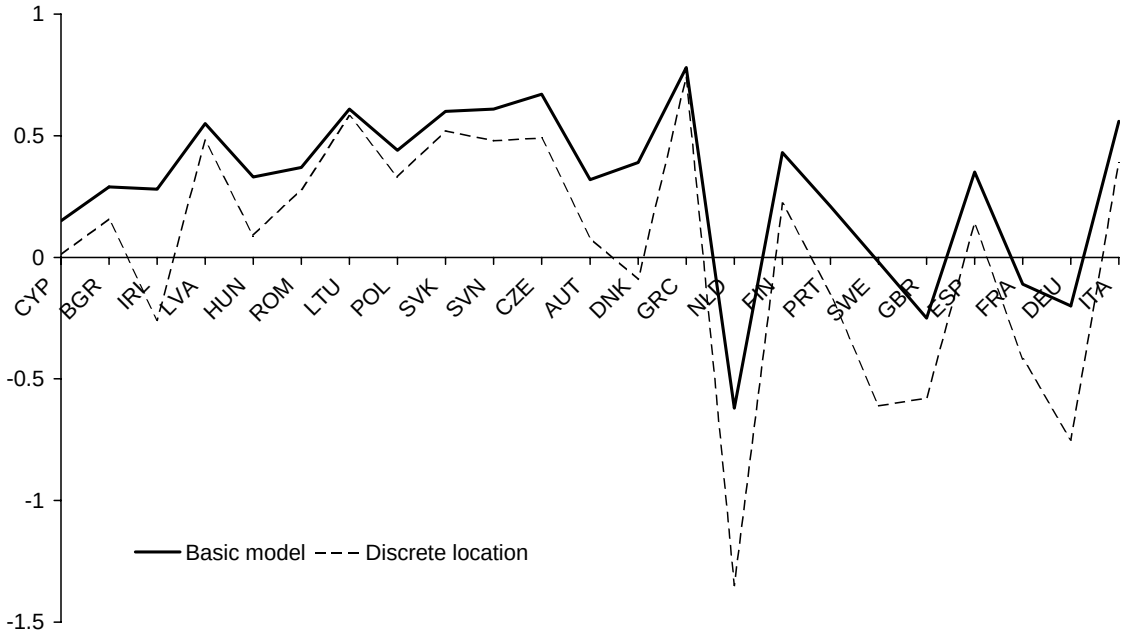
Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

The inclusion of tax havens exerts a relatively small effect on the welfare implications of ACE in Germany and Italy in Figure 4.14. The reason is that the corporate tax rate is capped at a maximum of 55%, which becomes binding for these countries. Since other countries need to increase their tax rates more substantially, Germany and Italy benefit from this as less profits are shifted to other EU countries. This offsets the adverse effects of higher tax rates on profit shifting to outside tax havens.

4.3.2 Discrete location

Discrete location choices matter for multinationals that choose between investment in different European countries. We therefore explore the implications of discrete location choices by considering unilateral ACE reforms. Table B.7 in appendix B shows the economic implications. Figure 4.15 compares the welfare effects in a model with and without discrete location choices. Note that the effects on location is a zero-sum game for the EU as a whole. The loss of capital in one country thus comes along with a gain in another country. These spillover effects are not visable in Figure 4.15, which only shows individual country effects of unilateral reforms.

Figure 4.15 Welfare effect of Unilateral ACE in EU countries, with and without discrete location



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

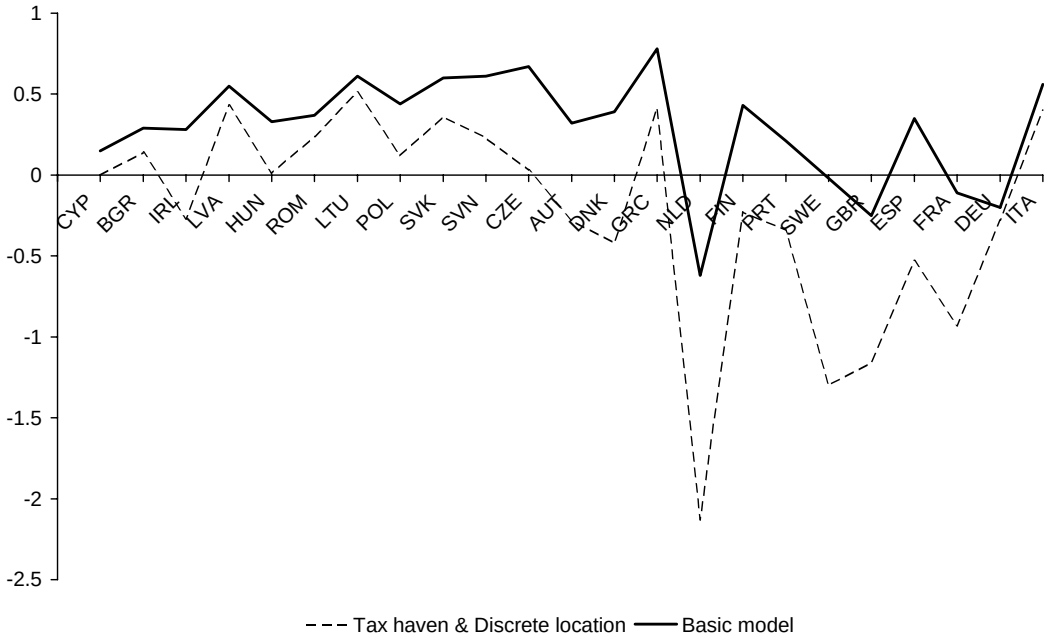
Figure 4.15 shows that the welfare effects of an ACE are less favourable in the presence of endogenous location choices. This is because the higher corporate tax rates increase the tax burden on profitable investments, thereby reducing the attractiveness of a location for investors. Indeed, the ACE moves the tax burden from the marginal investment towards economic rents. This creates location distortions if rents are mobile. An average European country benefits from an ACE in terms of welfare by around 0.3% of GDP if discrete location choices are ignored. In the presence of mobile rents, this effect is negligible. Especially high-tax countries in Western Europe are more likely to experience a reduction in welfare in response to the ACE as multinational firms are relatively important in those countries. The low-tax countries in Central and Eastern Europe still find the ACE attractive as these economies rely more heavily on purely domestic firms.

4.3.3 Tax havens and discrete location

To get an idea of the impact of ACE under both tax havens and discrete location choices, we consider a unilateral ACE in a model where both channels are incorporated. The effects are presented in Table B.8 of Appendix B. The welfare effects are shown in Figure 4.16. We see that ACE is considerably less attractive in terms of welfare in the extended model. In particular, the welfare gain of an ACE in the basic version of CORTAX by 0.3% on average turns into an average welfare loss of 0.15% when tax havens and discrete location choices are included. It shows how the two channels modify the attractiveness of an ACE when revenues need to be

recovered through higher corporate tax rates. Figure 4.16 shows that especially Western European countries suffer from severe welfare losses due to an ACE. A number of Eastern European countries where multinational firms play only a modest role in the economy may still find it attractive to introduce an ACE.

Figure 4.16 Welfare effect of Unilateral ACE in EU countries, with and without outside tax havens and discrete location



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

5 CBIT reform in CORTAX

This section discusses the outcomes of CBIT reforms in CORTAX. The structure is the same as in section 4. Section 5.1 starts with a unilateral CBIT where revenue neutrality is obtained by an adjustment of lump-sum transfers or other taxes. Section 5.2 compares unilateral and multilateral CBIT reforms. Finally, section 5.3 analyses CBIT in extended versions of CORTAX where tax havens and discrete location choices are modelled.

5.1 Unilateral CBIT reform in EU countries

We introduce CBIT reforms in the 27 Members of the EU by simulating an abolition of the interest deductibility. The interest deducted is simply computed in CORTAX as the product of total assets, the debt share taken from ORBIS and the nominal interest rate.[12] In principle, a CBIT reform along the lines of the US treasury proposal is more complicated than this. First of all, we do not consider changes in personal taxes on capital, which are all abolished under the US-treasury proposal. Second, it depends on the tax treatment of various forms of income, such as interest receipts from CBIT and non-CBIT entities. In particular, a CBIT reform would exempt interest received by firms when this income comes from other CBIT entities, such as banks. This may reduce the base broadening potential of the CBIT reform as compared to our assessment. However, interest received by banks would be taxed when it originates from non-CBIT entities, including foreign sources. This would further broaden the tax base. The approach taken in CORTAX seems a reasonable approximation of the revenue-impact of CBIT. For Belgium, we assume that the introduction of CBIT is accompanied by an abolition of the ACE, which avoids distortions in the financial structure in favour of equity finance.

[12] Debt-asset ratios taken from ORBIS reflect gross figures taken from the liability side of the balance sheet of firms. However, firms also hold equity stakes and deposits, i.e. on the asset side. For a proper analysis of CBIT, we need to determine the net debt shares. Using Dutch micro data from tax accounts, we compared the ratio using gross debt and equity and using net debt and equity. It appears that the ratios are almost the same.

5.1.1 Balanced budget with lump-sum transfers

In the simulations, the government budget is first balanced by adjusting government transfers to households. The simulation outcomes are presented in Table B.9 in Appendix B.

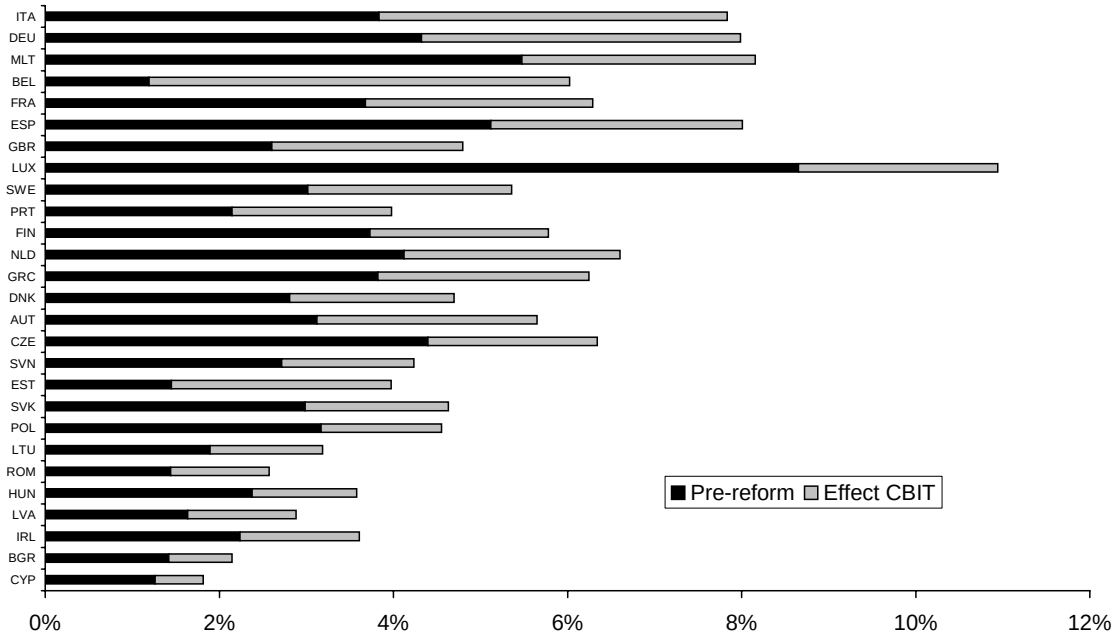
Table 5.1 Summary of results for CBIT reforms with lump-sum adjustment[a]

Corporate tax revenue (ex-post) (% GDP)	2.8
Transfers (ex-post) (% GDP)	0.7
Debt share (Δ)	– 7.7
Cost of capital (Δ)	1.1
Wage (%)	– 4.3
Capital (%)	– 12.0
Employment (%)	– 1.7
GDP (%)	– 4.6
Welfare ((Δ in % GDP)	– 1.2

[a] Weighted averages for EU countries.
Source: CORTAX simulations

By broadening the corporate tax base, the CBIT raises corporate tax revenue. Figure 5.1 shows by how much the corporate tax-to-GDP ratio increase in EU countries according to CORTAX. The black bars show the current corporate tax revenue; the grey bars show the additional revenue due to the abolition of interest deductibility. Together, the two bars add up to the post-reform corporate tax-to-GDP ratio. Corporate tax revenue rises by 2.7% of GDP, which is an increase of about 76% of the current revenue. This is larger than the revenue implications of an ACE. It is mainly because debt/asset ratios typically exceed 50% in the calibration of CORTAX.

Figure 5.1 Effects of CBIT on corporate tax-to-gdp ratio in CORTAX



Source: CORTAX simulations

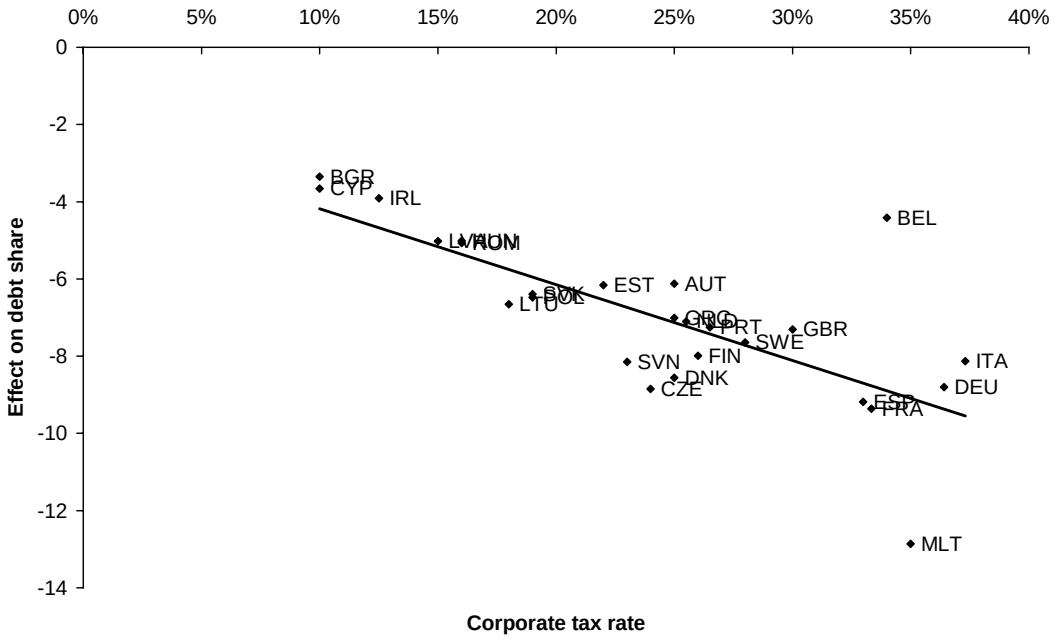
Table 5.1 summarises the economic implications of CBIT according to CORTAX for the average of the EU. Again, the effects are driven by responses in the financial structure of firms and responses in investment. Like the ACE, the CBIT eliminates the tax advantage of debt over equity, thereby reducing the debt share by 7.7% on average. The effect differs between countries. Figure 5.2 shows that it varies with the initial corporate tax rate. The reduction in the debt share ranges from less than 4% in Bulgaria and Cyprus to more than 9% in France and Spain.

Comparing this result with the ACE suggests that the impact of CBIT on corporate financial policy is not symmetric. In particular, while the tax distortion on debt-equity choices is fully neutralised under CBIT, this is not the case under the ACE. The reason is that ACE applies to the capital stock registered in the tax accounts, while the interest deductibility applies to the actual interest payments. As a result, accelerated fiscal depreciation increases in value under interest deductibility and still favour debt over equity finance.

Table 5.1 shows that CBIT raises the cost of capital by 1.1%-point on average in the EU. This reduces investment by 12%. This contrasts to the impact of ACE. Indeed, disallowing interest as a cost for corporate taxation raises the tax burden on interest and, therefore, on debt-financed investment. Figure 5.3 shows that the negative impact on investment is correlated with the corporate tax rate: the higher the rate, the stronger investment falls. This is due to the differential impact of CBIT on the cost of capital in different countries. The cost of capital rises by 0.2%-point in Bulgaria and Cyprus and by around 1½%-point in Italy and Germany. The

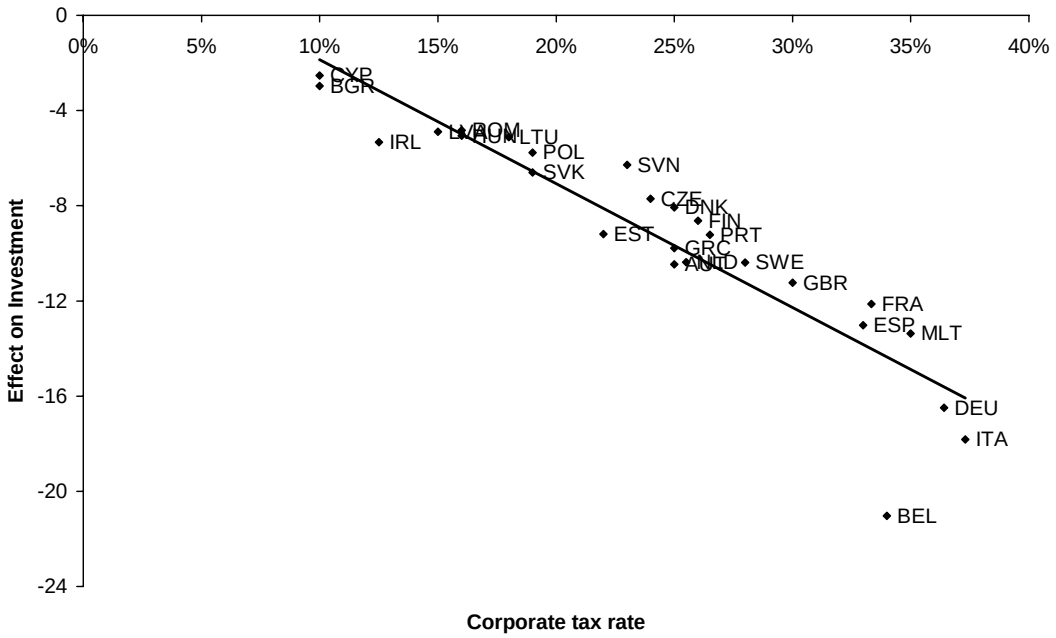
initial corporate tax systems determine these distortionary effects, which is proxied by the tax rate. In Belgium, we find a reduction in investment of 21%, which is due to the simultaneous introduction of CBIT and the abolition of ACE.

Figure 5.2 Effect of CBIT on debt shares



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 5.3 Effect of CBIT on investment

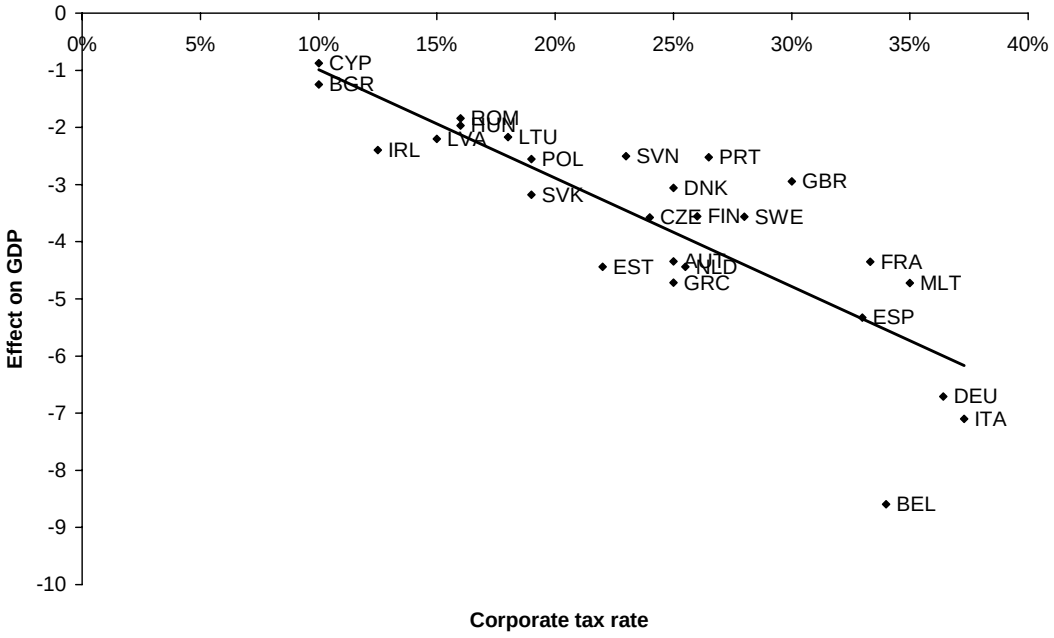


Source: CORTAX simulations, 26 European countries excluding Luxembourg

The reduction in investment due to CBIT reduces labour productivity and, therefore, wages. This discourages labour supply and reduces employment. The reduction in capital and labour cause a decline in GDP by 4.6% on average in the EU. This effect varies between – 0.9% in Cyprus and around – 7% in Germany and Italy. The contraction of economic activity has implications for the revenue effects of the CBIT, ex-post. Indeed, while corporate tax revenues increase by 2.8% of GDP ex-ante, aggregate tax revenues rise by only 0.6% of GDP ex-post. Hence, the erosion of corporate, labour and consumption tax bases cost more than three quarters of the initial revenue.

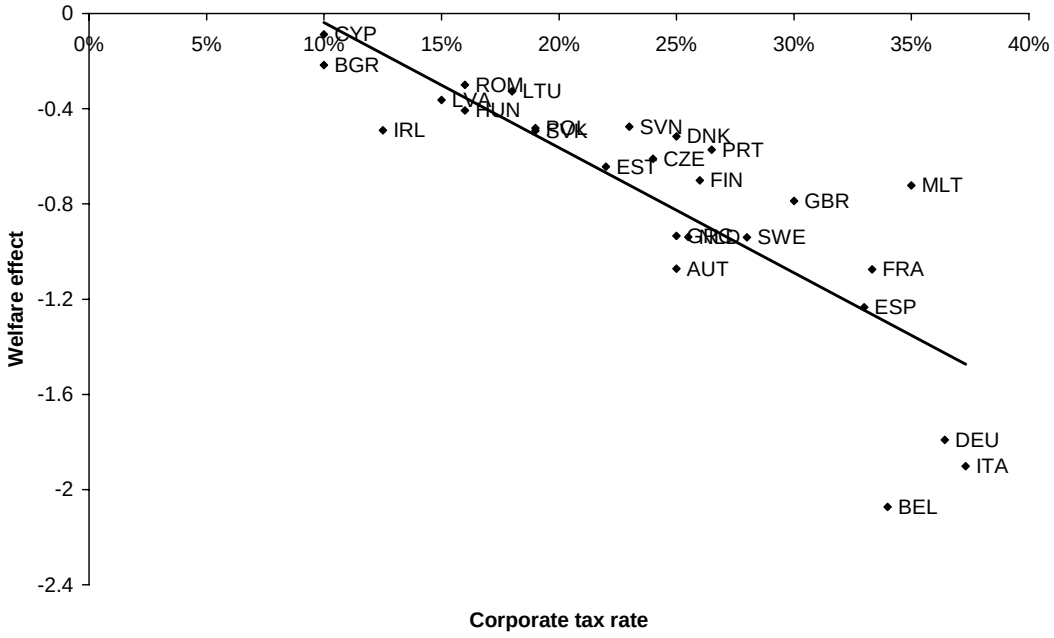
The welfare effects of CBIT are smaller than the effects on GDP. This is due to an improvement in the net foreign asset position against the rest of the world and the extra leisure associated with less employment. On average, welfare falls by 1.2% of GDP. The effect ranges between – 0.2% in Cyprus and – 1.9% in Italy. Figure 5.5 demonstrates that the negative welfare effects of CBIT correlate with the initial corporate tax rate.

Figure 5.4 Effect of CBIT on GDP



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 5.5 Welfare effects of CBIT



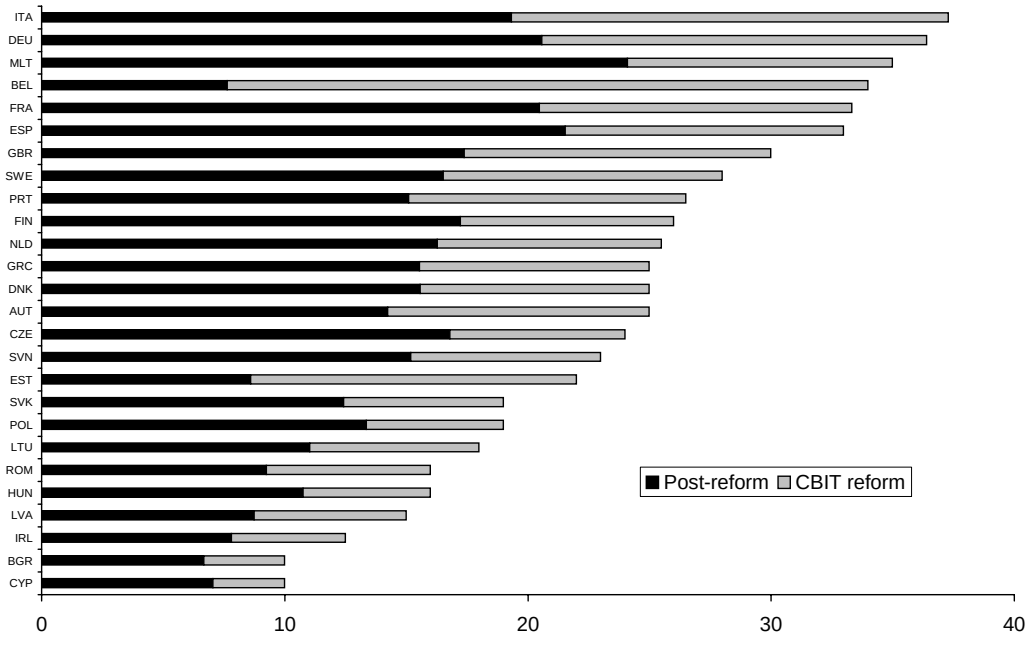
Source: CORTAX simulations, 26 European countries excluding Luxembourg

5.1.2 Adjusting corporate tax rates

This section considers CBIT when the government recycles the revenues via lower corporate tax rates. As under ACE, the corporate tax rate is modified ex-ante, i.e. before behavioural effects are taken into account. If government revenues change due to such behavioural effects, the budget is closed ex-post by consumption taxes. The economic effects of CBIT with corporate tax rate adjustments is presented in Table B.10 in Appendix B. In the figures in the rest of this section, we usually exclude Estonia, Malta, Belgium and Luxembourg.

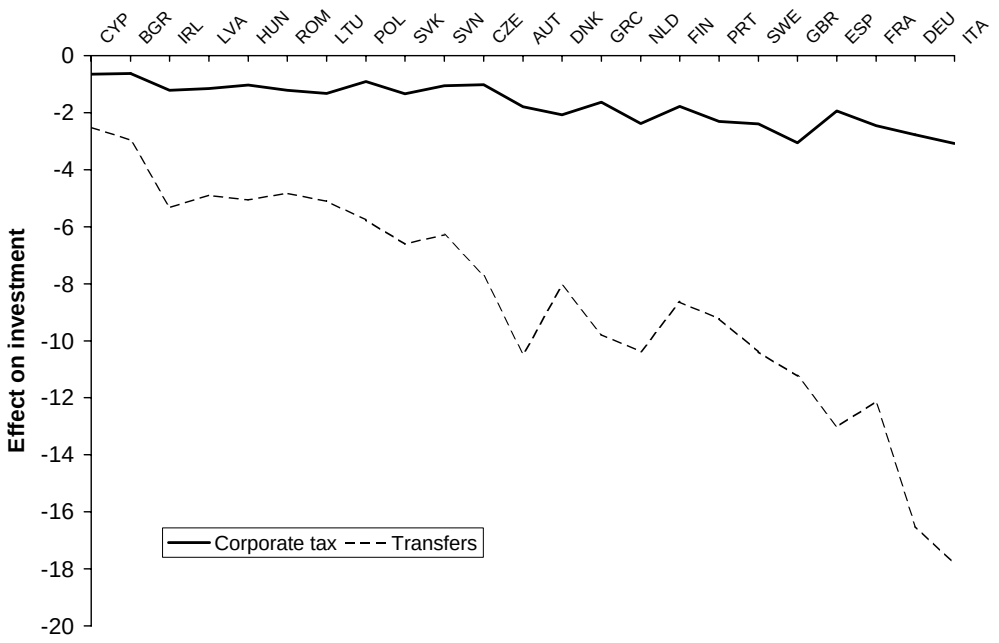
Figure 5.6 shows that CBIT allows for a substantial reduction in corporate tax rates. The black bars show the new tax rates after the CBIT reform and the grey bars denote the reduction in tax rates made possible by CBIT. On average in the EU, the rate is reduced by 12.3%-points. The reduction in tax rates range between 3%-points in Cyprus and Bulgaria to 18%-points in Italy and almost 16% in Germany. The Belgian rate is reduced by more than 23%-points due to the simultaneous abolition of the ACE and introduction of CBIT. Compared to the ACE, the change in tax rates seems small. Remind, however, that the tax base is considerably broader under CBIT than under ACE: the CBIT tax base contains capital income and economic rents; the ACE tax base contains only economic rents. The revenues raised per %-point under ACE are therefore smaller than under CBIT.

Figure 5.6 Reduction in corporate tax rates made possible by CBIT[a]



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 5.7 Investment effects of CBIT under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

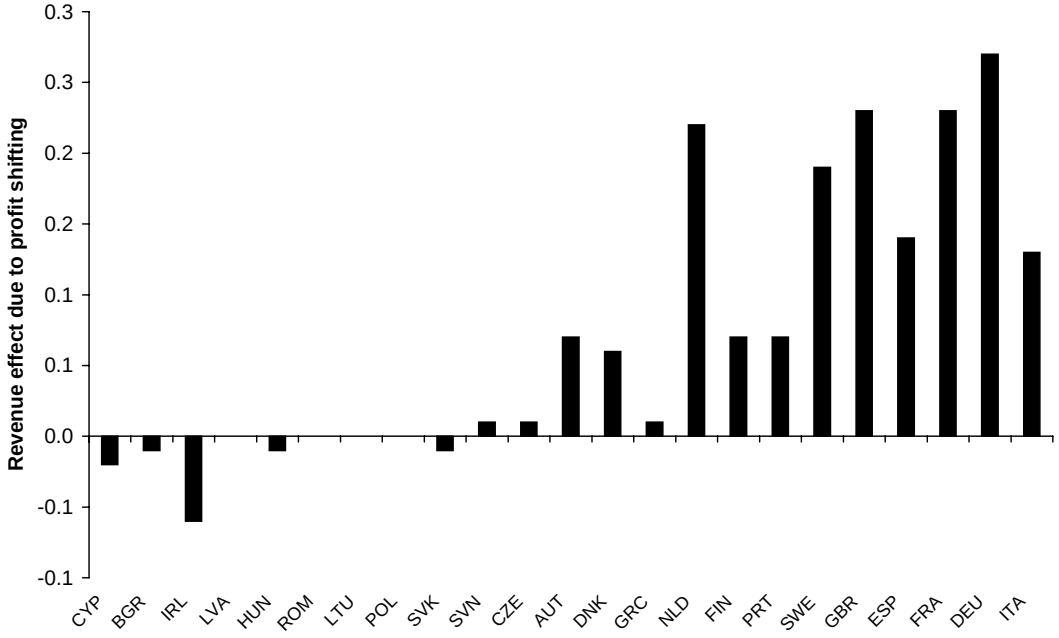
Figure 5.7 shows the effects of CBIT on investment. We again draw lines between the points to facilitate the comparison and rank countries according to their initial corporate tax rate. We see that the negative economic effects of the CBIT become considerably smaller if the revenues are used to cut corporate tax rates as compared to lump-sum recycling. The reason is that the lower tax rate reduces the cost of capital, both on equity-financed investment and debt-financed investment. The average increase in the cost of capital falls from 1.1% in case of transfers to 0.2% in case of lower corporate tax rates. As a result, investment falls by only 2% instead of 12%; GDP falls by 0.8% instead of 2.8%. These results suggest that CBIT still exacerbates investment distortions by shifting the tax burden away from economic rents towards the return on (debt-financed) investment, but the impact is mitigated by rate reduction.

Figure 5.8 shows the effects of lower corporate tax rates on profit shifting, which is the opposite of the effects under an ACE. Indeed, a lower corporate tax rate in a country reduces the transfer price that home parents charge for intermediate deliveries to their subsidiaries in other countries and foreign parents charge a lower transfer price for intermediate deliveries with home subsidiaries. The effect on the corporate tax base depends on the importance of multinationals. It is small for the Central and Eastern European countries and large for Western European countries. Hence, the lower corporate tax exerts relatively large benefits via profit shifting to some of the West-European countries, up to more than ½% of GDP in Belgium.

The effects on profit shifting are smaller than the adverse revenue consequences under the ACE reforms, where revenue effects go up to more than 1% of GDP. The reason is that the

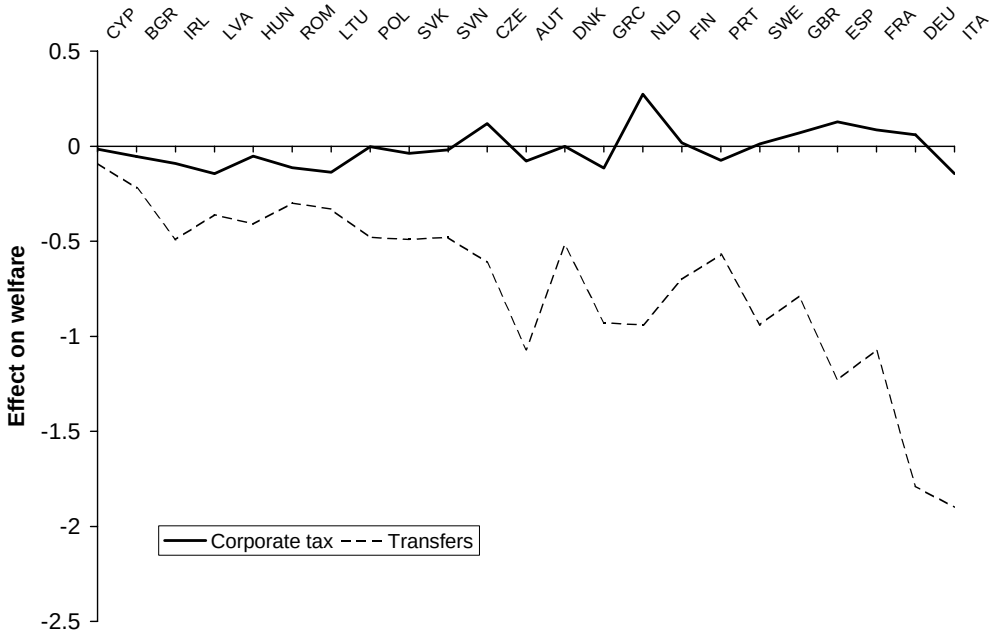
convex cost of transfer price manipulation makes it increasingly costly to shift profits into countries if they feature a lower corporate tax rate. The profit shifting channel is therefore not symmetric between tax increases and tax reductions.

Figure 5.8 Effects of CBIT on profit shifting under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 5.9 Welfare effects of CBIT under corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

The welfare effects of CBIT illustrate the same trade-off as the ACE but in an opposite way, namely between the welfare costs of a higher cost of capital and the welfare gain due to inward profit shifting. Figure 5.9 shows that the balance of these two effects is marginally positive for a number of countries, mainly those featuring high corporate tax rates (i.e. on the right in Figure 5.9). Hence, countries that would suffer most from CBIT under lump-sum recycling are most likely to benefit if revenues are recycled through lower corporate tax rates. Other countries marginally lose from CBIT in terms of welfare as the impact of a higher cost of capital dominates the gains from profit shifting.

Combining CBIT with more generous depreciation allowances

In principle, the revenues from base broadening under CBIT could be used alternatively to grant more generous depreciation allowances. This would be an effective way to offset the upward effect of the CBIT on the cost of capital. In the most extreme version, CBIT could be combined with immediate expensing of investment. Under such a system, which comes close to an R-base cash-flow tax, marginal investment is undistorted by the tax system. An R-base cash-flow tax, however, leaves all interest received untaxed so that financial institutions go untaxed. This differs from CBIT where interest received from non-CBIT entities will still be taxed at the level of financial intermediaries.

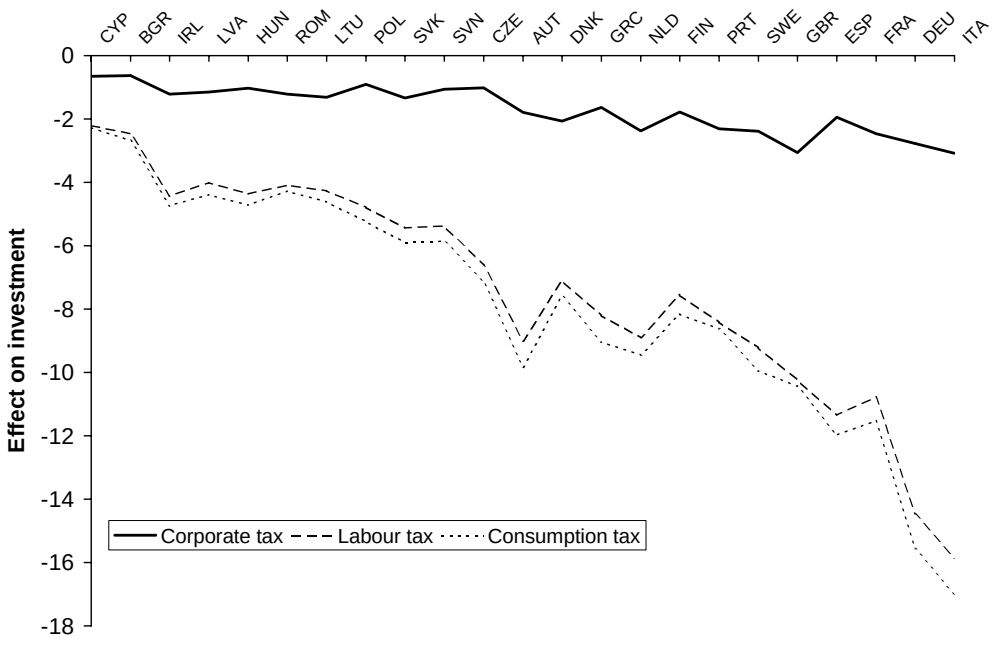
While using revenues from CBIT to grant more generous depreciation allowances will mitigate marginal investment distortions, it leaves less room for cutting statutory corporate tax rates. In fact, it relaxes the trade-off inherent in the design of CBIT between the adverse effect on investment and the positive effect on location and profit shifting. Granting more generous depreciation instead of lowering corporate tax rates, reduces both of these effects.

5.1.3 Adjusting labour or consumption taxes

The revenue of CBIT may alternatively be used to cut labour or consumption taxes. Tables B.11 and B.12 in Appendix B show the effects for all countries, which are summarised in this section.

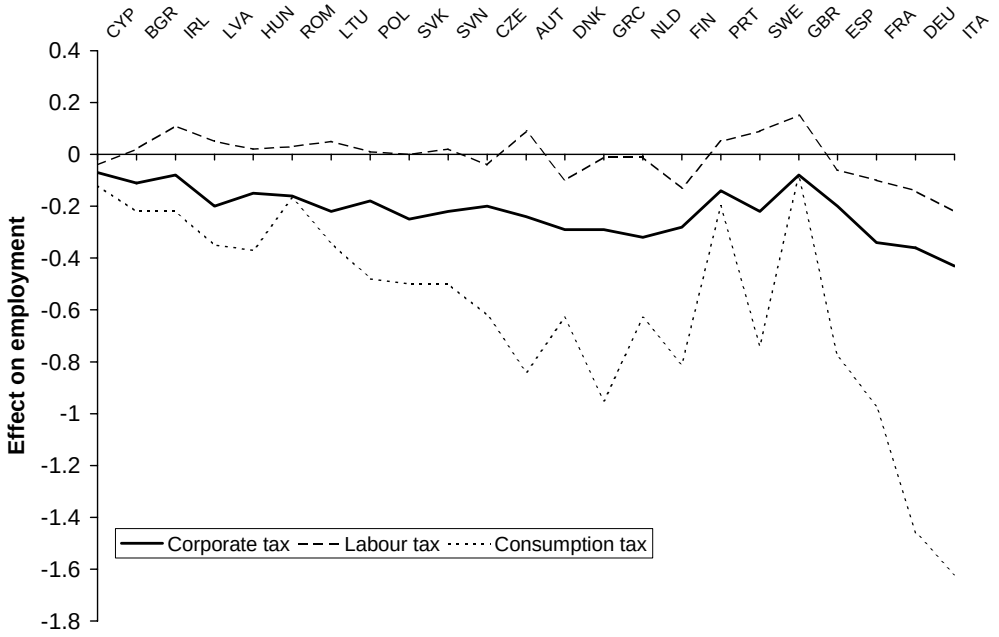
Figures 5.10 and 5.11 show the effects of CBIT on investment and employment, respectively, under alternative ways to recycle the revenue. Figure 5.10 shows that investment falls considerably if labour taxes or consumption taxes are reduced, but that this adverse effect is reduced if corporate tax rates are cut. The reason is that lower consumption or labour taxes do not compensate for the increase in the cost of capital induced by CBIT, as the lower corporate tax rate does. These taxes do affect labour supply though. According to Figure 5.11, the negative effect of CBIT on employment is mitigated or even turned into an expansion if countries use the proceeds to reduce labour taxes. Indeed, compared to corporate taxes, lower labour taxes are more effective to stimulate labour supply incentives and to raise employment. On average, employment falls by 0.1% if the revenues from CBIT are used to cut labour taxes. With lower consumption or corporate taxes, employment falls by 0.9% and 0.3%, respectively.

Figure 5.10 Effects of CBIT on investment, alternative tax adjustments



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

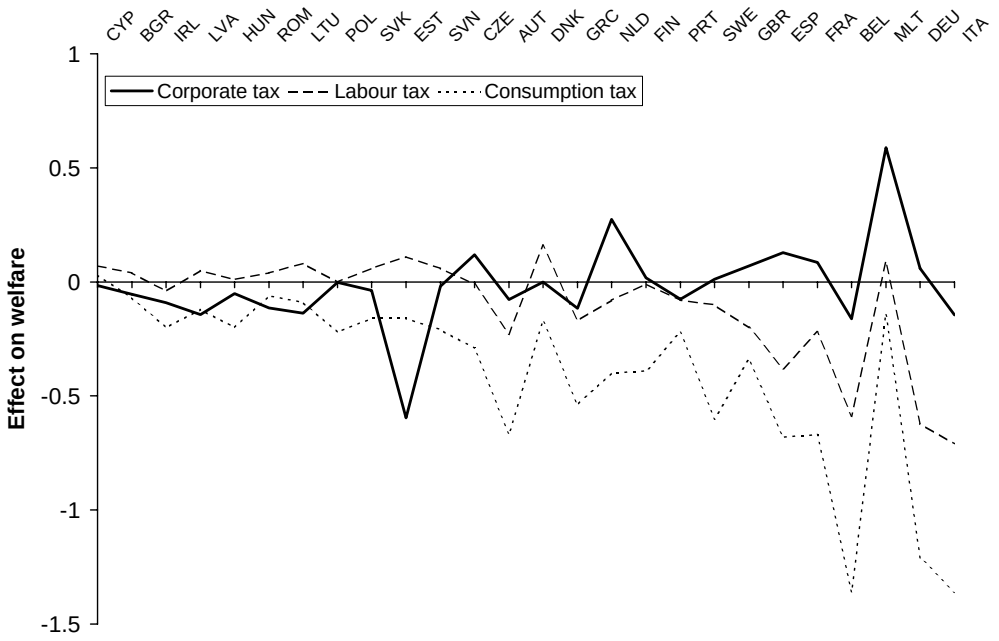
Figure 5.11 Effect of CBIT on employment, alternative tax adjustments



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

CBIT reduces GDP more under lower labour or consumption taxes than under lower corporate taxes. This is due to the larger adverse investment effects. Figure 5.13 shows that the difference in welfare effects is smaller. This is because lower capital import reduces the net foreign asset position and exerts only a small effect on national welfare (via the impact of capital on wages). For a number of countries, we actually observe an increase in welfare if the proceeds of CBIT are used to cut labour taxes, despite the decline in GDP. This applies mainly to countries that already feature a low corporate tax rate (i.e. left in Figure 5.13). In other countries, welfare drops. Indeed, countries with higher corporate tax rates (i.e. right in Figure 5.13) will find it more attractive to reduce corporate tax rates instead of labour or consumption taxes. If the revenues from CBIT are used to cut consumption taxes, we find that welfare drops in all countries.

Figure 5.12 Welfare effect of CBIT, alternative tax adjustments



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

5.2 European CBIT reform

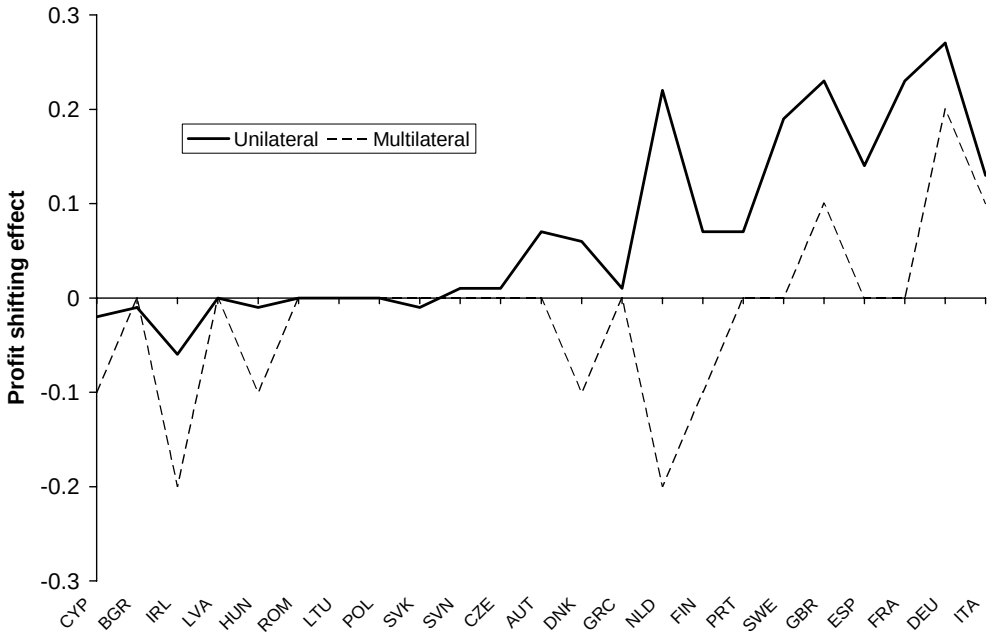
International spillover effects can be mitigated if European countries simultaneously introduce CBIT and reduce statutory corporate tax rates.[13] Table B.13 in Appendix B shows the economic

[13] In principle, the ex-ante revenue effect of CBIT may differ between a unilateral and a multilateral introduction. Indeed, if a single countries introduces CBIT, interest received from abroad will be considered as non-CBIT income and, therefore, be liable to tax in the CBIT country. In contrast, if all countries adopt CBIT, the interest will come from another CBIT entity and,

effects of a European introduction of CBIT and the budget is balanced by an adjustment in corporate tax rates. Here, we compare these results with a unilateral policy.

Figure 5.13 compares the effect of the unilateral and the multilateral introduction of CBIT on profit shifting. We see that the expansion in individual corporate tax-to-GDP ratios is smaller if countries simultaneously reduce their tax rates. Hence, while individual countries may find it attractive to introduce CBIT and reduce corporate tax rates, this policy is less likely to be attractive from an EU perspective. Figure 5.13 reveals that some low-tax countries actually lose revenue under a multilateral reform. This is because the reduction in corporate tax rates in high-tax countries mitigates profit shifting towards low-tax countries, even though these countries reduce their rates too. Indeed, the convex cost of manipulating transfer prices implies that profit shifting into low-tax countries rises only slightly while the reduction in profit shifting from high-tax countries drops relatively much.

Figure 5.13 Effects of European and unilateral CBIT on profit shifting



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 5.14 shows the welfare effects of a European-wide and a unilateral introduction of CBIT. As a unilateral reduction in corporate tax rates is more beneficial for countries than a simultaneous reduction in all countries, we find less favourable welfare effects under the latter policy. Indeed, welfare declines in most countries due to CBIT under a joint European implementation.

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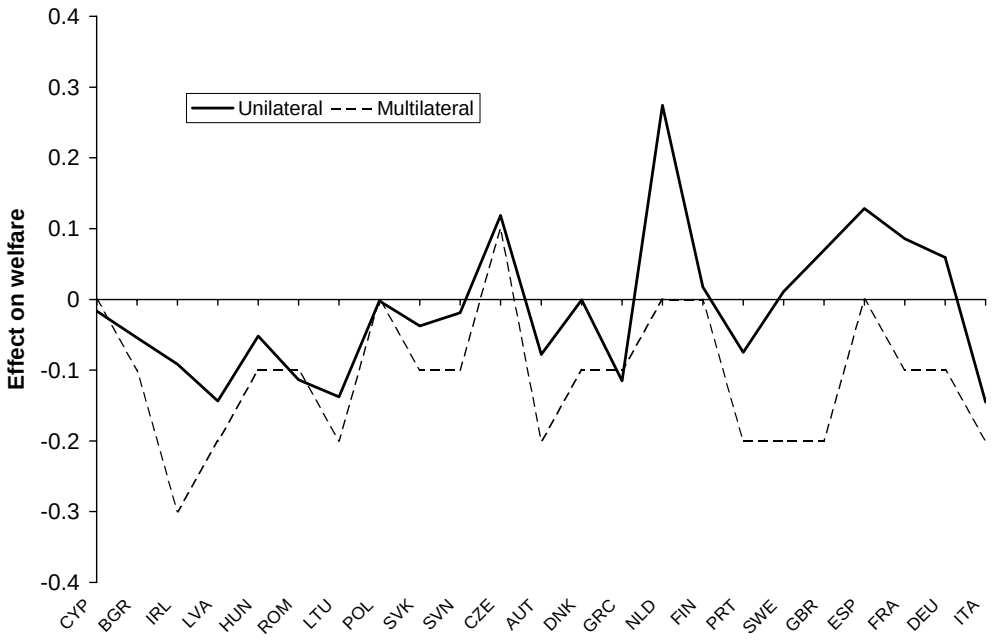
therefore, will be exempt from taxation. The revenue from CBIT for an individual country will then be smaller than under a unilateral CBIT. In the simulations, we ignore this difference.

Figure 5.14 Effects of European and unilateral CBIT on welfare



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

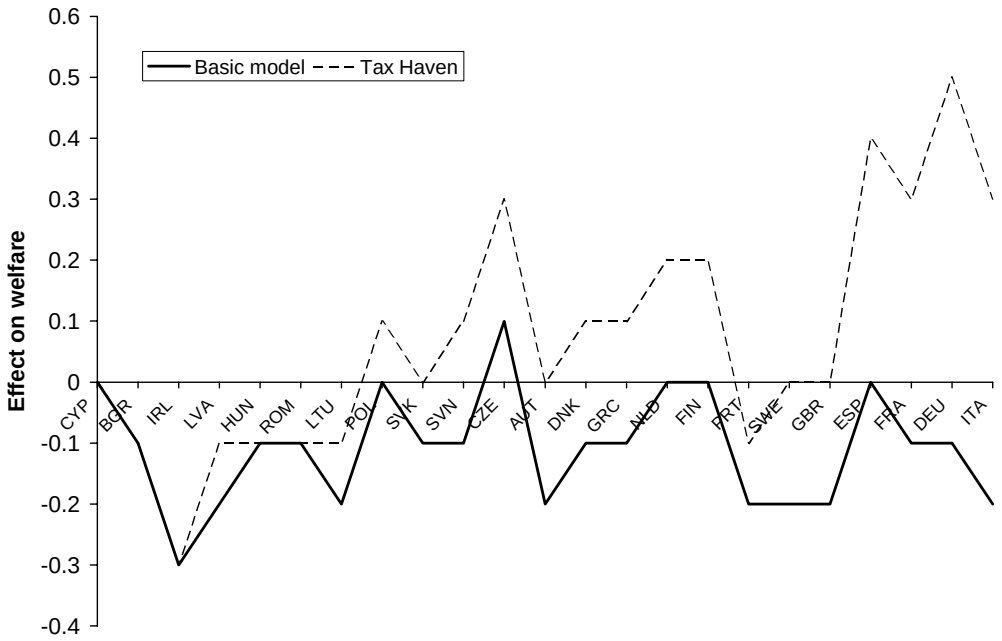
5.3 Outside tax havens and discrete location

This section explores the impact of CBIT if we include profit shifting to tax havens and discrete location decisions in CORTAX. We assume that statutory corporate tax rates are adjusted to balance the government budget ex-ante (consumption taxes ensure revenue neutrality ex-post).

5.3.1 Outside tax havens

Figure 5.15 shows the welfare effect of a European CBIT with a simultaneous reduction in corporate tax rates. It compares the effects with the model that excludes tax havens. A European CBIT typically reduces welfare by approximately 0.1% of GDP on average if we ignore outside tax havens. The inclusion of tax havens renders the European CBIT welfare enhancing on average for the EU (+ 0.2% of GDP). Especially Western European countries benefit as the lower corporate tax rates reduce the amount of profits shifted to tax havens. This welfare gain occurs because firms engage in less costly profit shifting efforts while they now pay to their national governments instead of foreign tax haven governments. The welfare gain runs up to between 0.4% and 0.5% for countries that feature the highest tax rates, such as Germany and Spain.

Figure 5.15 Including tax havens, welfare effect of European CBIT with corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

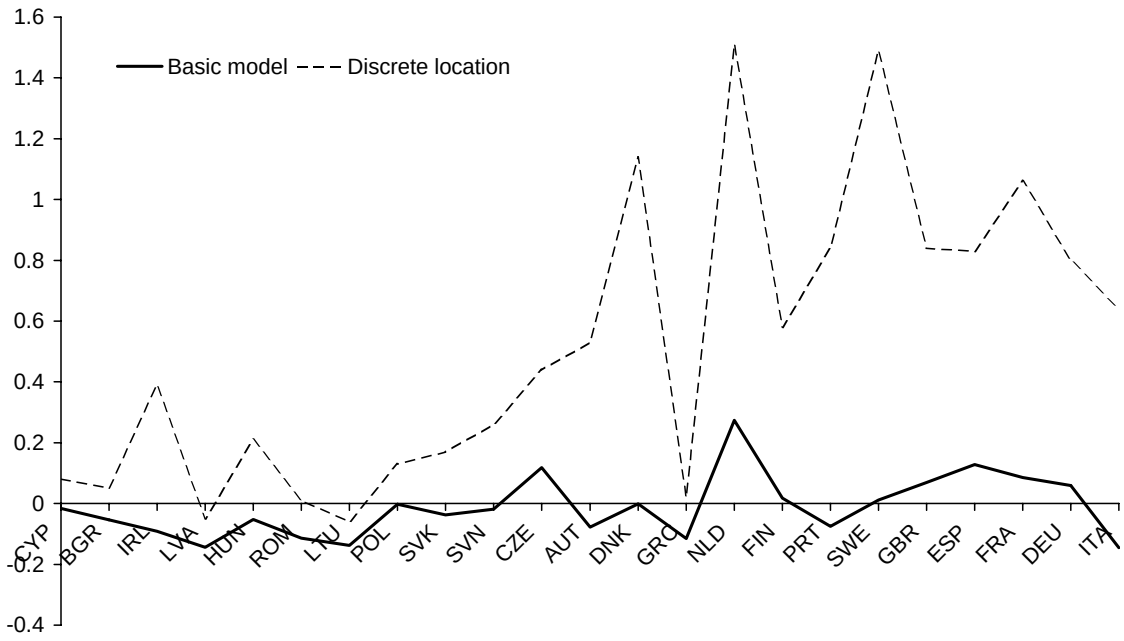
5.3.2 Discrete location

Figure 5.17 shows the welfare effects of unilateral CBIT reforms in Europe when corporate tax rates are reduced to balance the government budget. A lower corporate tax rate reduces the tax burden on mobile rents, which makes a country more attractive as a location for production. Accordingly, CBIT becomes more attractive for individual countries via the channel of discrete location. Instead of a small average reduction in welfare, discrete location choice turns CBIT into a welfare enhancing policy, which raises welfare by around 0.5% on average. Especially countries that host a large multinational sector benefit from the lower tax rates via the inflow of production units that yield firm-specific economic rents.

5.3.3 Tax havens and discrete location

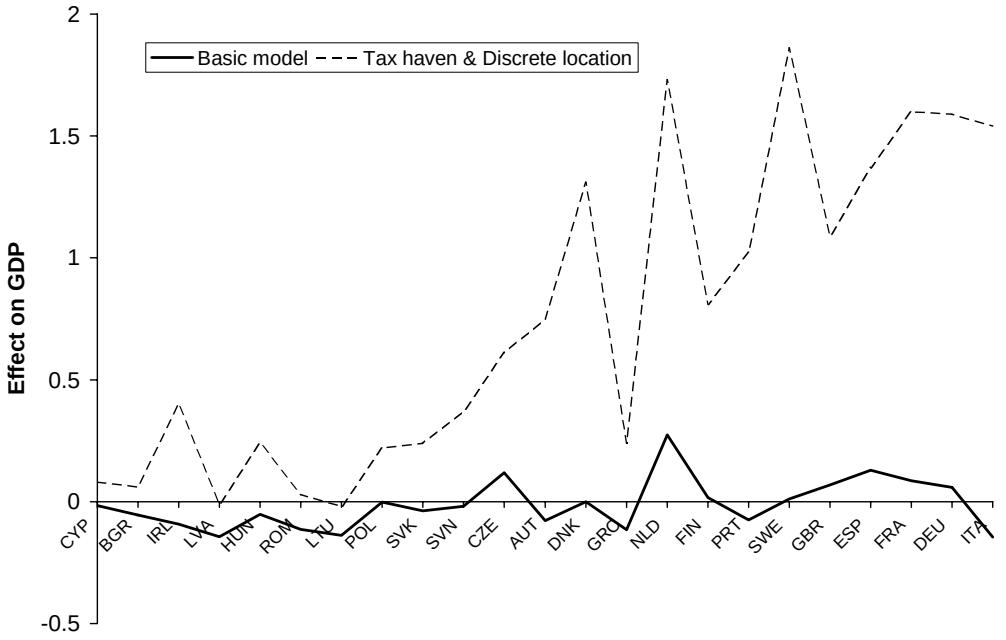
Figure 5.18 shows a unilateral CBIT in EU countries if CORTAX includes both tax havens and discrete location choices. The two channels reinforce the positive welfare effects associated with lower corporate tax rates. Accordingly, welfare expands by 0.75% of GDP for an average country in the EU. In some high-tax countries with large multinational sectors, welfare goes up by around 2% of GDP.

Figure 5.16 Including discrete location, welfare effect of unilateral CBIT with corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 5.17 Tax havens and discrete location, welfare effects of unilateral CBIT with corporate tax rate adjustment



Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

6 Combined ACE & CBIT reform in CORTAX

Both ACE and CBIT reforms move the corporate income tax closer to a system that is neutral with respect to capital structure. Yet, while ACE reduces the cost of capital but requires higher corporate tax rates, CBIT does precisely the opposite. In principle, a combination of ACE and CBIT reforms can be designed which mitigates distortions in capital structure without having implications for the cost of capital or corporate tax rates.

This section considers such a combination of the ACE and CBIT systems. The combined reform is designed such that, on average, it is revenue-neutral ex-ante. The percentages of ACE and CBIT should add up to 100% in order to achieve full neutrality of the system with respect to financial decisions. To design such a revenue-neutral combination, we have experimented with an ex-ante version of CORTAX, i.e. a model without behavioural responses but only bookkeeping identities. The experiments suggest that a combination of ⅔ of an ACE and ⅓ of a CBIT meets the conditions, i.e. revenue neutrality and neutrality with respect to financial structure. Hence, the revenue loss from the ⅔ ACE is, on average in the EU, offset by the extra revenue obtained from the ⅓ CBIT.

However, when implementing such a ⅔ ACE with ⅓ CBIT, it may not be revenue-neutral for each individual country. Indeed, high-tax countries will probably experience an increase in tax revenues because they feature a relatively high leverage ratio to start with. Low-tax countries will likely see their tax revenues fall due to relatively low leverage. To obtain revenue-neutral reforms for each country, we designed a set of country-specific ACE-CBIT combinations. For instance, while the ⅔ ACE - ⅓ CBIT yields a positive revenue in Italy, a 73% ACE and 27% CBIT in Italy is precisely revenue neutral. In this way, we determine for all countries the revenue-neutral combination of ACE and CBIT. In each case, the combination adds up to 100% to ensure neutrality with respect to capital structure. The ACE moves from 54% in Cyprus and Poland to over 70% in Italy and Germany. The country-specific revenue-neutral combinations are then simulated with CORTAX.

For Belgium, we have not explored the ACE-CBIT combination as it already has an ACE system in place. Therefore, no revenue-neutral combined reform is feasible in Belgium that eliminates tax distortions in capital structure. In the simulations, consumption tax rates are adjusted if revenues change ex-post after the ACE-CBIT reform. The results for each country are presented in Table B.17 in Appendix B. Here, we summarise the main findings. The economic effects of the combined ACE-CBIT reform on average in the EU are summarised in Table 6.1.

6.1 Country-specific ACE-CBIT reform

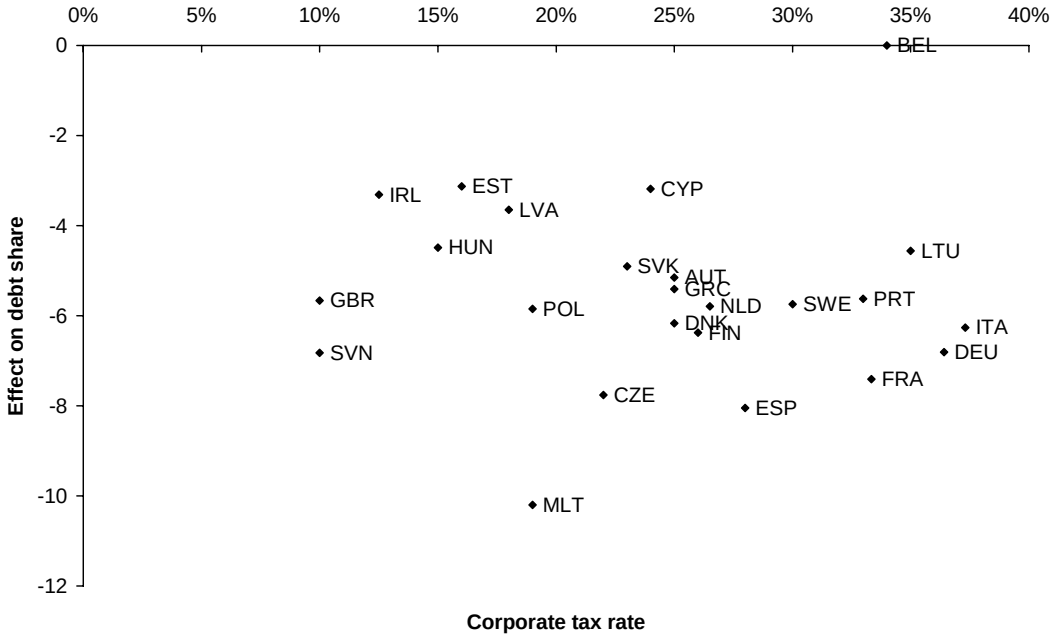
Table 6.1 shows that the combined ACE&CBIT reform reduces the debt share by 6.1% on average in the EU. Indeed, both ACE and CBIT work in the same direction by reducing the benefit of debt finance. Figure 6.1 shows that the effect on the debt share ranges between 2.8% in Bulgaria to more than 7% in Spain, Malta, Czech Republic and France.

Table 6.1 Summary of results of revenue-neutral ACE & CBIT reform in EU countries[a]

Corporate tax revenue (ex-post) (% GDP)	0.0
Debt share (Δ)	– 6.1
Cost of capital (Δ)	– 0.1
Wage (%)	0.3
Capital (%)	0.7
Employment (%)	0.1
GDP (%)	0.3
Welfare ((Δ in % GDP)	0.3

[a] GDP-weighted averages for EU countries. Shocks are country-specific to ensure revenue neutrality ex-ante. Consumption taxes are adjusted to keep the budget balanced ex-post.
Source: CORTAX simulations

Figure 6.1 Effects of revenue-neutral ACE & CBIT combinations on debt shares



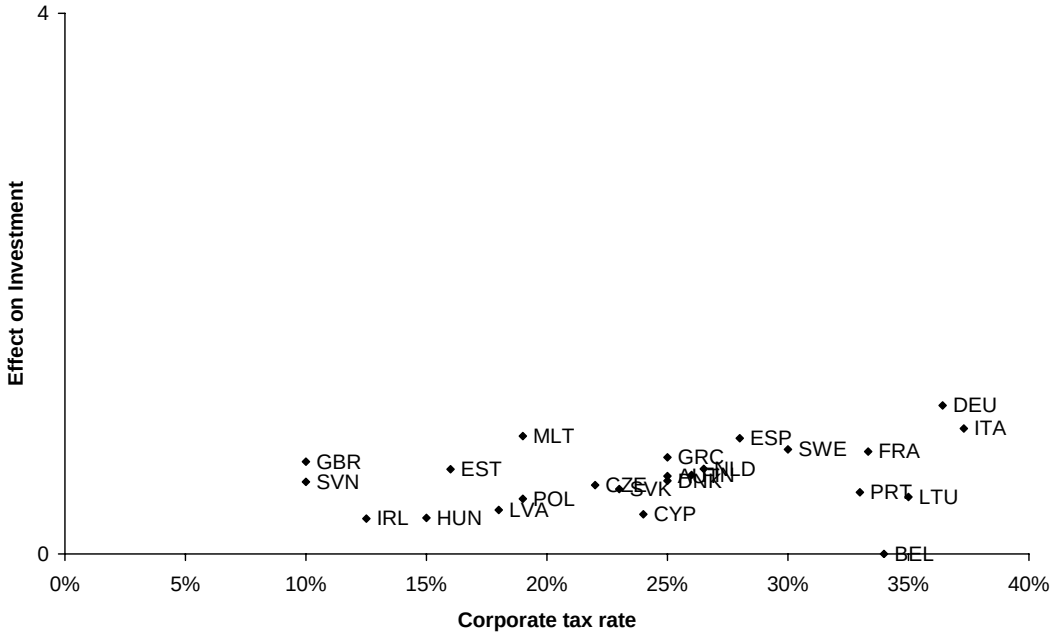
Source: CORTAX simulations, 26 European countries excluding Luxembourg

The effects of the combined ACE-CBIT reform on economic variables are small but positive. Table 6.1 suggests that investment rises by 0.7% on average while GDP expands by 0.3%. The reason for these small effects is that the two reforms have opposing effects on the cost of capital: the ACE-part reduces the cost of capital on equity-financed investment; the CBIT-part raises the cost of capital on debt-financed investment. Overall, the cost of capital slightly falls in the EU. This explains the rise in investment, which is also shown in Figure 6.2.

GDP expands in light of the extra investment. Moreover, the higher capital stock raises the marginal productivity of labour and, therefore, wages. This induces extra labour supply so that employment expands. This adds to the rise in GDP as shown in Figure 6.3.

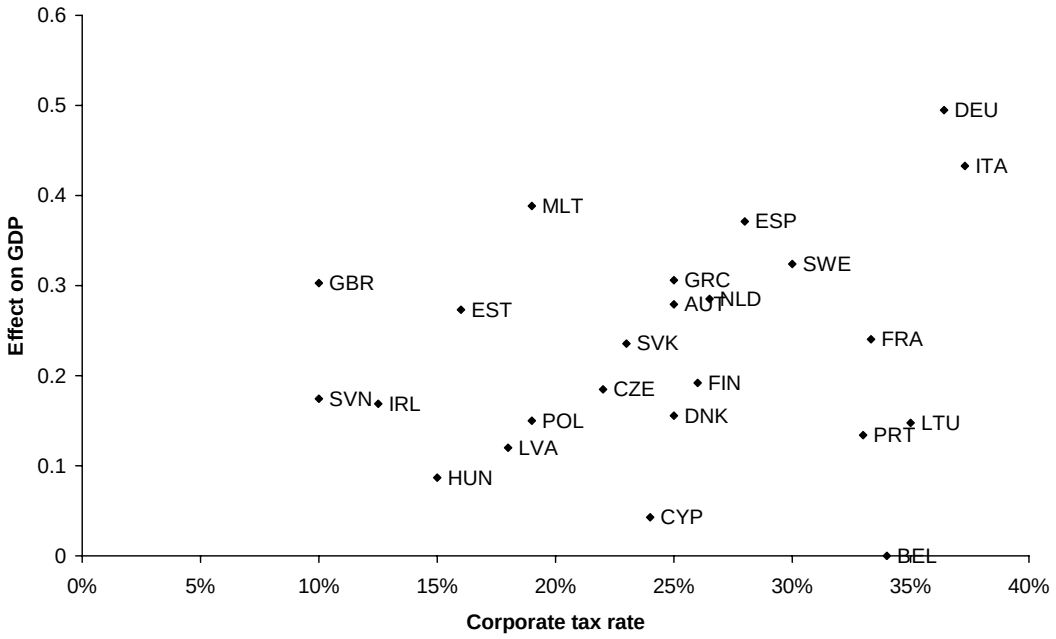
Figure 6.4 shows that all countries (except for Belgium where we do not impose a reform) experience a welfare gain due to the combined ACE-CBIT reform, mostly somewhere between 0.1 and 0.4% of GDP. It reflects the welfare gain associated with the alleviation of the financial distortion. In particular, the social cost of debt finance currently exceeds the private costs due to the discrimination of the tax system in favour of debt finance. The ACE-CBIT combination removes this discrimination so that firms decide to reduce their debt ratio. Thus, they save on financial distress and agency costs, which creates a social benefit.

Figure 6.2 Effects of revenue-neutral ACE & CBIT combinations on investment



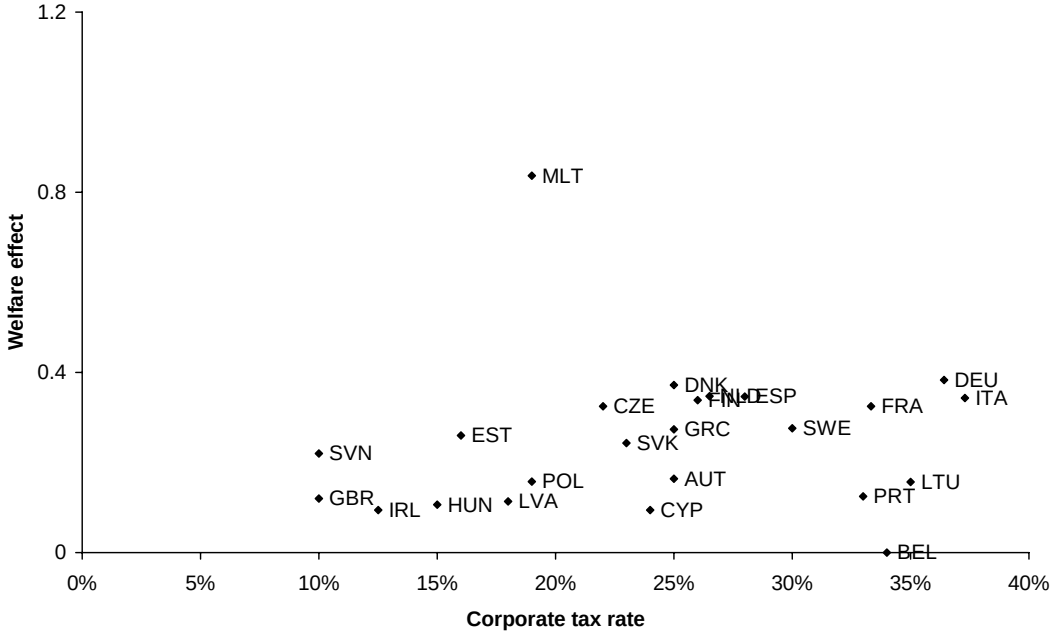
Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 6.3 Effects of revenue-neutral ACE & CBIT combinations on GDP



Source: CORTAX simulations, 26 European countries excluding Luxembourg

Figure 6.4 Welfare effects of revenue-neutral ACE & CBIT combinations



Source: CORTAX simulations, 26 European countries excluding Luxembourg

6.2 European reform, tax havens and discrete location

The previous section explores the combined ACE-CBIT reform when implemented individually by each of the European countries. As in sections 4 and 5, we could alternatively explore the combined ACE-CBIT reform when implemented on a European scale. Moreover, we could explore the reform in the extended version of CORTAX in which tax havens and discrete location choices are modelled. We do not, however, present these results here. The reason is that the effects of both the coordinated reform and the reforms in the extended version of CORTAX yield the same effects as in section 6.1. The reason is that the combined reform is revenue-neutral so that statutory corporate tax rates remain unchanged. International spillovers via profit shifting, either or not to tax havens, and discrete location choices are driven in CORTAX by changes in these statutory corporate tax rates. As they do not change, the effects are not modified either. The effects of the previous section therefore carry over to these other cases.

7 Sensitivity analysis

The simulation outcomes depend on the parameterisation in CORTAX. On various parameters, there is uncertainty about values, either because of variation in empirical estimates or because empirical evidence is scarce. This section demonstrates the robustness of our findings by performing a sensitivity analysis on a number of parameter values. We first explore parameters that determine, respectively, the strength of investment responses, the ease to adjust financial structures and the change in transfer prices in response to tax rate differentials. Then, we present a sensitivity analysis with respect to the size of the fixed factor. Finally, we consider a sensitivity analysis on the model that includes a tax haven and discrete location. The full outcomes of the ACE and CBIT reforms with alternative parameters are presented in Tables B.18 – B.27 in Appendix B. Here, we summarize the most important differences.

7.1 Investment and financial behaviour

For the first two sensitivity analyses on the production function and debt policy, international spillovers are not important. To focus on the variation in the strength of investment and financial responses, the reforms are explored where the government budget is balanced by changes in the consumption tax rate. The outcomes are reported in Table 7.1. The first column shows the outcomes from the baseline simulation. In the second column, we reduce the substitution elasticity between labour and capital in production from 0.7 to 0.5. This reduces the investment response to the cost of capital. The third column shows the effects when we reduce the tax rate elasticity of the debt share from an average of – 0.27 to – 0.16.

The second column in Table 7.1 shows that an ACE raises investment less if substitution between labour and capital is more difficult. Investment rises by 5.6% on average compared to 7.5% in the baseline simulation. Under CBIT, investment declines by 9.1% compared to 11.3% in the benchmark. The smaller effect on investment implies a smaller change in GDP as well. In terms of domestic wages, however, the difference is small. This is because a smaller substitution elasticity implies that the same change in investment exerts a smaller effect on the marginal productivity of labour. The welfare effects of ACE and CBIT reforms are slightly reduced in case of a smaller substitution elasticity as lower substitution implies smaller distortions.

The third column in Table 7.1 shows the that ACE and CBIT exert a smaller effect on the debt/asset ratio if the tax elasticity of the debt share is reduced. The ACE now reduces it by 3.2%-point; CBIT by 4.4%-point. The smaller reduction in the debt share renders the positive welfare implications of ACE also smaller. The decline in welfare due to CBIT becomes larger.

Table 7.1 Sensitivity analysis of ACE and CBIT reforms regarding investment and financial responses			
	Baseline	substitution K - L = 0.5	elasticity of debt halved
ACE reform, consumption tax adjustment			
Debt	– 5.4	– 5.4	– 3.2
Wage	2.7	2.7	2.7
Capital	7.5	5.6	7.8
Employment	0.5	0.5	0.5
GDP	2.4	1.9	2.4
Welfare	0.6	0.6	0.5
CBIT reform, consumption tax adjustment			
Debt	– 7.7	– 7.7	– 4.4
Wage	– 4.3	– 4.7	– 4.8
Capital	– 11.3	– 9.1	– 12.6
Employment	– 0.9	– 0.9	– 0.9
GDP	– 3.8	– 3.2	– 4.2
Welfare	– 0.7	– 0.6	– 0.8

7.2 Transfer pricing and fixed factor

In the third and fourth sensitivity analyses, international spillovers via changes in corporate tax rates are more important. Therefore, we consider for these sensitivity analyses the unilateral reforms where the government budget is balanced ex-ante by adjustments in the corporate tax rate. The third sensitivity involves the convexity of the cost of transfer price manipulation. We halve ε_q from 1 to 0.5, implying that the elasticity of the inward transfer price with respect to the corporate tax rate falls on average from 1.25 to 0.25. This comes closer to the elasticity reported by Clausing (2003).

The fourth sensitivity analysis increases the share of income from the fixed factor. In particular, we double the share from 2.5% of value added in the basic calibration to 5% in the sensitivity analysis. The income shares of capital and labour decline proportionally with their shares in the national accounts. The higher share of economic profits in the economy raises the corporate tax base in the initial equilibrium. As a result, corporate tax revenue rises from 3.5% to 4.5% of GDP. This has important implications for the ACE and CBIT reforms. For instance, due to the smaller share of capital in the economy, the revenue cost of the ACE reform falls by 0.15% of GDP and the revenue raised by CBIT drops by 0.2% of GDP. In terms of the broader corporate tax base, this decline is more pronounced: the cost of ACE in terms of total corporate tax revenue drops from 44% in the baseline to 34% in the sensitivity analysis; the rise in corporate tax revenue from CBIT declines from 76% to 61%. The change in corporate tax rates to ensure revenue neutrality for the government ex-ante is also considerably modified in this sensitivity analysis: whereas ACE requires a 14.8%-points rate increase in the baseline, this is

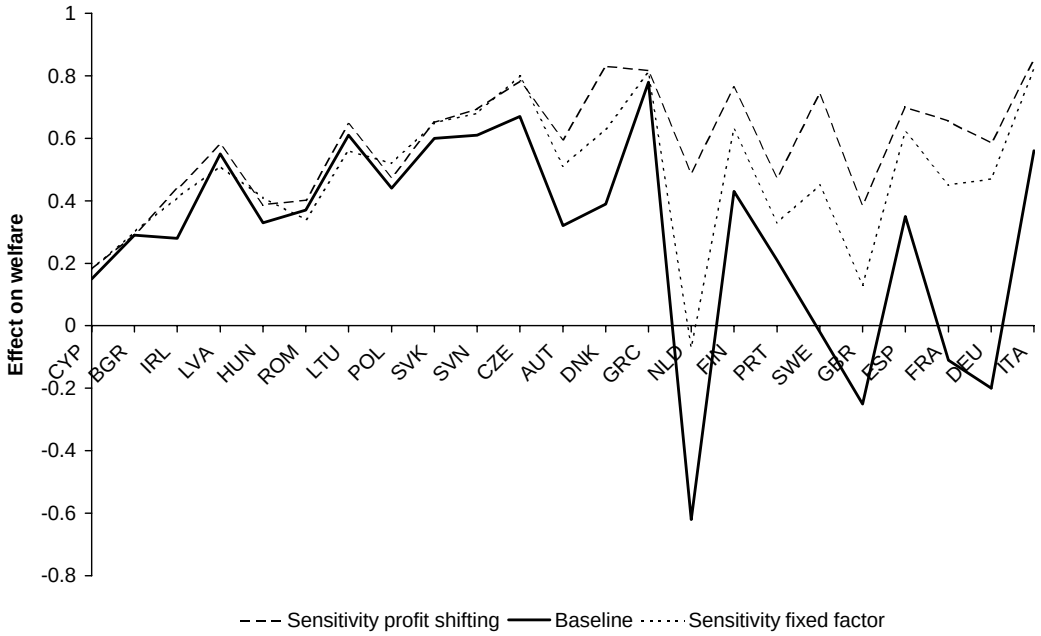
only 10.3%-points in the sensitivity analysis. In case of CBIT, the tax rate can be reduced by 12.3%-points in the baseline but by only 10.4%-points in the sensitivity analysis.

Figures 7.1 and 7.2 show the impact of the two sensitivity analyses for the ACE and CBIT reforms on welfare. Under the smaller elasticity of profit shifting, changes in statutory corporate tax rates exert smaller effects on profits allocated in a country. Hence, the higher corporate tax rates to finance an ACE induces less outward profit shifting and the lower corporate tax rates under CBIT induce less inward profit shifting. Accordingly, the welfare effects of ACE become larger and those of CBIT smaller. A unilateral introduction of ACE is always beneficial for countries if profit shifting is less important, while this was not the case in the baseline. CBIT is no longer attractive for a number of countries if profit shifting is less strong, as it was in the baseline.

A larger share of rents implies modifies the welfare implications of ACE primarily via the profit shifting channel. In particular, as the necessary increase in tax rates becomes smaller, fewer profits are shifted out of a country if it introduces an ACE. As a result, the cost of the ACE effectively falls. Intuitively, the ACE is more efficient as a pure rent tax if the size of economic rents is larger. Therefore, the welfare gains of introducing an ACE rise as compared to the baseline. Figure 7.1 suggests that only the Netherlands will not gain welfare from the introduction of an ACE as profit shifting is still too important and thus more than offsets the gains from its introduction.

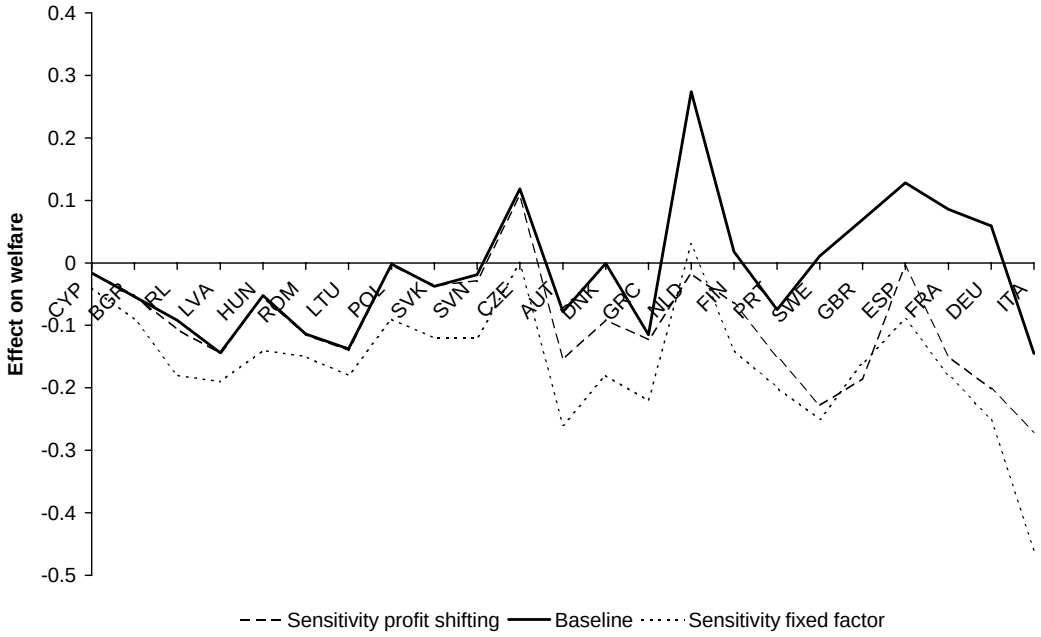
CBIT shifts the tax burden away from economic rents towards capital income. With a larger share of economic rents in the economy, this policy is less beneficial for welfare. One reason is that corporate tax rates decline less so that inward profit shifting becomes smaller. A second reason is that the larger share of rents makes corporate tax rates less distortionary as a way of raising revenue as this part of the tax is in fact non-distortionary. Therefore, shifting away from rents to capital, namely the debt-financed share of investment, becomes increasingly distortionary.

Figure 7.1 **Effect of ACE on welfare if either profit shifting is more costly or if economic rents are more important**[a]



[a] Government budget is balanced by an ex-ante adjustment in corporate tax rates, consumption taxes ex-post.
Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 7.2 **Effect of CBIT on welfare if either profit shifting is more costly or if economic rents are more important**[a]



[a] Government budget is balanced by an ex-ante adjustment in corporate tax rates, consumption taxes ex-post.
Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

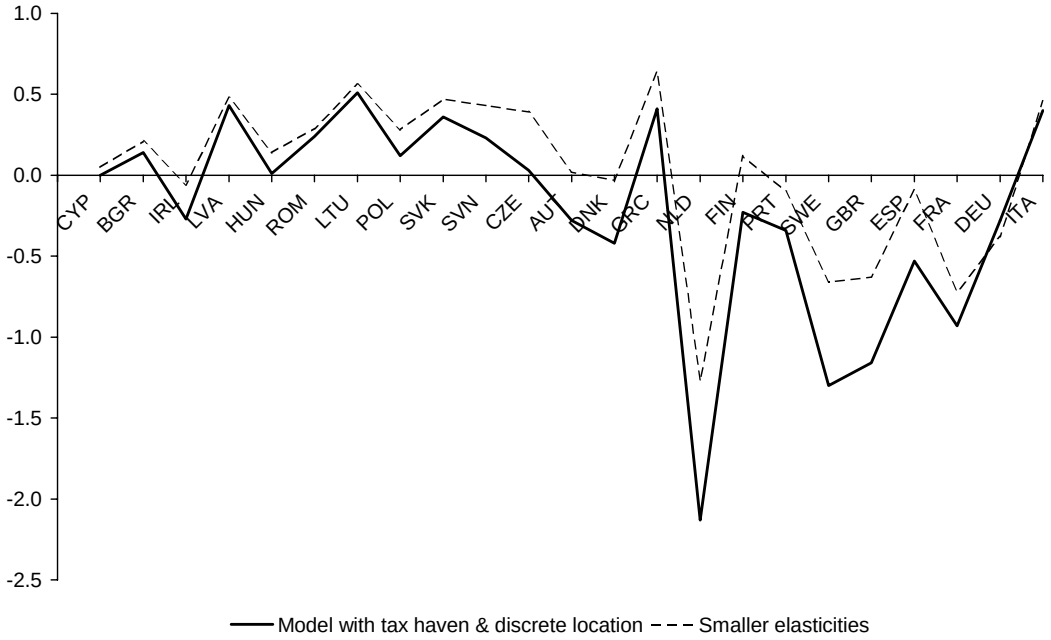
7.3 Tax haven and discrete location

The last sensitivity analysis involves the extended model with the outside tax haven and discrete location choice. In sections 4 and 5, the semi-elasticity of the corporate tax base via profit shifting to the tax haven is set at – ½. This adds to profit shifting via transfer price manipulation that is already in place the basic version of CORTAX. In this section, we set the semi-elasticity of profit shifting to the tax haven at – ¼.

The parameters for location choice regarding firm-specific capital of multinationals is set in sections 4 and 5 so as to obtain an overall semi-elasticity of FDI with respect to the tax rate of – 6, which is the average found in empirical studies. In this section, we reduce this semi-elasticity to – 4 which implies a halving of the response of mobile rents to taxes.

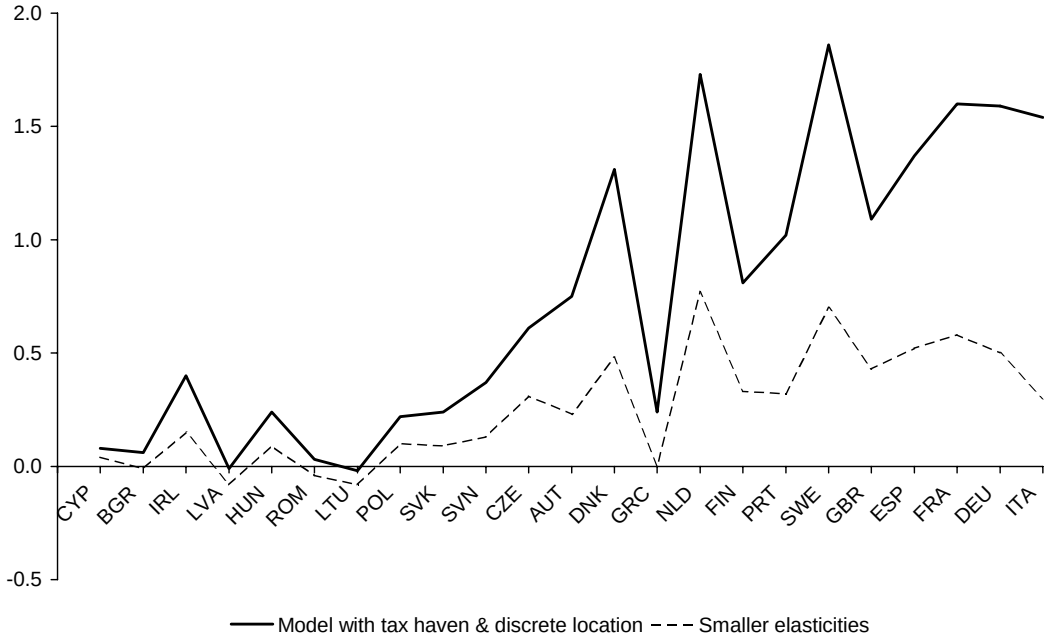
The smaller elasticities imply that changes in statutory corporate tax rates exert smaller economic and welfare effects. Accordingly, Figure 7.3 shows that the welfare effects of a unilateral ACE reform with corporate tax rate adjustment is generally more favourable than in section 4. Still, most Western European countries suffer from a welfare loss by introducing an ACE. The exceptions are Germany and Italy in Figure 7.3. However, this is because corporate tax rates are capped at a maximum of 55%, which becomes binding for these countries. As neighbouring countries do have to raise corporate tax rates further in light of the smaller tax base in the presence of a tax haven, this renders the impact for Italy and Germany more favourable at the expense of other countries. Figure 7.4 shows that unilateral CBIT reforms with simultaneous reductions in corporate tax rates become less beneficial for welfare as compared to section 5. Yet, the welfare effects remain positive under the smaller response to corporate tax rate reductions for the majority of countries.

Figure 7.3 **Effect of unilateral ACE on welfare in model with tax haven and discrete location but with elasticities halved**[a]



[a] Government budget is balanced by an ex-ante adjustment in corporate tax rates, consumption taxes ex-post.
Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

Figure 7.4 **Effect of unilateral CBIT on welfare in model with tax haven and discrete location but with elasticities halved**[a]



[a] Government budget is balanced by an ex-ante adjustment in corporate tax rates, consumption taxes ex-post.
Source: CORTAX simulations, 23 European countries excluding Luxembourg, Belgium, Estonia and Malta

8 Conclusion

This study analyzes reforms in Europe in the direction of a comprehensive business income tax (CBIT) and an allowance for corporate equity (ACE). We illustrate the key trade-offs in designing such reforms between, on the one hand, efficiency effects via distortions in investment and financial structures and, on the other hand, the welfare effects of changes in other tax rates. An applied general equilibrium model for Europe is used to quantitatively assess the economic implications of ACE and CBIT in EU countries.

ACE is found to improve efficiency by removing the distortion between debt and equity finance and by reducing the cost of capital. If the ACE is accompanied by higher taxes on labour or consumption or by lower transfers to households, welfare in Europe expands. However, if ACE is accompanied by higher corporate tax rates, the corporate tax base erodes due to profit shifting and adverse effects on discrete location of profitable investment. Under strong responses to higher statutory tax rates, we find that ACE reforms are welfare reducing for most Western European countries. Most Eastern European countries still benefit from ACE due to a small multinational sector. A simultaneous introduction of an ACE in Europe tends to improve welfare since international cooperation eliminates fiscal spillovers within the EU.

CBIT improves welfare via smaller distortions in the financial structure of companies. Yet, disallowing the interest deduction increases the cost of capital, thereby exacerbating investment distortions. When the revenue raised by CBIT is used for higher transfers or reductions in labour or consumption taxes, welfare in the EU falls. If CBIT is accompanied by lower corporate tax rates, welfare typically rises as lower rates cause a broadening of the tax base via inward profit shifting and by attracting discrete profitable investments. Under a European CBIT, the benefits are reduced since fiscal spillovers within Europe are mitigated.

A revenue-neutral combination of ACE and CBIT reforms improves efficiency as it reduces distortions in debt-equity choices. Welfare is found to expand slightly on account of this more efficient financial structure. Combinations of ACE&CBIT may reflect a simultaneous movement towards limitations to the deductibility of interest and reductions in the tax burden on the normal return to equity.

Table 8.1 compares some of our simulations to two earlier studies that are close to ours. The table presents the average effect for the EU for ACE and CBIT, where consumption taxes are adjusted to keep the government budget balanced ex-post (which is the same as the previous studies). We add to this simulations of ACE, CBIT and the combined reform, where statutory corporate tax rates are adjusted to keep the government budget balanced ex-ante. Thereby, we use the version of CORTAX that includes a tax haven and discrete location choices.

Our numerical results on ACE with consumption tax adjustment are similar to those reported by Keuschnigg and Dietz (2007) for Switzerland, although we report a slightly larger effect on the debt ratio. The findings suggest that investment and GDP rise by 7.5% and 2.4%

respectively. Radulescu and Stimmelmayr (2007) find larger effects of ACE in Germany on investment and GDP. With respect to CBIT, our results are more similar to Radulescu and Stimmelmayr (2007). Investment falls by 11.3% and GDP by 3.8%. We find that a revenue-neutral combination of ACE and CBIT is welfare improving: it boosts welfare by 0.3% of GDP.

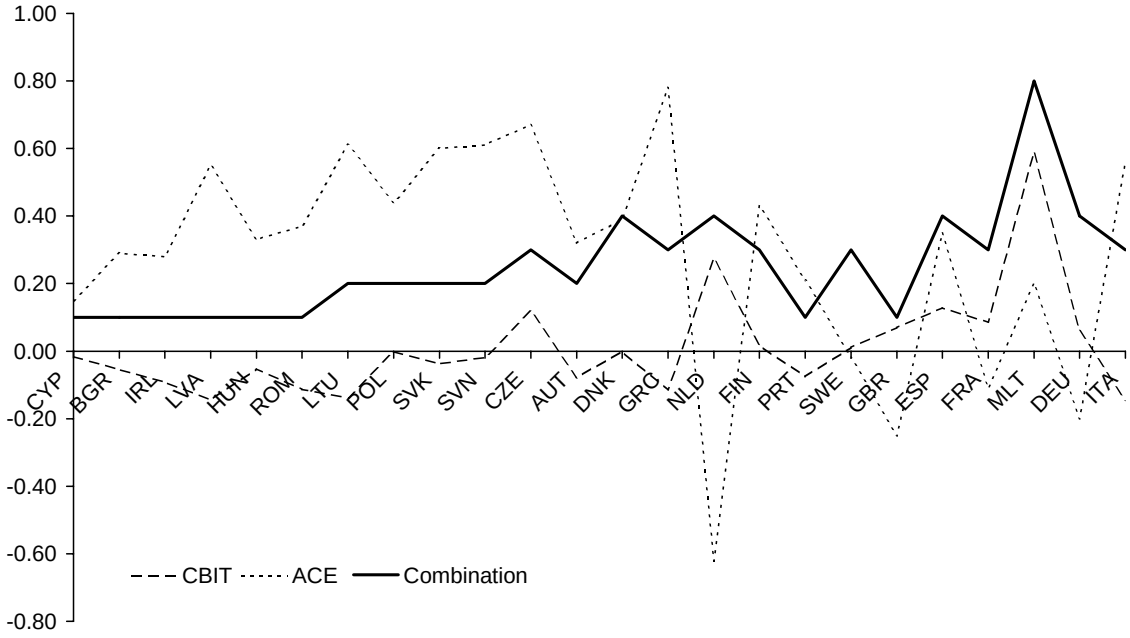
Table 8.1 Simulation outcomes of ACE and CBIT reforms, consumption or corporate tax adjustment

				This study	
		Keuschnigg & Dietz (2007)	Radulescu & Stimmelmayr (2007)	Basic model & consumption tax	Tax haven & location; corporate tax
Country		Switzerland	Germany	European average	European average
ACE					
Debt ratio		– 3.8	n.a.	– 5.4	– 3.3
Employment	%Δ	0.4	1.7	0.5	0.2
Capital stock	%Δ	7.8	20.5	7.5	3.8
GDP	%Δ	2.6	9.1	2.4	0.8
Private consumption	%Δ	1.4	4.6	1.2	
Welfare (in % GDP)	Δ	n.a.	0.08	0.6	– 0.3
CBIT					
Debt	Δ			– 7.7	– 6.9
Employment	%Δ		– 1.4	– 0.9	0.4
Capital stock	%Δ		– 10.2	– 11.3	0.7
GDP	%Δ		– 5.3	– 3.8	1.5
Private consumption	%Δ		– 4.7	– 1.6	
Welfare (in % GDP)	Δ		– 0.7	– 0.7	1.1
Combined ACE – CBIT					
Debt	Δ			– 6.1	– 6.1
Employment	%Δ			0.1	0.1
Capital stock	%Δ			0.7	0.7
GDP	%Δ			0.3	0.3
Welfare (in % GDP)	Δ			0.3	0.3

The results reported in the third column of Table 8.1 reflect a well-known economic view on ACE and CBIT. However, the outcomes presented in the last column of table 8.1 shed a very different light on them. In particular, if corporate tax rates are increased to cover the cost of an ACE, welfare falls in the model where tax havens and discrete location choices are included. Indeed, higher tax rates cause a substantial erosion of the corporate tax base due to profit shifting to outside tax havens and by reducing the inflow of profitable investment projects of multinationals. This renders ACE welfare reducing, although GDP still rises slightly. CBIT reforms tend to raise welfare in a typical European country since lower corporate tax rates attract substantial profits and discrete investments. These results contrast sharply with the findings in the third column. Recent empirical studies have emphasised the importance of profit shifting and discrete location. The model simulations suggest that this changes the perspective

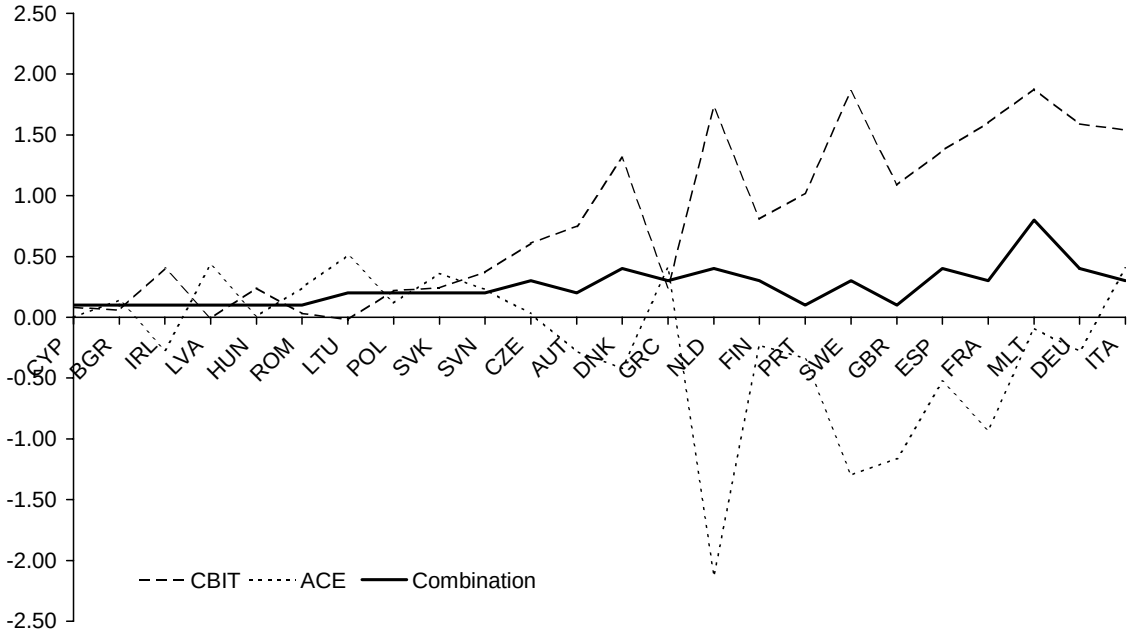
on ACE and CBIT. Interestingly, the combined ACE-CBIT reform designed as a revenue-neutral policy is independent on whether the model is extended with tax havens or discrete location choices as corporate tax rates remain unchanged in this reform. In both cases, the reform raises welfare by 0.3% of GDP, which is due to the more neutral treatment of debt and equity.

Figure 8.1 **Welfare effect of a unilateral ACE, CBIT and combined reform in the basic version of CORTAX, corporate tax rates adjusted to keep revenue neutral**



Source: CORTAX simulations, 24 European countries, excluding Luxembourg, Belgium and Estonia

Figure 8.2 **Welfare effect of a unilateral ACE, CBIT and combined reform in the extended version of CORTAX (including tax havens and discrete location), corporate tax rates adjusted to keep revenue neutral**



Source: CORTAX simulations, 24 European countries, excluding Luxembourg, Belgium and Estonia

Figures 8.1 and 8.2 summarise for individual countries the welfare effect of the unilateral ACE and CBIT reforms with corporate tax rate adjustment and the revenue-neutral combined reform of ACE and CBIT. In the basic version of CORTAX, ACE is more attractive than CBIT in the low-tax countries of Central and Eastern Europe, who are characterised by a small multinational sector. For a number of Western European countries with higher rates and a larger multinational sector, however, CBIT is more attractive due to the positive implications of a reduction in the statutory tax rate. For many Western countries, the revenue-neutral combination of ACE and CBIT outperforms either ACE or CBIT. In the extended version of CORTAX with tax havens and discrete location, CBIT is the most attractive reform in the Western European countries since lower corporate tax rates exert more favourable effects. ACE is no longer an attractive policy in Western Europe.

The numerical outcomes from CORTAX are consistent with the claims of Bond (2000). He argues that ACE may have attractive features for closed economies as it renders the tax system neutral for investment. However, base narrowing renders it unattractive for open economies since higher corporate tax rates induce a strong erosion of the corporate tax base due to profit shifting and fewer profitable investment. Therefore, he advocates CBIT as it allows for reductions in corporate tax rates which can induce a broadening of the corporate tax base. Our numerical results illustrate precisely this trade-off and show that the effects of changes in tax rates indeed tend to dominate for plausible parameters in the model. Indeed, CBIT reforms are

more likely to yield welfare gains for Western European countries if these countries pursue unilateral policies. If Europe would coordinate their policies, however, fiscal spillovers in the EU via profit shifting and discrete locations will be mitigated. This renders ACE-type reforms more attractive and CBIT type reforms less attractive from a welfare point of view. Indeed, European coordination allows countries to implement a different type of welfare improving reforms than is optimal under unilateral policies.

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Appendix A Modelling ACE & CBIT in CORTAX

To understand the properties of the ACE and CBIT in CORTAX, this appendix discusses in more detail how firm behaviour is modelled. CORTAX starts from a standard dynamic optimization problem of the firm, which maximizes its value subject to accumulation constraints and a production function. In optimizing its value, firms choose their optimal levels of employment and investment, as well as the optimal financial structure between debt and equity. ACE and CBIT exert a direct impact on financial and investment behaviour. We also discuss two extensions of the basic framework: the introduction of a tax haven and the modelling of location choices.

Model of the firm

Denote the value of the firm in period t by V_t and its dividend payments by Div_t. We ignore new equity issues and abstract from residence taxes on capital levied at the household level. An investor is indifferent between investing in the firm and investing elsewhere at a rate of return r as long as:

$$rV_t = Div_t + V_{t+1} - V_t \tag{A.1}$$

The right-hand side of (A.1) reflects the sum of dividends and capital gains on the investment in the firm. The left-hand side shows the return on the asset V_t if it were invested elsewhere. The rate r denotes the discount rate used by the firm. Solving (A.1) for V_t yields an expression for the value of the firm as the discounted stream of future dividends:

$$V_t = \sum_{s=t}^{\infty} Div_s \left[\frac{1}{1+r}\right]^{s-t+1} \tag{A.2}$$

Dividends follow from the cash-flow restriction of the firm:

$$Div_t = Y_t - wL_t - [r_b + c_b]d_{bt}K_t - \tau\Pi_t - I_t + d_{bt+1}K_{t+1} - d_{bt}K_t \tag{A.3}$$

where Y_t denotes output (price is normalized to 1) and wL_t stands for labour costs. The third term on the right-hand side of (A.3) captures the cost of debt. It equals the debt ratio (d_b) times the capital stock (K_t) times the real interest on firm debt r_b. In addition to this, the variable c_b denotes a financial distress or agency cost associated with high debt finance. It depends on the leverage of the firm, i.e. $c_b = c_b\,(d_{bt})$. The fourth and fifth terms on the right-hand side of (A.3) reflect corporate tax payments ($\tau\Pi_t$) and investment (I_t). Finally, cash-flow is affected by a change in debt of the firm, captured by the last two terms on the right-hand side of (A.3).

The corporate tax base, Π_t, is defined as:

$$\Pi_t = Y_t - wL_t - \left[(1-\beta^{CBIT})d_{bt}R_bK_t + \beta^{ACE}(1-d_{bt})RD_t\right] - \delta_f D_t - \phi I_t \qquad \text{(A.4)}$$

It consist of total revenue from sales minus labour costs, deductible financial costs and deductible depreciation allowances. The third term on the right-hand side of (A.4) reflects the deductible financial costs from investment. The parameters β^{CBIT} and β^{ACE} determine whether financial costs are deductible. If interest payments are deductible, we have $\beta^{CBIT} = 0$. This reflects current practice in European countries. As shown by (A.4), it is the nominal interest payments on actual debt ($d_{bt}R_bK_t$) which are deductible from the corporate tax base, where $R_b = (1+r_b)(1+\pi)-1 \approx r + \pi$ is the nominal interest rate and π is the rate of inflation. If interest is not deductible, as under the CBIT, we have $\beta^{CBIT} = 1$.

Most corporate tax systems do not allow a deduction of the cost of equity, i.e. we have $\beta^{ACE} = 0$. Under an allowance for corporate equity (ACE), an imputed return on equity capital in the tax accounts is deductible, so we have $\beta^{ACE} = 1$. Following Bond and Devereux (1995), we apply a nominal risk-free rate of return $R = (1+r)(1+\pi)-1 \approx r + \pi$ which can be set equal to the nominal return on bonds ($R = R_b$).[14]

The last two terms on the right-hand side of (A.4) reflect fiscal depreciation. The fourth term is the annual rate of fiscal depreciation, equal to δ_f, times the stock of fiscal depreciable assets, denoted by D_t. The last term denotes the share of the investment that can be depreciated immediately after its purchase, measured by ϕ. Note that $\phi = 1$ would imply immediate expensing of investment. If $\phi = \delta_f$, annual fiscal depreciation at rate δ_f would start in the period of purchase, rather than one year after the purchase.

Regarding economic and fiscal depreciation, we assume a declining balance at a rates of, respectively, δ and δ_f. The accumulation of capital in, respectively, the firms financial accounts and its tax accounts is thus reflected by:

$$K_{t+1} = I_t + (1-\delta)K_t \qquad \text{(A.5)}$$

$$(1+\pi)D_{t+1} = (1-\phi)I_t + (1-\delta_f)D_t \qquad \text{(A.6)}$$

where (A.6) takes into account that fiscal depreciation only applies to the share that is not immediately expensed, i.e. $(1-\phi)$ and that the price of fiscal assets is not indexed for inflation.

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[14] Under an allowance for corporate capital (ACC), the deductibility of interest is abolished as it is under the CBIT. At the same time, an imputed return on the capital stock according to the fiscal account is introduced, irrespective of its source of finance.

Firm behaviour is now derived from maximizing its value (A.2), subject to the accumulation equations (A.5) and (A.6):

$$L = \sum_{s=t}^{\infty} \Big[Div_s - \lambda_{s+1}[(1+\pi)D_{s+1} - (1-\phi)I_s - (1-\delta_f)D_s] - \mu_{s+1}[K_{s+1} - I_s - (1-\delta)K_s] \Big] \left[\frac{1}{1+r} \right]^{s-t+1} \quad \text{(A.7)}$$

where λ_t is the Langrange multiplier for D_t and μ_t the Langrange multiplier for K_t (Tobins q) and discounting occurs at the real rate r. We will now subsequently discuss the optimal choice regarding the financial structure and investment by the firm.

Financial behaviour

We first optimize (A.7) with respect to the debt share. This yields the following first-order condition:

$$c_b + \frac{\partial c_b}{\partial d_{bt}} d_{bt} = r - r_b - \tau \left[\beta^{ACE} \frac{D_t}{K_t} R - (1 - \beta^{CBIT}) R_b \right] \quad \text{(A.8)}$$

The left-hand side of (A.8) denotes the marginal cost of a higher debt share. High debt may be costly due to financial distress associated with a larger risk of bankruptcy or higher agency costs. In the optimum, the marginal cost of higher debt equal the marginal benefit reflected by the right-hand side of (A.8). This marginal benefit of debt finance is equal to the difference in the real required market cost of debt versus equity plus a tax term reflected by the terms between square brackets. Here, we consider three regimes:

- Under current regimes, we have $\beta^{CBIT} = 0$ and $\beta^{ACE} = 0$. In this case, the tax term is positive. Hence, due to the discrimination of the corporate tax system in favour of debt, the corporate tax rate raises the relative benefits of debt finance.
- Under CBIT, we have $\beta^{CBIT} = 1$ and $\beta^{ACE} = 0$. We see that the tax term now disappears. Corporate taxation is thus neutral to the debt/equity choice.
- Under an ACE regime, we have $\beta^{CBIT} = 0$ and $\beta^{ACE} = 1$. Assuming $R = R_b$, we see that the corporate tax is not entirely neutral under an ACE as long as $K_t \neq D_t$. The reason is that the ACE applies to the equity value in the tax accounts, i.e. to D_t. In contrast, the interest deductibility applies to the actual interest payments on debt, applying to K_t. If tax depreciation is more generous than economic depreciation, D_t will be smaller than K_t so that debt finance is still favoured by the tax system as compared to equity finance.

The benefits from debt finance on the right-hand side of (A.8) are independent of the debt share. To avoid a corner solution in which firms find it optimal to finance the entire capital stock with either debt or equity, we specify a convex cost function of holding debt. In particular, we use the following function for the cost of holding debt:

$$c_b = \frac{\chi}{d_b^{(1+\varepsilon_b)}(1-d_b)^{(1-\varepsilon_b)}} - \frac{c_{b0}}{d_b} \tag{A.9}$$

so that

$$c_b + \frac{\partial c_b}{\partial d_b} d_b = \left[\frac{d_b - \varepsilon_b}{1-d_b}\right](c_b + \frac{c_{b0}}{d_b}) \tag{A.10}$$

As long as the debt share exceeds ε_b, expression (A.10) suggests that the marginal cost of holding debt is positive. The marginal costs tend to rise in the debt share and fall in the parameters χ and ε_b. Hence, the higher the initial leverage of the firm, the more costly it is to further raise the share of debt finance. The parameters χ and ε_b are set at levels so as to replicate the elasticity of the debt share found in empirical studies.

Investment behaviour

To find optimal investment, we specify the production function $Y_t = CES(K_t, L_t)$ as a constant elasticity of substitution function with capital and labour as inputs. Production features decreasing returns to scale with respect to these to inputs. Thus, a fixed factor is at the background, which earns an economic rent in production. In optimizing its value, the firm determines the optimal demand for labour and investment. Labour demand is determined by setting the value of the marginal product of labour equal to the before-tax wage rate. Below, we concentrate on the demand for investment. Denote the marginal product of capital as Y_K. The first-order conditions for investment I_t, and the stock variables D_t and K_t read as follows:

$$(1-\phi\tau) = (1-\phi)\lambda + \mu \tag{A.11}$$

$$\lambda = \tau \frac{\delta_f + \beta^{ACE}(1-d_b)R}{R+\delta_f} \tag{A.12}$$

$$Y_K(1-\tau) = \mu(r+\delta) - d_b(r - r_b - c_b) - d_b \tau R_b(1-\beta^{CBIT}) \tag{A.13}$$

where we used the property that λ and μ are constant on a steady state balanced growth path. The first-order conditions in (A.11) – (A.13) together determine the optimal investment by firms. In particular, by substituting (A.11) and (A.12) into (A.13), we get the following expression for the optimal capital stock:[15]

[15] We assume no adjustment costs in capital formation so the capital stock will immediately move to its new optimum

$$Y_K = \frac{1}{1-\tau}\left[r^* + \delta - \tau\left[\frac{\phi R + \delta_f}{R + \delta_f} \right](r+\delta) \right] \tag{A.14}$$

$$r^* = d_b\left[r_b + c_b - \tau d_b (1-\beta^{CBIT}) R_b \right] + (1-d_b)\left[r - \tau \frac{(1-\phi)(r+\delta)}{R+\delta_f} \beta^{ACE} R \right] \tag{A.15}$$

Expression (A.14) denotes the cost of capital, i.e. the marginal productivity of capital that is required to make up for the cost of finance and depreciation. In the absence of a corporate income tax, the cost of capital is equal to the financial cost of investment (i.e. the weighted average of debt and equity) and economic depreciation. To understand the impact of corporate taxation, we first consider the case of equity-financed investment (i.e. if the marginal debt share is zero, $d_b = 0$). In that case, (A.14) and (A.15) modify to:

$$Y_K = r + \delta + \frac{\tau}{1-\tau}\left[1 - \frac{(1-\phi)\beta^{ACE} R + \phi R + \delta_f}{R + \delta_f} \right](r+\delta) \tag{A.16}$$

We see that the cost of capital is equal to that in the absence of tax ($r + \delta$), plus a tax term between square brackets. The tax term is zero under two parameterisations: $\phi = 1$ or $\beta^{ACE} = 1$. If $\phi = 1$, there is immediate expensing of investment, which transforms the corporate income tax into an R-based cash-flow tax. This system is neutral to the cost of capital and, therefore, for investment. If $\beta^{ACE} = 1$, the normal return on equity-financed investment is deductible from the corporate tax. Whatever the rate of fiscal depreciation, the corporate tax is now always neutral to the cost of capital and investment. This neutrality property of the ACE requires that the imputed return on equity equals the nominal discount rate used by the firm, i.e. the rate R.

In the absence of an ACE ($\beta^{ACE} = 0$) and $\phi < 1$, the term between square brackets on the right-hand side of (A.16) is always positive. Hence, corporate taxes raise the cost of capital financed by equity. A higher cost of capital requires that the marginal product of capital increases. In light of decreasing returns to scale with respect to capital in production, a smaller capital stock is required to achieve this. Consequently, a higher cost of capital induced by a higher corporate tax rate will reduce investment.

Expression (A.16) can also be used to assess the impact of a marginal change in the direction of an ACE:

$$\frac{\partial Y_K}{\partial \beta^{ACE}} = -\frac{\tau}{1-\tau}\left[\frac{(1-\phi)R(r+\delta)}{R+\delta_f} \right] < 0 \tag{A.17}$$

$$\frac{\partial^2 Y_K}{\partial \beta^{ACE} \partial \tau} = -\left[\frac{\tau}{1-\tau} \right]^2 \left[\frac{(1-\phi)R(r+\delta)}{R+\delta_f} \right] < 0 \tag{A.18}$$

$$\frac{\partial^2 Y_K}{\partial \beta^{ACE} \partial \phi} = \frac{\tau}{1-\tau}\left[\frac{R(r+\delta)}{R+\delta_f}\right] > 0 \qquad \text{(A.19)}$$

Expression (A.17) shows that the ACE reduces the cost of capital at the margin, which will encourage investment. Expressions (A.18) and (A.19) suggest that the ACE exerts a larger reduction in the cost of capital if a country starts with a high corporate tax rate and a broad tax base, respectively. Intuitively, a high corporate tax rate and a broad tax base render the tax system more distortionary at the margin so that an ACE is relatively effective in reducing these distortions.

If part of investment is financed by debt ($d_b > 0$), (A.15) is modified as the financial cost of investment is now a weighted average of the cost of debt and the cost of equity. We see that the cost of debt is reduced by the deductibility of nominal interest costs as long as $\beta^{CBIT} = 0$. The interest deductibility thus reduces the cost of capital, perhaps even below the level obtained in the absence of tax. The introduction of CBIT will abolish the interest deductibility and thus raises the cost of capital. Indeed, differentiating (A.15) yields:

$$\frac{\partial Y_K}{\partial \beta^{CBIT}} = \frac{\tau}{1-\tau} d_b R_b \qquad \frac{\partial^2 Y_K}{\partial \tau \partial \beta^{CBIT}} = \left[\frac{1}{1-\tau}\right]^2 d_b R_b > 0 \qquad \text{(A.20)}$$

Hence, reforms in the direction of CBIT will raise the cost of capital and reduce investment. Moreover, this effect is more pronounced if the corporate tax rate is higher. Movements towards a CBIT will therefore be more distortionary in countries featuring high corporate tax rates.

Profit shifting behaviour

In producing output, subsidiaries use intermediate inputs that are supplied by their parent company. The arms-length price for this intermediate input is equal to the market price of the numeraire good, but the parent company can manipulate this transfer price for intra-company deliveries. In particular, the benefit from marginally changing the transfer price is measured by the difference in the statutory corporate tax rate that applies to the subsidiary (τ^f) and the rate that applies to the parent (τ^m). This benefit needs to be weighed against the cost of transfer pricing. We adopt the following cost function for manipulating transfer pricing (i.e. the price that the headquarter charges for goods supplied to its subsidiary):

$$c_q = \frac{\left|p_q - 1\right|^{1+\varepsilon_q}}{1+\varepsilon_q} \qquad \text{(A.21)}$$

Hence, deviating the transfer price (p_q) from its arms-length price (equal to one) creates a cost for the multinational, which is convex if $\varepsilon_q > 0$. In the optimum, the marginal cost from transfer price manipulation is set equal to marginal

benefit, which is determined by the corporate tax differential between the foreign subsidiary and the multinational headquarter, i.e.:

$$\frac{\partial c_q}{\partial p_q} = sign(p_q - 1)\left|p_q - 1\right|^{\varepsilon_q} = \tau^f - \tau^m \tag{A.22}$$

Expression (A.22) shows that the headquarter company has an incentive to set an artificially low (high) transfer price for supplies to subsidiaries in countries that feature a lower (higher) statutory corporate tax rate. In this way, it shifts profits from high to low-tax countries, thereby reducing its overall tax payment. The marginal cost of this manipulation depends on the initial deviation of the transfer price from its arms-length price. The speed at which transfer prices increase is determined by the parameter ε_q. In the model, we set its value so as to replicate empirical evidence on profit shifting.

Modelling an outside tax haven

In an extended version of CORTAX, we introduce an outside tax haven that features an exceptionally low corporate tax rate, denoted by τ^h. Firms are able shift part of their profits to this tax haven, independent of the amount of FDI they have invested. Hence, the inclusion of a tax haven reflects other modes of profit shifting than transfer price manipulation. In modelling profit shifting to tax havens, we assume that firms decide about the effort they put into profit shifting activities. This effort is denoted by θ. The idea may be that the multinational has to invest manpower in the relations with the subsidiaries and governments in the tax havens. The higher the effort, the more profits will be shifted to the tax haven but also the higher will be the costs involved. In particular, for each euro paid in corporate tax, the tax saving from profit shifting is assumed to rise linearly in the effort, i.e.

$$\Theta = \theta(\tau - \tau^h) \tag{A.23}$$

The costs of profit shifting per euro of profit is assumed to rise in a convex way in the effort, i.e.

$$c^{ps} = A^{-1/\gamma}\,\frac{\theta^{1+1/\gamma}}{1+1/\gamma} \tag{A.24}$$

where $\gamma \geq 0$. The costs and benefits enter the expression for dividends

$$Div = Div^{org} + \tau\Theta\Pi - c^{ps}\Pi \tag{A.25}$$

where Div^{org} denotes the original dividend equation in CORTAX. By optimising the value of the firm with respect to the effort θ, we find the following first-order condition

$$\theta = A[\tau(\tau - \tau^h)]^{\gamma} \tag{A.26}$$

Substituting into the dividend equation yields that the average net benefit from profit shifting is positive as long as $\tau > \tau^h$

$$\left(\tau\Theta - c^{ps}\right)\Pi = A\frac{[\tau(\tau - \tau^h)]^{1+\gamma}}{1+\gamma}\Pi > 0 \tag{A.27}$$

which is due to the convex character of the cost function. For the government, profit shifting to the tax haven implies a revenue loss equal to

$$\tau\Theta\Pi = A[\tau(\tau - \tau^h)]^{1+\gamma}\Pi \tag{A.28}$$

In the calibration of CORTAX, we set γ equal to 1 so that the costs of profit shifting rise quadratically in effort. The parameter A is set in such a way that we obtain a reasonable amount of profit shifting.

Discrete location choice

Another extension of CORTAX refers to location choice. The literature on foreign direct investment emphasises that investment is not only responsive to the cost of capital, but that also inframarginal investment and location choices are important. One reason may be that firms earn firm-specific economic rents that are mobile across borders. Such rents can be due to patents, brand names, specific managerial talents or market power. Firms then locate their affiliates in countries where the average effective tax rates are relatively low.

In CORTAX, we do not explicitly model the origins of firm-specific economic rents. Instead, we endogenise the value of economic rents earned by a multinational in CORTAX in each location by making it dependent of the corporate tax rate. In particular, suppose that the multinational owns a firm-specific fixed factor H, which it can allocate between two countries, H_i and H_j. If the firm maximizes the sum of profits in the two locations ($\Pi_i + \Pi_j$), the first order condition with respect to the allocation of the fixed factor in country i reads as

$$\frac{\partial\Pi}{\partial H_i} = (1-\tau_i)F_{Hi} - (1-\tau_j)F_{Hj} = 0 \tag{A.29}$$

In the production function of CORTAX, firms combine labour and capital using a CES production function and then combine this with the fixed factor using a cobb-douglas structure. This yields a simple expression for the marginal value of allocating the fixed factor in each of the two locations. Using this production structure, we can write the optimal share of the fixed factor in the two locations as:

$$\frac{H_j}{H_i} = \frac{X_j}{X_i}\left[\frac{1-\tau_j}{1-\tau_i}\right]^{\frac{1}{1-\alpha}} \tag{A.30}$$

where X denotes the composite input of labour and capital. Hence, the share of the fixed factor allocated in country *j* relative to country *i* falls in the tax rate in country *j* relative to country *i*. In CORTAX, we model the share of the fixed factor of a multinational in a specific country as a function of the statutory tax rate in that country, relative to the weighted EU average. The responsiveness of the fixed factor to this tax differential is set so as the replicate empirical estimates on the impact of corporate taxes on FDI.

Appendix B Tables of CORTAX results on ACE & CBIT

The tables in this appendix show the country-specific outcomes of several simulations of ACE and CBIT. In presenting the results, we focus on the following variables

- CIT-rate = absolute change in the statutory corporate tax rate
- Rev_CIT = absolute change in the corporate tax revenue as a share of GDP
- Rev_tax = absolute change in total tax revenue as a share of GDP
- Debt = absolute change in the debt / asset ratio, average across all firms
- Shift_CIT = relative change in the corporate tax base induced by profit shifting
- CoC = absolute change in the cost of capital, average across all firms
- Wage = relative change in the wage rate
- Capital = relative change in total capital stock
- Employm. = relative change in total employment
- GDP = relative change in gross domestic product
- Welfare = absolute change in – 1 x compensating variation expressed in % of GDP (i.e. positive value reflects a welfare gain)

Tables B.1 – B.8 show the effects of ACE reforms. In Table B.1, the government budget is balanced through adjusting lump-sum transfers. Tables B.2 – B.4 explore the same ACE reform under alternative assumptions regarding closure of the government budget. In Table B.2, we adjust the corporate tax rate to balance the budget ex-ante, i.e. before behavioural responses are taken into account. If behavioural responses have implications for tax revenue, the budget is balanced ex-post by adjusting consumption taxes. Tables B.3 and B.4 consider revenue neutrality by means of adjustment in labour income taxes or consumption taxes, respectively. These taxes are adjusted so that the government budget is balanced ex-post, i.e. after taking into account behavioural responses on tax revenue. Table B.5 shows ACE reforms if European countries coordinate their policy. It is primarily important when international spillovers are large, which is the case if corporate tax rates are modified. We therefore show European ACE reforms only if the corporate tax rate is adjusted to balance the government budget ex-ante (consumption taxes ensure ex-post revenue neutrality). Table B.6 shows the same European ACE if we include a tax haven in the model. Tables B.7 and B.8 show the unilateral ACE with corporate tax rate adjustment in the model that includes discrete location, respectively discrete location and tax havens.

Tables B.9 – B.16 show the effects of CBIT reforms, with the same assumptions as under the ACE. Hence, Table B.9 assumes lump-sum revenue recycling of the revenues from CBIT, Table B.10 considers an ex-ante adjustment of corporate tax rates, and Tables B.11 and B.12 look at an ex-post adjustment of labour and consumption taxes. Tables B.13 and B.14 consider

a common European CBIT with revenue recycling via lower corporate tax rates, either or not with a tax haven. Tables B.15 and B.16 consider CBIT in the model with discrete location and tax havens.

Table B.17 presents a combined ACE-CBIT reform, whereby an allowance for corporate equity is applied to ⅔ of the nominal risk-free return and the interest deductibility is restricted to ⅔ of the current level. This combined reform is approximately revenue-neutral for the government ex-ante when viewed from an average EU point of view. If there are revenue changes for an individual country, consumption taxes are adjusted to keep the government budget balanced. As the combined reform yields very similar effects if other taxes are adjusted or if the policy is implemented on a European scale, we only consider one option with respect to the balanced budget rule.

Tables B.18 – B.27 explores ACE and CBIT reforms under alternative parameter values in CORTAX. It sheds light on the robustness of the numerical findings for crucial choices in the calibration and illustrates the working of the model. The first reduces the substitution elasticity between labour and capital in production from 0.7 to 0.5. The second reduces in the cost function of debt finance χ_0 from 0.015 to 0.03, which reduces the tax rate elasticity of the debt share from an average of – 0.27 to – 0.16. The third reduces in the cost of transfer price manipulation ε_q from 1 to 0.5, implying that the elasticity of the transfer price with respect to the corporate tax rate falls on average from – 1.27 to – 0.28. A fourth sensitivity analysis raises the share of economic rents in the economy from 2.5% to 5%. The final sensitivity analysis halves the elasticities of profit shifting to tax havens and discrete location in the extended CORTAX model. The first two sensitivity analysis on the production function and debt policy are explored for reforms where the government budget is balanced by changes in the consumption tax rate. The last three sensitivity analyses are applied to a unilateral reform where the government budget is balanced ex-ante by changes in the corporate tax rate.

Table B.1: ACE, lump-sum transfer adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	-1.4	-0.3	-4.7	0.0	-0.5	2.4	6.6	0.9	2.6	0.6
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
DNK	0.0	-1.2	-0.2	-4.9	0.0	-0.5	2.1	5.8	0.5	2.0	0.7
FIN	0.0	-1.5	-0.2	-5.4	0.0	-0.6	2.7	7.0	0.8	2.6	0.8
FRA	0.0	-1.7	-0.3	-6.5	0.0	-0.7	2.7	8.8	0.9	2.8	0.9
DEU	0.0	-2.1	-0.4	-6.0	0.0	-0.7	3.7	10.7	1.4	4.0	1.1
GRC	0.0	-1.6	-0.4	-4.6	0.0	-0.5	3.2	7.5	1.1	3.3	0.8
IRL	0.0	-1.0	-0.4	-3.0	0.0	-0.2	1.7	4.0	0.6	1.8	0.4
ITA	0.0	-2.0	-0.3	-5.6	0.0	-0.7	3.3	9.8	1.2	3.6	1.0
LUX	0.0	-1.5	-0.5	-8.5	0.2	-0.9	3.6	6.2	-1.0	1.4	3.6
NLD	0.0	-1.6	-0.5	-5.1	0.0	-0.5	3.0	7.5	0.9	3.0	0.9
PRT	0.0	-1.0	-0.4	-4.9	0.0	-0.5	1.4	5.7	0.5	1.5	0.4
ESP	0.0	-2.2	-0.8	-7.4	0.0	-0.8	3.9	10.9	1.4	4.1	1.1
SWE	0.0	-1.3	-0.1	-4.9	0.0	-0.5	2.2	6.9	0.7	2.2	0.7
GBR	0.0	-1.1	-0.5	-5.0	0.0	-0.5	1.6	6.5	0.6	1.7	0.4
CYP	0.0	-0.5	-0.3	-2.9	0.0	-0.2	0.8	2.5	0.3	0.8	0.2
CZE	0.0	-2.0	-0.5	-6.8	0.0	-0.6	3.8	8.8	1.1	3.7	1.0
EST	0.0	-0.9	-0.3	-2.2	0.0	-0.3	1.9	4.1	0.5	1.8	0.5
HUN	0.0	-1.0	-0.2	-4.1	0.0	-0.4	1.6	4.4	0.5	1.6	0.4
LVA	0.0	-0.8	-0.3	-2.9	0.0	-0.3	1.4	3.6	0.6	1.5	0.4
LTU	0.0	-0.9	-0.3	-3.3	0.0	-0.3	1.5	4.1	0.5	1.6	0.4
MLT	0.0	-2.2	-0.8	-8.6	0.0	-1.0	4.1	12.0	1.1	3.9	1.6
POL	0.0	-1.4	-0.4	-5.3	0.0	-0.5	2.3	6.2	0.9	2.6	0.6
SVK	0.0	-1.3	-0.4	-4.0	0.0	-0.4	2.4	5.5	0.8	2.5	0.6
SVN	0.0	-1.3	-0.3	-5.8	0.0	-0.5	2.2	6.2	0.7	2.3	0.7

BGR	0.0	-0.6	-0.2	-2.4	0.0	-0.2	1.0	2.6	0.4	1.1	0.3
ROM	0.0	-0.7	-0.3	-3.2	0.0	-0.3	1.1	3.3	0.4	1.2	0.3

Table B.2: ACE, ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	14.1	-0.6	0.0	-4.0	-0.3	-0.4	1.3	4.9	0.5	1.8	0.3
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	13.6	-0.7	0.0	-3.1	-0.4	-0.5	1.5	5.9	0.5	1.9	0.4
FIN	12.5	-0.5	0.0	-4.3	-0.4	-0.4	1.3	5.2	0.5	1.9	0.4
FRA	16.0	-1.4	0.0	-5.2	-1.0	-0.6	1.7	7.7	0.7	2.3	-0.1
DEU	18.2	-2.0	0.1	-4.7	-1.6	-0.7	2.3	9.3	0.9	3.2	-0.4
GRC	13.4	-0.2	0.0	-3.3	-0.1	-0.4	1.6	5.3	0.7	2.3	0.8
IRL	8.1	-0.3	0.0	-2.4	0.0	-0.2	0.9	3.0	0.2	1.1	0.3
ITA	17.7	-1.3	0.1	-4.5	-0.6	-0.7	2.5	9.6	1.0	3.3	0.5
LUX	5.5	-1.7	0.0	-7.8	-1.7	-0.7	1.2	6.1	0.5	2.2	-1.2
NLD	12.1	-1.6	0.0	-4.2	-1.2	-0.4	1.8	5.9	0.5	2.1	-0.6
PRT	14.7	-0.6	0.0	-3.7	-0.3	-0.5	1.2	6.0	0.3	1.3	0.2
ESP	15.2	-0.7	0.0	-6.6	-0.5	-0.5	1.7	6.8	0.5	2.3	0.4
SWE	14.7	-1.2	0.0	-3.6	-0.9	-0.5	1.6	6.8	0.6	2.0	0.0
GBR	13.8	-1.1	0.0	-4.0	-0.8	-0.6	1.3	6.6	0.2	1.4	-0.3
CYP	6.2	-0.1	0.0	-2.4	0.0	-0.2	0.4	1.8	0.1	0.5	0.2
CZE	14.4	-0.3	0.0	-5.6	-0.1	-0.4	1.5	5.1	0.5	2.1	0.7
EST	13.0	-1.3	0.1	-0.2	-0.2	-0.5	3.3	7.7	0.6	3.1	0.9
HUN	9.2	-0.2	0.0	-3.6	0.0	-0.2	0.7	2.9	0.3	1.0	0.3
LVA	12.0	-0.2	0.0	-1.2	0.0	-0.3	1.1	3.7	0.5	1.5	0.6
LTU	12.6	-0.2	0.0	-1.2	0.0	-0.3	1.3	4.3	0.5	1.6	0.6
MLT	15.0	-1.1	0.0	-7.0	-0.8	-0.6	1.9	9.5	0.5	2.5	0.2
POL	11.3	-0.1	0.0	-4.7	0.0	-0.3	0.9	3.5	0.4	1.4	0.4

SVK	11.0	-0.2	0.0	-2.7	-0.1	-0.3	1.3	4.0	0.5	1.7	0.6
SVN	15.6	-0.3	0.0	-4.3	-0.1	-0.4	1.3	4.7	0.6	1.7	0.6
BGR	6.6	0.0	0.0	-1.7	0.0	-0.1	0.5	1.8	0.2	0.7	0.3
ROM	11.9	-0.2	0.0	-1.8	0.0	-0.3	0.9	3.4	0.3	1.1	0.4

Table B.3: ACE, labour tax adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	-1.4	0.0	-4.7	0.0	-0.5	2.4	5.8	0.2	1.9	0.3
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
DNK	0.0	-1.2	0.0	-4.9	0.0	-0.5	2.1	5.3	0.0	1.5	0.4
FIN	0.0	-1.5	0.0	-5.4	0.0	-0.6	2.7	6.4	0.1	2.0	0.5
FRA	0.0	-1.7	0.0	-6.5	0.0	-0.7	2.7	8.0	0.2	2.1	0.5
DEU	0.0	-2.1	0.1	-6.0	0.0	-0.7	3.7	9.6	0.3	2.9	0.6
GRC	0.0	-1.7	0.0	-4.6	0.0	-0.5	3.2	6.5	0.2	2.4	0.4
IRL	0.0	-1.0	0.0	-3.0	0.0	-0.2	1.8	3.4	0.0	1.2	0.1
ITA	0.0	-2.0	0.1	-5.6	0.0	-0.7	3.4	8.9	0.3	2.7	0.5
LUX	0.0	-1.6	0.0	-8.5	0.2	-0.9	3.7	4.8	-2.3	0.0	2.9
NLD	0.0	-1.6	0.0	-5.1	0.0	-0.5	3.0	6.6	0.0	2.1	0.4
PRT	0.0	-1.0	0.0	-4.9	0.0	-0.5	1.5	5.3	0.0	1.0	0.2
ESP	0.0	-2.2	0.1	-7.4	0.0	-0.8	4.0	9.6	0.1	2.9	0.6
SWE	0.0	-1.4	0.0	-4.9	0.0	-0.5	2.2	6.4	0.3	1.8	0.4
GBR	0.0	-1.1	0.0	-5.0	0.0	-0.5	1.7	6.0	0.1	1.3	0.2
CYP	0.0	-0.5	0.0	-2.9	0.0	-0.2	0.8	2.2	-0.1	0.5	0.1
CZE	0.0	-2.0	0.1	-6.8	0.0	-0.6	3.9	7.8	0.1	2.7	0.5
EST	0.0	-1.0	0.0	-2.2	0.0	-0.3	1.9	3.6	0.1	1.4	0.2
HUN	0.0	-1.0	0.0	-4.1	0.0	-0.4	1.6	3.9	0.0	1.1	0.1
LVA	0.0	-0.8	0.0	-2.9	0.0	-0.3	1.4	3.1	0.0	1.0	0.1
LTU	0.0	-0.9	0.0	-3.3	0.0	-0.3	1.6	3.6	0.0	1.1	0.2

MLT	0.0	-2.2	0.1	-8.6	0.0	-1.0	4.1	10.9	0.0	2.8	1.0
POL	0.0	-1.4	0.0	-5.3	0.0	-0.5	2.4	5.3	0.0	1.7	0.2
SVK	0.0	-1.3	0.0	-4.0	0.0	-0.4	2.5	4.7	0.0	1.7	0.3
SVN	0.0	-1.4	0.0	-5.8	0.0	-0.5	2.2	5.6	0.1	1.6	0.3
BGR	0.0	-0.6	0.0	-2.4	0.0	-0.2	1.0	2.3	0.0	0.7	0.1
ROM	0.0	-0.7	0.0	-3.2	0.0	-0.3	1.1	2.9	0.0	0.7	0.1

Table B.4: ACE, consumption tax adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	-1.4	0.0	-4.7	0.0	-0.5	2.4	6.2	0.6	2.3	0.5
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
DNK	0.0	-1.2	0.0	-4.9	0.0	-0.5	2.1	5.5	0.3	1.7	0.6
FIN	0.0	-1.5	0.0	-5.4	0.0	-0.6	2.7	6.7	0.5	2.3	0.7
FRA	0.0	-1.7	0.0	-6.5	0.0	-0.7	2.7	8.4	0.6	2.5	0.7
DEU	0.0	-2.1	0.1	-6.0	0.0	-0.7	3.7	10.2	0.9	3.5	0.9
GRC	0.0	-1.6	0.1	-4.6	0.0	-0.5	3.2	7.0	0.7	2.9	0.6
IRL	0.0	-1.0	0.0	-3.0	0.0	-0.2	1.8	3.6	0.2	1.4	0.2
ITA	0.0	-2.0	0.1	-5.6	0.0	-0.7	3.4	9.4	0.8	3.2	0.8
LUX	0.0	-1.5	0.0	-8.5	0.2	-0.9	3.6	5.7	-1.5	0.9	3.4
NLD	0.0	-1.6	0.1	-5.1	0.0	-0.5	3.0	6.9	0.4	2.5	0.6
PRT	0.0	-1.0	0.0	-4.9	0.0	-0.5	1.5	5.4	0.1	1.2	0.2
ESP	0.0	-2.2	0.1	-7.4	0.0	-0.8	4.0	10.1	0.6	3.3	0.8
SWE	0.0	-1.3	0.0	-4.9	0.0	-0.5	2.2	6.7	0.5	2.1	0.6
GBR	0.0	-1.1	0.0	-5.0	0.0	-0.5	1.7	6.1	0.2	1.4	0.2
CYP	0.0	-0.5	0.0	-2.9	0.0	-0.2	0.8	2.2	0.0	0.5	0.1
CZE	0.0	-2.0	0.1	-6.8	0.0	-0.6	3.8	8.2	0.5	3.2	0.7
EST	0.0	-1.0	0.0	-2.2	0.0	-0.3	1.9	3.8	0.2	1.5	0.3
HUN	0.0	-1.0	0.0	-4.1	0.0	-0.4	1.6	4.2	0.3	1.4	0.3

LVA	0.0	-0.8	0.0	-2.9	0.0	-0.3	1.4	3.3	0.2	1.2	0.2
LTU	0.0	-0.9	0.0	-3.3	0.0	-0.3	1.5	3.8	0.2	1.3	0.3
MLT	0.0	-2.2	0.1	-8.6	0.0	-1.0	4.1	11.1	0.3	3.1	1.2
POL	0.0	-1.4	0.0	-5.3	0.0	-0.5	2.4	5.7	0.5	2.1	0.4
SVK	0.0	-1.3	0.0	-4.0	0.0	-0.4	2.4	5.0	0.3	2.0	0.4
SVN	0.0	-1.3	0.0	-5.8	0.0	-0.5	2.2	5.9	0.4	2.0	0.5
BGR	0.0	-0.6	0.0	-2.4	0.0	-0.2	1.0	2.4	0.2	0.9	0.2
ROM	0.0	-0.7	0.0	-3.2	0.0	-0.3	1.1	3.0	0.1	0.9	0.1

Table B.5: European ACE, ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (r)	CoC (a)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	14.1	-0.2	0.0	-4.0	0.1	-0.4	1.3	5.0	0.7	1.9	0.7
BEL	0.0	0.8	0.0	0.0	0.9	0.0	0.1	0.4	0.2	0.2	1.0
DNK	13.6	-0.3	0.0	-3.1	0.0	-0.5	1.5	6.0	0.6	2.0	0.9
FIN	12.5	-0.1	0.0	-4.3	0.1	-0.4	1.3	5.3	0.6	2.0	0.8
FRA	16.0	-0.8	0.0	-5.2	-0.4	-0.6	1.6	7.6	0.7	2.4	0.5
DEU	18.2	-1.1	0.1	-4.7	-0.7	-0.7	2.2	9.3	0.9	3.2	0.4
GRC	13.4	-0.2	0.0	-3.3	0.0	-0.4	1.6	5.3	0.7	2.3	0.8
IRL	8.1	0.1	0.0	-2.4	0.4	-0.2	1.1	3.2	0.3	1.3	0.8
ITA	17.7	-0.9	0.1	-4.5	-0.2	-0.7	2.4	9.6	1.0	3.3	0.9
LUX	5.5	1.9	0.1	-7.8	2.0	-0.7	1.4	7.8	1.9	3.7	2.1
NLD	12.1	-0.3	0.1	-4.2	0.2	-0.4	1.8	6.4	0.9	2.6	0.7
PRT	14.7	-0.3	0.0	-3.7	0.1	-0.5	1.1	6.0	0.3	1.4	0.6
ESP	15.2	-0.4	0.0	-6.6	-0.1	-0.5	1.6	6.7	0.5	2.3	0.7
SWE	14.7	-0.6	0.0	-3.6	-0.2	-0.5	1.5	6.8	0.7	2.1	0.7
GBR	13.8	-0.6	0.0	-4.0	-0.2	-0.6	1.2	6.7	0.3	1.4	0.3
CYP	6.2	0.1	0.0	-2.4	0.3	-0.2	0.5	2.1	0.2	0.6	0.5
CZE	14.4	-0.1	0.0	-5.6	0.0	-0.4	1.5	5.2	0.5	2.1	0.8

EST	13.0	-1.0	0.1	-0.2	0.1	-0.5	3.3	7.8	0.6	3.1	1.1
HUN	9.2	0.0	0.0	-3.6	0.2	-0.2	0.8	3.1	0.4	1.2	0.6
LVA	12.0	-0.1	0.0	-1.2	0.1	-0.3	1.2	3.8	0.5	1.5	0.6
LTU	12.6	-0.2	0.0	-1.2	0.0	-0.3	1.3	4.4	0.5	1.7	0.7
MLT	15.0	-0.3	0.0	-7.0	-0.2	-0.6	1.7	8.8	0.4	2.4	0.9
POL	11.3	0.0	0.0	-4.7	0.1	-0.3	0.9	3.6	0.5	1.4	0.6
SVK	11.0	-0.1	0.0	-2.7	0.1	-0.3	1.4	4.2	0.5	1.8	0.8
SVN	15.6	-0.2	0.0	-4.3	0.0	-0.4	1.3	4.7	0.6	1.7	0.7
BGR	6.6	0.0	0.0	-1.7	0.1	-0.1	0.6	2.0	0.3	0.8	0.4
ROM	11.9	-0.1	0.0	-1.8	0.1	-0.3	0.9	3.5	0.4	1.2	0.5
EU	14.5	-0.6	0.0	-4.3	-0.2	-0.5	1.6	6.7	0.6	2.2	0.6

Table B.6: Including tax haven, European ACE with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (r)	CoC (a)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	20.3	-0.2	0.0	-3.6	-0.1	-0.3	0.9	4.4	0.6	1.7	0.3
BEL	0.0	0.9	0.0	0.0	1.1	0.0	0.1	0.2	0.2	0.2	1.1
DNK	19.3	-0.3	0.0	-2.6	0.0	-0.4	1.3	5.6	0.6	1.9	0.6
FIN	17.9	-0.1	0.0	-3.8	0.1	-0.3	0.9	4.6	0.6	1.8	0.5
FRA	21.7	-0.9	0.0	-4.7	-0.6	-0.6	1.4	6.9	0.7	2.1	0.0
DEU	18.6	-1.2	0.1	-4.6	-0.4	-0.6	2.3	8.5	0.9	3.0	0.5
GRC	19.0	-0.2	0.0	-2.9	0.0	-0.3	1.2	4.6	0.6	2.0	0.5
IRL	9.5	0.1	0.0	-2.3	0.4	-0.2	0.9	3.0	0.3	1.2	0.8
ITA	17.7	-1.0	0.1	-4.4	-0.1	-0.6	2.4	8.5	0.9	2.9	0.8
LUX	7.7	1.9	0.1	-7.3	2.3	-0.6	0.7	6.9	1.9	3.4	1.6
NLD	17.2	-0.4	0.0	-3.9	0.0	-0.4	1.4	5.8	0.9	2.4	0.2
PRT	21.7	-0.3	0.0	-3.2	0.0	-0.5	1.0	5.7	0.3	1.3	0.4
ESP	22.0	-0.5	0.0	-6.1	-0.2	-0.4	1.1	5.6	0.5	1.9	0.1
SWE	22.4	-0.7	0.0	-3.1	-0.5	-0.5	1.2	6.4	0.6	2.0	0.2

GBR	21.6	-0.8	0.0	-3.6	-0.6	-0.5	1.0	6.3	0.3	1.3	-0.2
CYP	6.9	0.2	0.0	-2.3	0.3	-0.2	0.4	1.9	0.2	0.6	0.4
CZE	20.4	-0.1	0.0	-5.2	0.0	-0.3	0.9	4.1	0.4	1.7	0.3
EST	13.0	-0.8	0.1	-0.4	0.2	-0.4	3.0	6.8	0.6	2.8	1.2
HUN	11.2	0.0	0.0	-3.5	0.2	-0.2	0.6	2.7	0.3	1.0	0.4
LVA	14.7	-0.1	0.0	-1.0	0.1	-0.3	1.1	3.7	0.5	1.5	0.6
LTU	16.0	-0.2	0.0	-0.9	0.0	-0.3	1.2	4.3	0.5	1.6	0.6
MLT	20.0	-0.6	0.0	-6.4	-0.2	-0.6	1.4	7.7	0.4	2.2	0.3
POL	14.5	0.0	0.0	-4.4	0.1	-0.2	0.6	3.0	0.4	1.2	0.3
SVK	14.0	0.0	0.0	-2.4	0.1	-0.2	1.1	3.8	0.5	1.6	0.6
SVN	22.0	-0.2	0.0	-3.9	0.0	-0.4	1.0	4.2	0.6	1.6	0.4
BGR	7.4	0.0	0.0	-1.7	0.1	-0.1	0.5	1.9	0.3	0.7	0.3
ROM	14.8	-0.1	0.0	-1.6	0.1	-0.3	0.8	3.4	0.4	1.1	0.4
EU	18.3	-0.7	0.0	-4.1	-0.2	-0.5	1.4	6.0	0.6	2.0	0.3

Table B.7: Including location choice, unilateral ACE with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	14.1	-0.6	0.0	-4.0	-0.3	-0.4	0.9	4.5	0.3	1.2	0.1
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	13.6	-0.5	0.0	-3.1	-0.3	-0.5	0.5	3.3	0.0	0.3	-0.1
FIN	12.5	-0.4	0.0	-4.3	-0.3	-0.4	0.8	3.7	0.2	0.9	0.2
FRA	16.0	-1.2	0.0	-5.2	-0.9	-0.6	1.0	6.4	0.2	1.1	-0.4
DEU	18.3	-2.0	0.0	-4.7	-1.6	-0.7	1.9	8.6	0.5	2.3	-0.8
GRC	13.4	-0.2	0.0	-3.3	-0.1	-0.4	1.5	4.9	0.6	2.0	0.7
IRL	8.2	-0.4	0.0	-2.3	-0.1	-0.2	0.1	2.4	-0.1	-0.3	-0.3
ITA	17.7	-1.3	0.1	-4.5	-0.5	-0.7	2.2	9.4	0.8	2.8	0.4
LUX	5.5	-1.8	0.0	-7.8	-1.8	-0.7	0.0	3.4	-0.1	0.2	-2.1
NLD	12.1	-1.6	0.0	-4.2	-1.1	-0.4	0.5	3.8	-0.2	0.2	-1.4

PRT	14.6	-0.6	0.0	-3.7	-0.2	-0.5	0.6	5.8	0.1	0.4	-0.2
ESP	15.2	-0.6	0.0	-6.6	-0.4	-0.5	1.1	5.9	0.2	1.3	0.1
SWE	14.8	-1.1	0.0	-3.6	-0.7	-0.5	0.7	5.3	0.0	0.5	-0.6
GBR	13.9	-1.2	0.0	-4.0	-0.7	-0.6	0.8	6.6	0.0	0.6	-0.6
CYP	6.2	-0.1	0.0	-2.4	0.0	-0.2	0.1	1.4	0.0	0.1	0.0
CZE	14.3	-0.2	0.0	-5.6	-0.1	-0.4	1.0	4.2	0.2	1.2	0.5
EST	13.0	-1.1	0.0	-0.2	-0.1	-0.5	2.5	5.9	0.3	2.0	0.7
HUN	9.2	-0.2	0.0	-3.6	-0.1	-0.2	0.3	2.2	0.1	0.4	0.1
LVA	12.0	-0.2	0.0	-1.2	0.0	-0.3	1.0	3.4	0.4	1.2	0.5
LTU	12.6	-0.2	0.0	-1.2	0.0	-0.3	1.2	4.1	0.4	1.4	0.6
MLT	15.0	-0.2	0.0	-7.0	-0.3	-0.6	0.8	4.9	0.1	1.1	0.6
POL	11.3	-0.1	0.0	-4.7	0.0	-0.3	0.6	3.0	0.3	1.0	0.3
SVK	11.0	-0.1	0.0	-2.7	-0.1	-0.3	0.9	2.7	0.2	1.1	0.5
SVN	15.5	-0.3	0.0	-4.3	-0.1	-0.4	1.0	4.1	0.4	1.2	0.5
BGR	6.6	-0.1	0.0	-1.7	0.0	-0.1	0.2	1.1	0.1	0.3	0.2
ROM	12.0	-0.2	0.0	-1.8	0.0	-0.3	0.7	3.1	0.2	0.8	0.3

Table B.8: Including tax haven and location choice, unilateral ACE with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	20.3	-0.6	0.0	-3.6	-0.5	-0.3	0.6	3.9	0.3	1.0	-0.3
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	19.3	-0.5	0.0	-2.6	-0.5	-0.4	0.2	2.9	-0.1	0.2	-0.4
FIN	17.9	-0.4	0.0	-3.8	-0.4	-0.3	0.4	2.9	0.1	0.7	-0.2
FRA	21.7	-1.4	0.0	-4.7	-1.2	-0.6	0.8	5.6	0.2	0.9	-0.9
DEU	18.6	-1.7	0.0	-4.6	-1.0	-0.6	2.0	8.0	0.5	2.2	-0.3
GRC	19.0	-0.2	0.0	-2.9	-0.1	-0.3	1.1	4.2	0.5	1.8	0.4
IRL	9.7	-0.4	0.0	-2.3	-0.1	-0.2	0.1	2.4	-0.1	-0.3	-0.3
ITA	17.7	-1.3	0.0	-4.4	-0.3	-0.6	2.2	8.3	0.7	2.5	0.4

LUX	7.6	-2.2	0.0	-7.3	-2.6	-0.6	-0.6	2.3	-0.3	-0.4	-3.2
NLD	17.1	-1.9	0.0	-3.9	-1.8	-0.4	0.2	3.1	-0.3	-0.2	-2.1
PRT	21.7	-0.6	0.0	-3.2	-0.3	-0.5	0.4	5.5	0.1	0.4	-0.3
ESP	22.0	-0.8	0.0	-6.1	-0.5	-0.4	0.5	4.8	0.2	0.9	-0.5
SWE	22.4	-1.3	0.0	-3.1	-1.2	-0.5	0.4	4.8	0.0	0.3	-1.3
GBR	21.7	-1.5	0.0	-3.6	-1.3	-0.5	0.5	6.3	0.0	0.4	-1.2
CYP	7.1	-0.1	0.0	-2.3	0.0	-0.2	0.1	1.4	0.0	0.1	0.0
CZE	20.4	-0.1	0.0	-5.2	-0.1	-0.3	0.4	3.3	0.2	0.9	0.0
EST	13.0	-0.9	0.0	-0.4	-0.1	-0.4	2.3	5.3	0.2	1.8	0.7
HUN	11.3	-0.2	0.0	-3.5	-0.1	-0.2	0.3	2.1	0.1	0.4	0.0
LVA	14.8	-0.2	0.0	-1.0	0.0	-0.3	1.0	3.4	0.4	1.2	0.4
LTU	16.1	-0.2	0.0	-0.8	0.0	-0.3	1.1	4.0	0.5	1.4	0.5
MLT	20.0	-0.5	0.0	-6.4	-0.4	-0.6	0.6	4.1	0.0	0.8	-0.1
POL	14.5	-0.1	0.0	-4.4	0.0	-0.2	0.4	2.6	0.3	0.9	0.1
SVK	14.0	-0.1	0.0	-2.4	-0.1	-0.2	0.7	2.5	0.2	1.0	0.4
SVN	22.0	-0.2	0.0	-3.9	-0.1	-0.4	0.7	3.6	0.4	1.1	0.2
BGR	7.4	0.0	0.0	-1.7	0.0	-0.1	0.2	1.2	0.1	0.3	0.1
ROM	14.9	-0.2	0.0	-1.6	0.0	-0.3	0.7	3.2	0.3	0.9	0.2

Table B.9: CBIT, lump-sum transfers adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	2.5	0.6	-6.1	0.0	0.9	-4.1	-10.5	-1.6	-4.3	-1.1
BEL	0.0	4.8	0.8	-4.4	0.0	1.8	-7.8	-21.0	-3.4	-8.6	-2.1
DNK	0.0	1.9	0.5	-8.6	0.0	0.6	-2.7	-8.1	-1.2	-3.1	-0.5
FIN	0.0	2.0	0.4	-8.0	0.0	0.7	-3.2	-8.6	-1.3	-3.6	-0.7
FRA	0.0	2.6	0.5	-9.4	0.0	1.1	-3.9	-12.1	-1.7	-4.4	-1.1
DEU	0.0	3.6	0.8	-8.8	0.0	1.4	-6.2	-16.5	-2.6	-6.7	-1.8
GRC	0.0	2.4	0.7	-7.0	0.0	0.7	-4.3	-9.8	-1.8	-4.7	-0.9
IRL	0.0	1.4	0.6	-3.9	0.0	0.3	-2.3	-5.3	-0.9	-2.4	-0.5
ITA	0.0	4.0	0.7	-8.1	0.0	1.6	-6.7	-17.8	-2.6	-7.1	-1.9
LUX	0.0	2.3	0.1	-12.6	0.4	0.6	-4.2	-16.1	-6.5	-9.5	2.9
NLD	0.0	2.5	0.9	-7.1	0.0	0.8	-4.1	-10.4	-1.7	-4.4	-0.9
PRT	0.0	1.8	0.9	-7.3	0.0	0.9	-2.4	-9.2	-0.9	-2.5	-0.6
ESP	0.0	2.9	1.1	-9.2	0.0	1.1	-5.0	-13.0	-2.0	-5.3	-1.2
SWE	0.0	2.3	0.4	-7.6	0.0	0.9	-3.4	-10.4	-1.2	-3.6	-0.9
GBR	0.0	2.2	1.1	-7.3	0.0	1.1	-3.0	-11.2	-1.0	-2.9	-0.8
CYP	0.0	0.6	0.3	-3.7	0.0	0.2	-0.7	-2.5	-0.4	-0.9	-0.1
CZE	0.0	1.9	0.6	-8.9	0.0	0.6	-3.3	-7.7	-1.2	-3.6	-0.6
EST	0.0	2.5	1.0	-6.2	0.0	0.6	-4.2	-9.2	-1.6	-4.4	-0.6
HUN	0.0	1.2	0.3	-5.0	0.0	0.4	-1.8	-5.1	-0.7	-2.0	-0.4
LVA	0.0	1.2	0.5	-5.0	0.0	0.4	-1.9	-4.9	-0.9	-2.2	-0.4
LTU	0.0	1.3	0.5	-6.7	0.0	0.4	-1.9	-5.1	-0.9	-2.2	-0.3
MLT	0.0	2.7	1.2	-12.9	0.0	0.9	-4.1	-13.4	-1.9	-4.7	-0.7
POL	0.0	1.4	0.4	-6.5	0.0	0.4	-2.2	-5.8	-1.0	-2.6	-0.5
SVK	0.0	1.6	0.6	-6.4	0.0	0.4	-2.8	-6.6	-1.3	-3.2	-0.5
SVN	0.0	1.5	0.4	-8.2	0.0	0.6	-2.2	-6.3	-1.0	-2.5	-0.5

BGR	0.0	0.7	0.3	-3.4	0.0	0.2	-1.1	-3.0	-0.5	-1.3	-0.2
ROM	0.0	1.1	0.6	-5.1	0.0	0.4	-1.6	-4.8	-0.8	-1.8	-0.3

Table B.10: CBIT, ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-10.8	0.1	0.0	-6.1	0.1	0.2	-0.3	-1.8	-0.2	-0.7	-0.1
BEL	-23.4	0.4	0.0	-6.7	0.6	0.3	-0.7	-4.3	-0.5	-1.4	-0.2
DNK	-9.4	0.1	0.0	-8.6	0.1	0.1	-0.3	-2.1	-0.3	-0.7	0.0
FIN	-8.8	0.1	0.0	-8.0	0.1	0.1	-0.2	-1.8	-0.3	-0.7	0.0
FRA	-12.9	0.2	0.0	-9.4	0.2	0.2	-0.3	-2.5	-0.3	-0.8	0.1
DEU	-15.8	0.2	0.0	-8.8	0.3	0.2	-0.3	-2.8	-0.4	-0.9	0.1
GRC	-9.5	0.0	0.0	-7.0	0.0	0.1	-0.3	-1.6	-0.3	-0.8	-0.1
IRL	-4.7	0.1	0.0	-3.9	-0.1	0.1	-0.2	-1.2	-0.1	-0.4	-0.1
ITA	-18.0	0.1	0.0	-8.1	0.1	0.3	-0.5	-3.1	-0.4	-1.0	-0.1
LUX	-6.4	1.0	0.0	-12.6	1.0	0.0	-0.1	-5.1	-0.5	-1.8	1.6
NLD	-9.2	0.4	0.0	-7.1	0.2	0.2	-0.4	-2.4	-0.3	-0.8	0.3
PRT	-11.4	0.1	0.0	-7.3	0.1	0.2	-0.3	-2.3	-0.1	-0.5	-0.1
ESP	-11.5	0.1	0.0	-9.2	0.1	0.2	-0.1	-1.9	-0.2	-0.6	0.1
SWE	-11.5	0.2	0.0	-7.6	0.2	0.2	-0.3	-2.4	-0.2	-0.7	0.0
GBR	-12.6	0.3	0.0	-7.3	0.2	0.4	-0.3	-3.1	-0.1	-0.5	0.1
CYP	-3.0	0.0	0.0	-3.7	0.0	0.1	-0.1	-0.7	-0.1	-0.2	0.0
CZE	-7.2	0.0	0.0	-8.9	0.0	0.0	0.0	-1.0	-0.2	-0.5	0.1
EST	-13.4	0.1	0.0	-6.2	0.0	0.2	-1.1	-2.9	-0.4	-1.3	-0.6
HUN	-5.3	0.0	0.0	-5.0	0.0	0.1	-0.2	-1.0	-0.2	-0.4	-0.1
LVA	-6.3	0.0	0.0	-5.0	0.0	0.1	-0.3	-1.2	-0.2	-0.5	-0.1
LTU	-7.0	0.0	0.0	-6.7	0.0	0.1	-0.3	-1.3	-0.2	-0.5	-0.1
MLT	-10.9	0.1	0.0	-12.9	0.2	0.0	0.2	-2.7	-0.4	-0.7	0.6
POL	-5.7	0.0	0.0	-6.5	0.0	0.1	-0.1	-0.9	-0.2	-0.4	0.0

SVK	-6.6	0.0	0.0	-6.4	0.0	0.1	-0.2	-1.3	-0.3	-0.6	0.0
SVN	-7.8	0.0	0.0	-8.2	0.0	0.1	-0.2	-1.1	-0.2	-0.5	0.0
BGR	-3.3	0.0	0.0	-3.4	0.0	0.0	-0.1	-0.6	-0.1	-0.3	-0.1
ROM	-6.8	0.0	0.0	-5.1	0.0	0.1	-0.3	-1.2	-0.2	-0.4	-0.1

Table B.11: CBIT, labour tax adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	2.6	-0.1	-6.1	0.0	0.9	-4.2	-9.0	0.1	-2.8	-0.2
BEL	0.0	5.0	-0.1	-4.4	0.0	1.8	-7.9	-18.7	-0.4	-5.9	-0.6
DNK	0.0	1.9	0.0	-8.6	0.0	0.6	-2.8	-7.1	-0.1	-2.1	0.2
FIN	0.0	2.1	-0.1	-8.0	0.0	0.7	-3.3	-7.6	-0.1	-2.4	0.0
FRA	0.0	2.7	-0.1	-9.4	0.0	1.1	-4.0	-10.8	-0.1	-2.9	-0.2
DEU	0.0	3.8	-0.1	-8.8	0.0	1.4	-6.3	-14.5	-0.1	-4.5	-0.6
GRC	0.0	2.5	-0.1	-7.0	0.0	0.7	-4.4	-8.2	0.0	-3.1	-0.2
IRL	0.0	1.4	0.0	-3.9	0.0	0.3	-2.3	-4.4	0.1	-1.5	0.0
ITA	0.0	4.2	-0.1	-8.1	0.0	1.6	-6.8	-15.9	-0.2	-4.9	-0.7
LUX	0.0	2.3	-0.2	-12.6	0.4	0.6	-4.2	-15.6	-5.9	-8.9	3.5
NLD	0.0	2.6	-0.1	-7.1	0.0	0.8	-4.2	-8.9	0.0	-2.9	-0.1
PRT	0.0	1.9	0.0	-7.3	0.0	0.9	-2.5	-8.4	0.1	-1.7	-0.1
ESP	0.0	3.0	-0.1	-9.2	0.0	1.1	-5.0	-11.4	-0.1	-3.5	-0.4
SWE	0.0	2.4	0.0	-7.6	0.0	0.9	-3.5	-9.2	0.1	-2.3	-0.1
GBR	0.0	2.2	0.0	-7.3	0.0	1.1	-3.0	-10.2	0.2	-1.9	-0.2
CYP	0.0	0.6	0.0	-3.7	0.0	0.2	-0.7	-2.2	0.0	-0.6	0.1
CZE	0.0	2.0	-0.1	-8.9	0.0	0.6	-3.4	-6.6	0.0	-2.4	0.0
EST	0.0	2.6	-0.1	-6.2	0.0	0.6	-4.2	-7.7	0.1	-2.9	0.1
HUN	0.0	1.2	0.0	-5.0	0.0	0.4	-1.8	-4.4	0.0	-1.3	0.0
LVA	0.0	1.3	0.0	-5.0	0.0	0.4	-1.9	-4.0	0.1	-1.3	0.1
LTU	0.0	1.3	0.0	-6.7	0.0	0.4	-1.9	-4.3	0.1	-1.3	0.1
MLT	0.0	2.8	-0.1	-12.9	0.0	0.9	-4.1	-11.9	-0.2	-3.1	0.1
POL	0.0	1.4	0.0	-6.5	0.0	0.4	-2.2	-4.8	0.0	-1.6	0.0
SVK	0.0	1.7	0.0	-6.4	0.0	0.4	-2.8	-5.4	0.0	-2.0	0.1
SVN	0.0	1.6	0.0	-8.2	0.0	0.6	-2.3	-5.4	0.0	-1.6	0.1

BGR	0.0	0.7	0.0	-3.4	0.0	0.2	-1.1	-2.5	0.0	-0.7	0.0
ROM	0.0	1.2	0.0	-5.1	0.0	0.4	-1.6	-4.1	0.0	-1.1	0.0

Table B.12: CBIT, consumption tax adjustment

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	2.6	-0.1	-6.1	0.0	0.9	-4.1	-9.8	-0.8	-3.7	-0.7
BEL	0.0	4.9	-0.1	-4.4	0.0	1.8	-7.8	-20.0	-2.1	-7.4	-1.4
DNK	0.0	1.9	-0.1	-8.6	0.0	0.6	-2.8	-7.6	-0.6	-2.6	-0.2
FIN	0.0	2.1	-0.1	-8.0	0.0	0.7	-3.3	-8.2	-0.8	-3.1	-0.4
FRA	0.0	2.6	-0.1	-9.4	0.0	1.1	-4.0	-11.5	-1.0	-3.7	-0.7
DEU	0.0	3.7	-0.1	-8.8	0.0	1.4	-6.2	-15.6	-1.5	-5.7	-1.2
GRC	0.0	2.5	-0.1	-7.0	0.0	0.7	-4.3	-9.0	-1.0	-3.9	-0.5
IRL	0.0	1.4	0.0	-3.9	0.0	0.3	-2.3	-4.7	-0.2	-1.8	-0.2
ITA	0.0	4.1	-0.1	-8.1	0.0	1.6	-6.7	-17.0	-1.6	-6.2	-1.4
LUX	0.0	2.3	-0.2	-12.6	0.4	0.6	-4.2	-16.0	-6.3	-9.3	3.1
NLD	0.0	2.5	-0.1	-7.1	0.0	0.8	-4.2	-9.5	-0.6	-3.5	-0.4
PRT	0.0	1.9	0.0	-7.3	0.0	0.9	-2.5	-8.6	-0.2	-1.9	-0.2
ESP	0.0	3.0	-0.1	-9.2	0.0	1.1	-5.0	-12.0	-0.8	-4.2	-0.7
SWE	0.0	2.4	-0.1	-7.6	0.0	0.9	-3.5	-9.9	-0.7	-3.1	-0.6
GBR	0.0	2.2	0.0	-7.3	0.0	1.1	-3.0	-10.4	-0.1	-2.1	-0.3
CYP	0.0	0.6	0.0	-3.7	0.0	0.2	-0.7	-2.3	-0.1	-0.6	0.0
CZE	0.0	2.0	-0.1	-8.9	0.0	0.6	-3.4	-7.1	-0.6	-3.0	-0.3
EST	0.0	2.6	-0.1	-6.2	0.0	0.6	-4.2	-8.2	-0.5	-3.4	-0.2
HUN	0.0	1.2	0.0	-5.0	0.0	0.4	-1.8	-4.7	-0.4	-1.6	-0.2
LVA	0.0	1.3	0.0	-5.0	0.0	0.4	-1.9	-4.4	-0.4	-1.7	-0.1
LTU	0.0	1.3	0.0	-6.7	0.0	0.4	-1.9	-4.6	-0.3	-1.7	-0.1
MLT	0.0	2.8	-0.1	-12.9	0.0	0.9	-4.1	-12.3	-0.7	-3.6	-0.1
POL	0.0	1.4	0.0	-6.5	0.0	0.4	-2.2	-5.2	-0.5	-2.0	-0.2

SVK	0.0	1.7	-0.1	-6.4	0.0	0.4	-2.8	-5.9	-0.5	-2.5	-0.2
SVN	0.0	1.5	0.0	-8.2	0.0	0.6	-2.3	-5.9	-0.5	-2.1	-0.2
BGR	0.0	0.7	0.0	-3.4	0.0	0.2	-1.1	-2.7	-0.2	-1.0	-0.1
ROM	0.0	1.1	0.0	-5.1	0.0	0.4	-1.6	-4.3	-0.2	-1.3	-0.1

Table B.13: European CBIT, ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	-10.8	0.0	0.0	-6.1	0.0	0.2	-0.4	-1.8	-0.2	-0.7	-0.2
BEL	-26.4	0.2	0.0	-4.4	0.4	0.4	-1.1	-5.4	-0.8	-2.0	-0.6
DNK	-9.4	0.0	0.0	-8.6	-0.1	0.1	-0.3	-2.3	-0.5	-0.9	-0.1
FIN	-8.8	-0.1	0.0	-8.0	-0.1	0.1	-0.3	-2.0	-0.5	-0.9	0.0
FRA	-12.9	0.0	0.0	-9.4	0.0	0.2	-0.3	-2.6	-0.5	-0.9	-0.1
DEU	-15.8	0.1	0.0	-8.8	0.2	0.2	-0.3	-2.8	-0.4	-0.9	-0.1
GRC	-9.5	0.0	0.0	-7.0	0.0	0.1	-0.3	-1.7	-0.3	-0.8	-0.1
IRL	-4.7	-0.1	0.0	-3.9	-0.2	0.1	-0.4	-1.3	-0.1	-0.5	-0.3
ITA	-18.0	0.0	0.0	-8.1	0.1	0.3	-0.5	-3.1	-0.4	-1.0	-0.2
LUX	-6.4	-2.0	-0.2	-12.6	-1.5	0.0	0.3	-12.8	-8.8	-9.7	5.2
NLD	-9.2	-0.1	0.0	-7.1	-0.2	0.2	-0.5	-2.9	-0.8	-1.3	0.0
PRT	-11.4	0.0	0.0	-7.3	0.0	0.2	-0.4	-2.3	-0.2	-0.5	-0.2
ESP	-11.5	0.0	0.0	-9.2	0.0	0.2	-0.1	-2.0	-0.2	-0.6	0.0
SWE	-11.5	0.1	0.0	-7.6	0.0	0.2	-0.4	-2.5	-0.3	-0.7	-0.2
GBR	-12.6	0.2	0.0	-7.3	0.1	0.4	-0.4	-3.0	-0.1	-0.5	-0.2
CYP	-3.0	0.0	0.0	-3.7	-0.1	0.1	-0.2	-0.8	-0.2	-0.3	0.0
CZE	-7.2	-0.1	0.0	-8.9	0.0	0.0	-0.1	-1.1	-0.2	-0.5	0.1
EST	-13.4	0.0	0.0	-6.2	0.0	0.2	-1.2	-3.0	-0.4	-1.3	-0.7
HUN	-5.3	0.0	0.0	-5.0	-0.1	0.1	-0.2	-1.2	-0.2	-0.5	-0.1
LVA	-6.3	0.0	0.0	-5.0	0.0	0.1	-0.3	-1.2	-0.2	-0.5	-0.2
LTU	-7.0	0.0	0.0	-6.7	0.0	0.1	-0.3	-1.4	-0.2	-0.6	-0.2

MLT	-10.9	0.0	0.0	-12.9	0.1	0.0	0.2	-2.8	-0.5	-0.8	0.6
POL	-5.7	0.0	0.0	-6.5	0.0	0.1	-0.1	-1.0	-0.2	-0.4	0.0
SVK	-6.6	0.0	0.0	-6.4	0.0	0.1	-0.3	-1.5	-0.3	-0.6	-0.1
SVN	-7.8	0.0	0.0	-8.2	0.0	0.1	-0.2	-1.1	-0.2	-0.5	-0.1
BGR	-3.3	0.0	0.0	-3.4	0.0	0.0	-0.2	-0.7	-0.1	-0.3	-0.1
ROM	-6.8	0.0	0.0	-5.1	0.0	0.1	-0.3	-1.3	-0.2	-0.5	-0.1
EU	-12.3	0.0	0.0	-7.7	0.1	0.2	-0.3	-2.4	-0.3	-0.8	-0.1

Table B.14: Including outside tax havens, European CBIT with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (r)	CoC (a)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-13.0	-0.3	0.0	-5.9	0.0	0.0	0.2	-0.6	-0.2	-0.2	0.0
BEL	-29.0	-0.1	0.0	-4.1	0.3	0.2	-0.6	-4.0	-0.7	-1.5	-0.5
DNK	-11.4	-0.2	0.0	-8.2	-0.1	0.0	0.0	-1.5	-0.4	-0.7	0.1
FIN	-10.7	-0.2	0.0	-7.6	-0.1	0.0	0.2	-1.0	-0.4	-0.6	0.2
FRA	-17.0	-0.3	0.0	-8.8	0.1	0.0	0.4	-0.6	-0.4	-0.3	0.3
DEU	-21.9	-0.6	0.0	-8.2	0.2	-0.1	1.0	0.6	-0.2	0.2	0.5
GRC	-11.4	-0.2	0.0	-6.7	0.0	0.0	0.2	-0.5	-0.2	-0.3	0.1
IRL	-5.1	-0.1	0.0	-3.9	-0.2	0.1	-0.2	-1.1	-0.1	-0.4	-0.3
ITA	-25.1	-0.8	0.0	-7.6	0.1	-0.1	1.1	0.8	-0.2	0.2	0.3
LUX	-8.1	-2.4	-0.2	-12.0	-2.0	-0.1	0.9	-12.2	-9.4	-9.9	5.9
NLD	-11.2	-0.3	0.0	-6.8	-0.3	0.1	0.1	-1.8	-0.8	-1.0	0.2
PRT	-14.0	-0.2	0.0	-6.9	0.0	0.1	-0.1	-1.3	-0.2	-0.3	-0.1
ESP	-15.2	-0.4	0.0	-8.6	0.0	0.0	0.8	0.2	-0.1	0.1	0.4
SWE	-14.3	-0.2	0.0	-7.3	0.0	0.1	0.1	-1.1	-0.2	-0.3	0.0
GBR	-16.1	-0.1	0.0	-6.9	0.1	0.2	0.1	-1.5	-0.1	-0.2	0.0
CYP	-3.2	-0.1	0.0	-3.6	-0.1	0.0	-0.1	-0.7	-0.2	-0.3	0.0
CZE	-8.6	-0.2	0.0	-8.5	0.0	0.0	0.4	-0.3	-0.2	-0.2	0.3
EST	-15.7	-0.2	0.0	-5.9	0.0	0.1	-0.7	-2.2	-0.4	-1.0	-0.6

HUN	-5.9	-0.1	0.0	-4.9	-0.1	0.0	-0.1	-0.8	-0.2	-0.4	-0.1
LVA	-6.9	-0.1	0.0	-4.9	0.0	0.1	-0.2	-0.9	-0.2	-0.4	-0.1
LTU	-7.9	-0.1	0.0	-6.5	0.0	0.1	-0.2	-1.0	-0.2	-0.5	-0.1
MLT	-14.6	-0.4	0.0	-12.1	0.1	-0.2	1.0	-0.5	-0.4	-0.2	0.9
POL	-6.5	-0.1	0.0	-6.3	0.0	0.0	0.1	-0.5	-0.2	-0.3	0.1
SVK	-7.5	-0.1	0.0	-6.2	0.0	0.0	0.0	-1.0	-0.3	-0.4	0.0
SVN	-9.2	-0.1	0.0	-7.8	0.0	0.0	0.1	-0.5	-0.2	-0.3	0.1
BGR	-3.6	0.0	0.0	-3.3	0.0	0.0	-0.1	-0.6	-0.1	-0.3	-0.1
ROM	-7.5	-0.1	0.0	-5.0	0.0	0.1	-0.2	-1.0	-0.2	-0.4	-0.1
EU	-16.0	-0.4	0.0	-7.3	0.0	0.0	0.4	-0.4	-0.2	-0.2	0.2

Table B.15: Including location choice, unilateral CBIT with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-10.8	0.2	0.0	-6.1	0.1	0.1	0.5	-0.8	0.3	0.8	0.5
BEL	-23.4	0.6	0.2	-6.7	0.7	0.3	5.0	2.0	1.7	6.2	4.9
DNK	-9.6	0.2	0.0	-8.6	0.1	0.1	1.0	0.1	0.4	1.3	1.1
FIN	-8.8	0.1	0.0	-8.0	0.1	0.1	0.5	-0.2	0.2	0.6	0.6
FRA	-12.9	0.3	0.0	-9.4	0.3	0.2	0.8	-0.8	0.5	1.2	1.1
DEU	-15.9	0.3	0.0	-8.8	0.3	0.2	0.7	-1.5	0.4	1.0	0.8
GRC	-9.5	0.0	0.0	-7.0	0.0	0.1	-0.1	-1.1	-0.1	-0.3	0.0
IRL	-4.7	0.1	0.0	-3.9	0.0	0.1	0.5	-0.6	0.2	0.9	0.4
ITA	-18.0	0.2	0.0	-8.1	0.2	0.3	0.5	-2.1	0.3	0.9	0.6
LUX	-6.4	1.2	0.0	-12.6	1.1	0.0	1.5	-2.6	0.2	0.7	3.0
NLD	-9.3	0.5	0.1	-7.1	0.3	0.2	1.2	-0.4	0.4	1.5	1.5
PRT	-11.4	0.2	0.1	-7.3	0.2	0.2	0.9	-1.5	0.4	1.4	0.8
ESP	-11.5	0.2	0.0	-9.2	0.2	0.2	0.9	-0.8	0.3	1.1	0.8
SWE	-11.5	0.3	0.1	-7.6	0.3	0.2	1.2	-0.4	0.6	1.9	1.5
GBR	-12.7	0.4	0.0	-7.3	0.3	0.4	0.7	-2.4	0.3	1.1	0.8
CYP	-3.0	0.0	0.0	-3.7	0.0	0.1	0.1	-0.4	0.0	0.1	0.1
CZE	-7.2	0.1	0.0	-8.9	0.1	0.0	0.5	-0.3	0.1	0.4	0.4
EST	-13.4	0.2	0.1	-6.2	0.1	0.2	0.9	0.3	0.5	1.4	0.5
HUN	-5.3	0.1	0.0	-5.0	0.0	0.1	0.2	-0.4	0.1	0.3	0.2
LVA	-6.3	0.0	0.0	-5.0	0.0	0.1	-0.1	-0.8	-0.1	-0.2	-0.1
LTU	-7.0	0.0	0.0	-6.7	0.0	0.1	-0.2	-1.0	-0.1	-0.3	-0.1
MLT	-10.8	0.2	0.0	-12.9	0.2	0.0	1.3	-0.2	0.2	1.1	1.3
POL	-5.6	0.0	0.0	-6.5	0.0	0.1	0.1	-0.5	0.0	0.0	0.1
SVK	-6.6	0.0	0.0	-6.4	0.0	0.1	0.2	-0.3	0.0	0.1	0.2
SVN	-7.8	0.1	0.0	-8.2	0.0	0.1	0.2	-0.4	0.1	0.2	0.3

BGR	-3.4	0.0	0.0	-3.4	0.0	0.0	0.1	-0.2	0.0	0.1	0.1
ROM	-6.8	0.0	0.0	-5.1	0.0	0.1	0.0	-0.9	0.0	0.0	0.0

Table B.16: Including tax havens and location choice, unilateral CBIT with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-13.1	-0.1	0.0	-5.9	0.1	0.0	1.1	0.6	0.5	1.4	0.8
BEL	-29.0	-0.1	0.2	-5.2	0.5	0.2	6.8	4.9	2.1	8.0	5.7
DNK	-11.4	0.0	0.1	-8.2	0.1	0.0	1.4	1.1	0.5	1.7	1.3
FIN	-10.7	0.0	0.0	-7.6	0.1	0.0	1.0	0.9	0.3	1.1	0.8
FRA	-17.0	0.0	0.1	-8.8	0.3	0.0	1.9	1.7	0.8	2.4	1.6
DEU	-21.8	-0.3	0.1	-8.2	0.3	-0.1	2.5	2.4	0.9	2.9	1.6
GRC	-11.5	-0.2	0.0	-6.7	0.0	0.0	0.5	0.0	0.0	0.2	0.2
IRL	-5.2	0.1	0.0	-3.9	0.0	0.1	0.6	-0.4	0.3	0.9	0.4
ITA	-25.1	-0.5	0.1	-7.6	0.2	-0.1	2.7	2.5	1.0	3.2	1.5
LUX	-8.0	1.1	0.0	-12.0	1.2	-0.1	2.3	-0.9	0.4	1.4	3.5
NLD	-11.2	0.3	0.1	-6.8	0.3	0.1	1.9	0.9	0.5	2.1	1.7
PRT	-14.0	0.1	0.1	-6.9	0.2	0.1	1.4	-0.2	0.4	1.8	1.0
ESP	-15.2	-0.1	0.1	-8.6	0.2	0.0	2.1	1.7	0.6	2.3	1.4
SWE	-14.3	0.1	0.1	-7.3	0.3	0.1	2.0	1.3	0.8	2.6	1.9
GBR	-16.1	0.1	0.1	-6.9	0.3	0.2	1.4	-0.7	0.4	1.7	1.1
CYP	-3.1	0.0	0.0	-3.6	0.0	0.0	0.1	-0.3	0.0	0.1	0.1
CZE	-8.6	-0.1	0.0	-8.5	0.1	0.0	0.9	0.6	0.2	0.8	0.6
EST	-15.6	-0.1	0.1	-5.9	0.1	0.1	1.5	1.4	0.6	1.9	0.6
HUN	-5.9	0.0	0.0	-4.9	0.0	0.0	0.3	-0.1	0.1	0.3	0.2
LVA	-6.9	0.0	0.0	-4.9	0.0	0.1	0.0	-0.6	-0.1	-0.1	0.0
LTU	-7.9	-0.1	0.0	-6.5	0.0	0.1	0.0	-0.7	-0.1	-0.2	0.0
MLT	-14.6	-0.1	0.1	-12.1	0.3	-0.2	2.4	2.8	0.3	2.1	1.9
POL	-6.4	0.0	0.0	-6.3	0.0	0.0	0.3	-0.1	0.0	0.2	0.2
SVK	-7.5	-0.1	0.0	-6.2	0.0	0.0	0.4	0.2	0.1	0.3	0.2
SVN	-9.2	-0.1	0.0	-7.8	0.0	0.0	0.5	0.2	0.1	0.4	0.4

BGR	-3.6	0.0	0.0	-3.3	0.0	0.0	0.1	-0.2	0.0	0.1	0.1
ROM	-7.5	0.0	0.0	-5.0	0.0	0.1	0.1	-0.6	0.0	0.0	0.0

Table B.17: Combined revenue-neutral ACE & CBIT combinations, consumption tax adjustment

	CIT_rate	Rev_CIT	Rev_tax	Debt	Shift_CIT	CoC	Wage	Capital	Employm.	GDP	Welfare
AUT	0.0	0.0	0.0	-5.2	0.0	0.0	0.2	0.6	0.1	0.3	0.2
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	0.0	0.0	0.0	-6.2	0.0	-0.1	0.3	0.5	-0.1	0.2	0.4
FIN	0.0	0.0	0.0	-6.4	0.0	-0.1	0.3	0.6	0.0	0.2	0.3
FRA	0.0	0.0	0.0	-7.4	0.0	-0.1	0.3	0.8	0.0	0.2	0.3
DEU	0.0	0.0	0.0	-6.8	0.0	-0.1	0.4	1.1	0.2	0.5	0.4
GRC	0.0	0.0	0.0	-5.4	0.0	-0.1	0.3	0.7	0.1	0.3	0.3
IRL	0.0	0.0	0.0	-3.3	0.0	0.0	0.2	0.3	0.0	0.2	0.1
ITA	0.0	0.0	0.0	-6.3	0.0	-0.1	0.4	0.9	0.1	0.4	0.3
LUX	0.0	0.0	0.0	-9.9	0.3	-0.4	0.8	-2.5	-3.0	-2.7	3.3
NLD	0.0	0.0	0.0	-5.8	0.0	-0.1	0.4	0.6	0.0	0.3	0.4
PRT	0.0	0.0	0.0	-5.6	0.0	0.0	0.1	0.5	0.0	0.1	0.1
ESP	0.0	0.0	0.0	-8.1	0.0	-0.1	0.4	0.9	0.1	0.4	0.4
SWE	0.0	0.0	0.0	-5.7	0.0	-0.1	0.3	0.8	0.1	0.3	0.3
GBR	0.0	0.0	0.0	-5.7	0.0	0.0	0.2	0.7	0.1	0.3	0.1
CYP	0.0	0.0	0.0	-3.2	0.0	0.0	0.1	0.3	0.0	0.0	0.1
CZE	0.0	0.0	0.0	-7.8	0.0	-0.1	0.3	0.5	0.0	0.2	0.3
EST	0.0	0.0	0.0	-3.1	0.0	-0.1	0.3	0.6	0.0	0.3	0.3
HUN	0.0	0.0	0.0	-4.5	0.0	0.0	0.1	0.3	0.0	0.1	0.1
LVA	0.0	0.0	0.0	-3.7	0.0	0.0	0.2	0.3	0.0	0.1	0.1
LTU	0.0	0.0	0.0	-4.6	0.0	0.0	0.2	0.4	0.0	0.2	0.2
MLT	0.0	0.0	0.0	-10.2	0.0	-0.3	0.8	0.9	-0.1	0.4	0.8
POL	0.0	0.0	0.0	-5.9	0.0	-0.1	0.2	0.4	0.0	0.2	0.2
SVK	0.0	0.0	0.0	-4.9	0.0	-0.1	0.3	0.5	0.0	0.2	0.2
SVN	0.0	0.0	0.0	-6.8	0.0	-0.1	0.2	0.5	0.0	0.2	0.2
BGR	0.0	0.0	0.0	-2.8	0.0	0.0	0.1	0.3	0.0	0.1	0.1

ROM	0.0	0.0	0.0	-3.8	0.0	0.0	0.1	0.3	0.0	0.1	0.1

Table B.18: ACE, consumption tax adjustment and lower elasticity of substitution between labour and capital

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	-1.4	0.0	-4.7	0.0	-0.5	2.4	4.6	0.6	1.8	0.5
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
DNK	0.0	-1.2	0.0	-4.9	0.0	-0.5	2.1	4.0	0.3	1.3	0.6
FIN	0.0	-1.5	0.0	-5.4	0.0	-0.6	2.7	4.9	0.5	1.8	0.7
FRA	0.0	-1.7	0.0	-6.5	0.0	-0.7	2.7	6.1	0.6	1.9	0.7
DEU	0.0	-2.1	0.1	-6.0	0.0	-0.7	3.6	7.4	0.9	2.7	0.8
GRC	0.0	-1.7	0.0	-4.6	0.0	-0.5	3.1	5.1	0.7	2.2	0.6
IRL	0.0	-1.0	0.0	-3.0	0.0	-0.2	1.8	2.6	0.2	1.1	0.2
ITA	0.0	-2.0	0.0	-5.6	0.0	-0.7	3.3	6.9	0.8	2.5	0.8
LUX	0.0	-1.6	0.0	-8.5	0.2	-0.9	3.6	3.4	-1.6	0.1	3.4
NLD	0.0	-1.7	0.0	-5.1	0.0	-0.5	3.0	5.0	0.4	1.9	0.6
PRT	0.0	-1.0	0.0	-4.9	0.0	-0.5	1.5	3.9	0.2	0.9	0.2
ESP	0.0	-2.2	0.1	-7.4	0.0	-0.8	3.9	7.3	0.6	2.5	0.7
SWE	0.0	-1.4	0.0	-4.9	0.0	-0.5	2.2	4.9	0.5	1.6	0.6
GBR	0.0	-1.1	0.0	-5.0	0.0	-0.5	1.7	4.4	0.2	1.0	0.2
CYP	0.0	-0.5	0.0	-2.9	0.0	-0.2	0.8	1.6	0.0	0.4	0.1
CZE	0.0	-2.0	0.1	-6.8	0.0	-0.6	3.8	6.0	0.6	2.4	0.7
EST	0.0	-0.9	0.0	-2.2	0.0	-0.3	1.9	2.8	0.2	1.2	0.3
HUN	0.0	-1.0	0.0	-4.1	0.0	-0.4	1.6	3.1	0.3	1.1	0.3
LVA	0.0	-0.8	0.0	-2.9	0.0	-0.3	1.4	2.4	0.3	0.9	0.2
LTU	0.0	-0.9	0.0	-3.3	0.0	-0.3	1.5	2.8	0.3	1.0	0.3
MLT	0.0	-2.2	0.0	-8.6	0.0	-1.0	4.1	7.9	0.3	2.3	1.1
POL	0.0	-1.4	0.0	-5.3	0.0	-0.5	2.4	4.2	0.5	1.6	0.4
SVK	0.0	-1.3	0.0	-4.0	0.0	-0.4	2.5	3.6	0.4	1.6	0.4

SVN	0.0	-1.4	0.0	-5.8	0.0	-0.5	2.2	4.3	0.4	1.5	0.5
BGR	0.0	-0.6	0.0	-2.4	0.0	-0.2	1.0	1.8	0.2	0.7	0.2
ROM	0.0	-0.7	0.0	-3.2	0.0	-0.3	1.1	2.2	0.1	0.6	0.1

Table B.19: CBIT, consumption tax adjustment and lower elasticity of substitution between labour and capital

	CIT_rate	Rev_CIT	Rev_tax	Debt	Shift_CIT	CoC	Wage	Capital	Employm.	GDP	Welfare
AUT	0.0	2.7	-0.1	-6.1	0.0	0.9	-4.2	-7.4	-0.9	-2.9	-0.6
BEL	0.0	5.1	-0.1	-4.4	0.0	1.8	-7.9	-15.3	-2.1	-6.0	-1.3
DNK	0.0	2.0	0.0	-8.6	0.0	0.6	-2.8	-5.7	-0.7	-2.0	-0.1
FIN	0.0	2.2	-0.1	-8.0	0.0	0.7	-3.3	-6.2	-0.8	-2.5	-0.3
FRA	0.0	2.8	-0.1	-9.4	0.0	1.1	-4.1	-8.7	-1.0	-3.0	-0.6
DEU	0.0	4.0	-0.1	-8.8	0.0	1.4	-6.4	-11.9	-1.5	-4.6	-1.0
GRC	0.0	2.6	-0.1	-7.0	0.0	0.7	-4.4	-6.9	-1.0	-3.1	-0.5
IRL	0.0	1.4	0.0	-3.9	0.0	0.3	-2.4	-3.5	-0.3	-1.4	-0.2
ITA	0.0	4.4	-0.1	-8.1	0.0	1.6	-6.9	-13.1	-1.7	-5.0	-1.2
LUX	0.0	2.5	-0.2	-12.6	0.4	0.6	-4.3	-13.3	-6.2	-8.3	3.1
NLD	0.0	2.7	-0.1	-7.1	0.0	0.8	-4.2	-7.1	-0.7	-2.7	-0.3
PRT	0.0	1.9	0.0	-7.3	0.0	0.9	-2.5	-6.3	-0.2	-1.4	-0.2
ESP	0.0	3.2	-0.1	-9.2	0.0	1.1	-5.1	-9.0	-0.8	-3.3	-0.5
SWE	0.0	2.5	-0.1	-7.6	0.0	0.9	-3.5	-7.5	-0.8	-2.5	-0.5
GBR	0.0	2.3	0.0	-7.3	0.0	1.1	-3.1	-7.6	-0.1	-1.5	-0.3
CYP	0.0	0.6	0.0	-3.7	0.0	0.2	-0.8	-1.7	-0.1	-0.5	0.0
CZE	0.0	2.1	-0.1	-8.9	0.0	0.6	-3.4	-5.4	-0.6	-2.3	-0.2
EST	0.0	2.6	-0.1	-6.2	0.0	0.6	-4.3	-6.2	-0.6	-2.7	-0.1
HUN	0.0	1.3	0.0	-5.0	0.0	0.4	-1.8	-3.5	-0.4	-1.3	-0.2
LVA	0.0	1.3	0.0	-5.0	0.0	0.4	-1.9	-3.3	-0.4	-1.3	-0.1
LTU	0.0	1.3	0.0	-6.7	0.0	0.4	-1.9	-3.4	-0.4	-1.3	-0.1
MLT	0.0	3.0	-0.1	-12.9	0.0	0.9	-4.2	-9.2	-0.7	-2.7	0.0
POL	0.0	1.5	0.0	-6.5	0.0	0.4	-2.3	-3.9	-0.5	-1.6	-0.2
SVK	0.0	1.7	0.0	-6.4	0.0	0.4	-2.9	-4.4	-0.5	-1.9	-0.1
SVN	0.0	1.6	0.0	-8.2	0.0	0.6	-2.3	-4.4	-0.5	-1.7	-0.2
BGR	0.0	0.7	0.0	-3.4	0.0	0.2	-1.1	-2.0	-0.2	-0.8	-0.1

ROM	0.0	1.2	0.0	-5.1	0.0	0.4	-1.6	-3.1	-0.2	-1.0	-0.1

Table B.20: ACE, consumption tax adjustment and smaller tax elasticity of the debt share

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	-1.5	0.0	-2.9	0.0	-0.4	2.4	6.2	0.6	2.2	0.4
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
DNK	0.0	-1.3	0.0	-2.7	0.0	-0.5	2.1	5.5	0.3	1.7	0.5
FIN	0.0	-1.6	0.0	-3.1	0.0	-0.6	2.7	6.8	0.5	2.3	0.6
FRA	0.0	-1.7	0.0	-3.8	0.0	-0.7	2.7	8.4	0.6	2.5	0.6
DEU	0.0	-2.2	0.1	-3.7	0.0	-0.7	3.7	10.2	0.9	3.4	0.7
GRC	0.0	-1.7	0.1	-2.7	0.0	-0.5	3.2	7.0	0.6	2.8	0.5
IRL	0.0	-1.0	0.0	-1.6	0.0	-0.2	1.7	3.5	0.2	1.4	0.2
ITA	0.0	-2.1	0.1	-3.6	0.0	-0.7	3.4	9.4	0.8	3.2	0.7
LUX	0.0	-1.7	0.0	-4.1	0.2	-0.8	3.9	6.0	-1.4	1.0	3.3
NLD	0.0	-1.7	0.0	-3.0	0.0	-0.5	3.0	6.9	0.3	2.4	0.5
PRT	0.0	-1.0	0.0	-2.9	0.0	-0.5	1.4	5.4	0.1	1.1	0.2
ESP	0.0	-2.3	0.1	-4.3	0.0	-0.8	3.9	10.0	0.6	3.3	0.6
SWE	0.0	-1.4	0.0	-2.9	0.0	-0.5	2.2	6.7	0.5	2.0	0.5
GBR	0.0	-1.1	0.0	-3.0	0.0	-0.5	1.6	6.1	0.2	1.3	0.2
CYP	0.0	-0.5	0.0	-1.4	0.0	-0.2	0.8	2.2	0.0	0.5	0.1
CZE	0.0	-2.1	0.1	-3.5	0.0	-0.6	3.8	8.1	0.5	3.1	0.6
EST	0.0	-1.1	0.0	-1.5	0.0	-0.3	2.1	4.1	0.2	1.7	0.3
HUN	0.0	-1.0	0.0	-2.3	0.0	-0.3	1.6	4.2	0.3	1.4	0.3
LVA	0.0	-0.9	0.0	-1.6	0.0	-0.2	1.4	3.3	0.2	1.2	0.2
LTU	0.0	-1.0	0.0	-1.8	0.0	-0.3	1.6	3.8	0.3	1.3	0.2
MLT	0.0	-2.4	0.1	-4.6	0.0	-1.0	4.2	11.5	0.3	3.1	1.0
POL	0.0	-1.4	0.0	-2.8	0.0	-0.5	2.4	5.7	0.4	2.1	0.4
SVK	0.0	-1.3	0.0	-2.2	0.0	-0.4	2.5	5.0	0.3	2.0	0.4
SVN	0.0	-1.4	0.0	-3.0	0.0	-0.5	2.2	5.9	0.4	1.9	0.4

BGR	0.0	-0.6	0.0	-1.3	0.0	-0.2	1.0	2.4	0.2	0.9	0.1
ROM	0.0	-0.7	0.0	-1.8	0.0	-0.3	1.1	3.0	0.1	0.9	0.1

Table B.21: CBIT, consumption tax adjustment and smaller tax elasticity of the debt share

	CIT_rate (a)	Rev_CIT (a)	Rev_tax (a)	Debt (r)	Shift_CIT (r)	CoC (r)	Wage (r)	Capital (y)	Employm. (y)	GDP (y)	Welfare (y)
AUT	0.0	2.6	-0.1	-3.7	0.0	0.9	-4.3	-10.2	-0.9	-3.8	-0.7
BEL	0.0	5.1	-0.1	-2.3	0.0	1.8	-8.1	-20.7	-2.1	-7.7	-1.4
DNK	0.0	2.0	-0.1	-4.5	0.0	0.7	-3.0	-8.1	-0.7	-2.7	-0.3
FIN	0.0	2.1	-0.1	-4.4	0.0	0.7	-3.5	-8.6	-0.9	-3.3	-0.5
FRA	0.0	2.7	-0.1	-5.3	0.0	1.2	-4.2	-12.1	-1.0	-3.9	-0.8
DEU	0.0	3.9	-0.1	-5.3	0.0	1.5	-6.6	-16.3	-1.5	-6.0	-1.3
GRC	0.0	2.6	-0.1	-4.0	0.0	0.8	-4.6	-9.6	-1.0	-4.2	-0.6
IRL	0.0	1.4	0.0	-2.1	0.0	0.3	-2.4	-5.0	-0.3	-2.0	-0.2
ITA	0.0	4.2	-0.1	-5.0	0.0	1.6	-7.0	-17.7	-1.7	-6.5	-1.5
LUX	0.0	2.5	-0.2	-5.8	0.4	0.7	-4.7	-16.2	-6.1	-9.4	2.7
NLD	0.0	2.6	-0.1	-4.0	0.0	0.8	-4.4	-10.0	-0.7	-3.7	-0.5
PRT	0.0	1.9	0.0	-4.1	0.0	0.9	-2.6	-9.0	-0.2	-2.0	-0.3
ESP	0.0	3.1	-0.1	-5.2	0.0	1.2	-5.3	-12.6	-0.8	-4.5	-0.8
SWE	0.0	2.4	-0.1	-4.4	0.0	0.9	-3.6	-10.5	-0.8	-3.3	-0.7
GBR	0.0	2.3	0.0	-4.3	0.0	1.2	-3.1	-10.9	-0.1	-2.2	-0.4
CYP	0.0	0.6	0.0	-1.8	0.0	0.2	-0.8	-2.4	-0.1	-0.7	0.0
CZE	0.0	2.1	-0.1	-4.4	0.0	0.6	-3.6	-7.6	-0.7	-3.2	-0.4
EST	0.0	2.6	-0.1	-3.6	0.0	0.6	-4.4	-8.7	-0.6	-3.6	-0.2
HUN	0.0	1.2	0.0	-2.7	0.0	0.4	-1.9	-4.9	-0.4	-1.7	-0.2
LVA	0.0	1.3	0.0	-2.7	0.0	0.4	-2.0	-4.6	-0.4	-1.8	-0.2
LTU	0.0	1.3	0.0	-3.4	0.0	0.4	-2.0	-4.9	-0.4	-1.8	-0.1
MLT	0.0	2.9	-0.1	-6.5	0.0	1.0	-4.5	-13.0	-0.7	-3.8	-0.4
POL	0.0	1.4	0.0	-3.4	0.0	0.5	-2.3	-5.5	-0.5	-2.1	-0.3
SVK	0.0	1.7	-0.1	-3.4	0.0	0.5	-3.0	-6.2	-0.5	-2.6	-0.2
SVN	0.0	1.6	0.0	-4.2	0.0	0.6	-2.4	-6.2	-0.5	-2.2	-0.3

BGR	0.0	0.8	0.0	-1.8	0.0	0.2	-1.2	-2.8	-0.2	-1.0	-0.1
ROM	0.0	1.2	0.0	-2.7	0.0	0.4	-1.7	-4.5	-0.2	-1.3	-0.1

Table B.22: Unilateral ACE, ex-ante corporate tax rate adjustment (consumption tax ex-post) and smaller elasticity of transfer pricing

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	14.6	-0.3	0.0	-3.9	-0.1	-0.4	1.3	4.9	0.6	1.8	0.6
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	14.5	-0.4	0.0	-3.0	-0.1	-0.4	1.5	5.9	0.5	1.9	0.8
FIN	13.0	-0.2	0.0	-4.2	-0.1	-0.4	1.3	5.2	0.5	1.9	0.8
FRA	16.0	-0.6	0.0	-5.2	-0.3	-0.6	1.6	7.6	0.7	2.3	0.7
DEU	17.5	-0.9	0.1	-3.9	-0.6	-0.6	2.1	8.5	0.8	3.0	0.6
GRC	13.4	-0.2	0.0	-3.3	0.0	-0.4	1.6	5.3	0.7	2.3	0.8
IRL	10.9	-0.2	0.0	-2.1	0.0	-0.2	1.0	3.0	0.2	1.1	0.4
ITA	18.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LUX	13.6	-1.6	0.1	-6.8	-1.5	-0.5	1.9	7.1	0.6	2.8	-0.6
NLD	14.9	-0.6	0.0	-4.0	-0.3	-0.4	1.6	5.6	0.4	2.0	0.5
PRT	15.5	-0.3	0.0	-3.6	-0.1	-0.5	1.1	6.0	0.3	1.4	0.5
ESP	15.0	-0.4	0.0	-6.6	-0.1	-0.5	1.6	6.7	0.5	2.3	0.7
SWE	15.9	-0.6	0.0	-3.5	-0.2	-0.5	1.6	6.8	0.6	2.1	0.7
GBR	16.0	-0.6	0.0	-3.9	-0.2	-0.6	1.3	6.8	0.3	1.4	0.4
CYP	7.1	-0.1	0.0	-2.3	0.0	-0.2	0.4	1.8	0.1	0.5	0.2
CZE	14.5	-0.1	0.0	-5.6	0.0	-0.4	1.5	5.1	0.5	2.1	0.8
EST	18.0	-1.3	0.1	0.5	-0.1	-0.6	4.0	9.6	0.8	3.8	1.2
HUN	10.0	-0.1	0.0	-3.6	0.0	-0.2	0.7	2.8	0.3	1.0	0.4
LVA	12.2	-0.2	0.0	-1.2	0.0	-0.3	1.1	3.7	0.5	1.5	0.6
LTU	12.8	-0.2	0.0	-1.1	0.0	-0.3	1.3	4.4	0.5	1.7	0.6
MLT	14.5	-0.5	0.0	-7.0	-0.2	-0.7	1.8	8.9	0.4	2.4	0.8
POL	11.5	-0.1	0.0	-4.6	0.0	-0.3	0.9	3.5	0.5	1.4	0.5
SVK	11.2	-0.1	0.0	-2.7	0.0	-0.3	1.3	4.0	0.5	1.7	0.7
SVN	15.8	-0.2	0.0	-4.3	0.0	-0.4	1.3	4.7	0.6	1.7	0.7

BGR	6.8	0.0	0.0	-1.7	0.0	-0.1	0.5	1.8	0.2	0.7	0.3
ROM	12.2	-0.1	0.0	-1.8	0.0	-0.3	0.9	3.4	0.3	1.1	0.4

Table B.23: Unilateral CBIT, ex-ante corporate tax rate adjustment (consumption tax ex-post) and smaller elasticity of transfer pricing

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-10.9	0.0	0.0	-6.1	0.0	0.1	-0.3	-1.8	-0.3	-0.7	-0.2
BEL	-21.9	0.1	0.0	-7.1	0.1	0.3	-1.0	-4.8	-0.5	-1.6	-0.8
DNK	-9.7	0.0	0.0	-8.6	0.0	0.1	-0.3	-2.0	-0.3	-0.7	-0.1
FIN	-8.9	0.0	0.0	-8.0	0.0	0.1	-0.2	-1.7	-0.3	-0.7	-0.1
FRA	-12.9	0.0	0.0	-9.4	0.1	0.2	-0.3	-2.5	-0.3	-0.8	-0.1
DEU	-15.6	0.0	0.0	-8.8	0.1	0.2	-0.4	-2.9	-0.4	-1.0	-0.2
GRC	-9.5	0.0	0.0	-7.0	0.0	0.1	-0.3	-1.6	-0.3	-0.8	-0.1
IRL	-5.2	0.0	0.0	-3.9	0.0	0.1	-0.2	-0.9	-0.1	-0.3	-0.1
ITA	-17.8	0.0	0.0	-8.1	0.0	0.3	-0.5	-3.2	-0.4	-1.1	-0.3
LUX	-10.0	0.3	0.0	-12.6	0.3	-0.2	0.2	-3.1	-0.5	-0.9	0.9
NLD	-10.0	0.1	0.0	-7.1	0.1	0.1	-0.3	-1.8	-0.2	-0.6	0.0
PRT	-11.6	0.0	0.0	-7.3	0.0	0.2	-0.3	-2.2	-0.2	-0.5	-0.2
ESP	-11.4	0.0	0.0	-9.2	0.0	0.2	-0.2	-2.0	-0.2	-0.6	0.0
SWE	-11.8	0.1	0.0	-7.6	0.1	0.2	-0.4	-2.3	-0.2	-0.7	-0.2
GBR	-13.3	0.1	0.0	-7.3	0.1	0.3	-0.4	-2.7	-0.1	-0.4	-0.2
CYP	-3.1	0.0	0.0	-3.7	0.0	0.0	-0.1	-0.6	-0.1	-0.2	0.0
CZE	-7.2	0.0	0.0	-8.9	0.0	0.0	0.0	-1.0	-0.2	-0.5	0.1
EST	-13.5	0.0	0.0	-6.2	0.0	0.2	-1.1	-3.0	-0.4	-1.3	-0.6
HUN	-5.4	0.0	0.0	-5.0	0.0	0.1	-0.2	-1.0	-0.2	-0.4	-0.1
LVA	-6.3	0.0	0.0	-5.0	0.0	0.1	-0.3	-1.2	-0.2	-0.5	-0.1
LTU	-7.0	0.0	0.0	-6.7	0.0	0.1	-0.3	-1.3	-0.2	-0.6	-0.1
MLT	-10.7	0.0	0.0	-12.9	0.0	0.0	0.1	-2.9	-0.4	-0.7	0.4
POL	-5.7	0.0	0.0	-6.5	0.0	0.1	-0.1	-0.9	-0.2	-0.4	0.0
SVK	-6.6	0.0	0.0	-6.4	0.0	0.1	-0.2	-1.4	-0.3	-0.6	0.0
SVN	-7.9	0.0	0.0	-8.2	0.0	0.1	-0.2	-1.1	-0.2	-0.5	0.0

BGR	-3.4	0.0	0.0	-3.4	0.0	0.0	-0.1	-0.6	-0.1	-0.3	-0.1
ROM	-6.8	0.0	0.0	-5.1	0.0	0.1	-0.3	-1.2	-0.2	-0.5	-0.1

Table B.24: Unilateral ACE, ex-ante corporate tax rate adjustment (consumption tax ex-post) and larger share of profits in the economy

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	10.1	-0.4	0.0	-4.2	-0.2	-0.4	1.4	5.3	0.7	2.0	0.5
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	9.2	-0.5	0.0	-3.7	-0.2	-0.5	1.4	5.6	0.5	1.8	0.6
FIN	9.3	-0.4	0.0	-4.6	-0.2	-0.4	1.5	5.6	0.7	2.0	0.6
FRA	10.9	-0.9	0.0	-5.6	-0.6	-0.6	1.7	7.9	0.8	2.4	0.5
DEU	12.9	-1.1	0.1	-5.1	-0.8	-0.7	2.3	9.5	1.1	3.3	0.5
GRC	10.2	-0.2	0.0	-3.6	0.0	-0.4	1.8	5.7	0.8	2.4	0.8
IRL	6.7	-0.2	0.0	-2.5	0.0	-0.2	1.1	3.3	0.4	1.4	0.4
ITA	12.9	-0.8	0.1	-4.8	-0.3	-0.7	2.3	9.4	1.1	3.2	0.8
LUX	5.8	-1.9	0.1	-7.8	-1.9	-0.7	1.8	7.1	0.8	3.0	-1.0
NLD	9.5	-1.2	0.0	-4.4	-0.8	-0.4	1.9	6.3	0.7	2.4	-0.1
PRT	8.6	-0.4	0.0	-4.2	-0.2	-0.5	1.0	5.6	0.3	1.2	0.3
ESP	11.5	-0.6	0.0	-6.8	-0.3	-0.6	1.9	7.6	0.7	2.6	0.6
SWE	9.9	-0.8	0.0	-4.0	-0.5	-0.5	1.5	6.6	0.6	2.0	0.5
GBR	8.4	-0.7	0.0	-4.4	-0.4	-0.5	1.1	6.3	0.3	1.3	0.1
CYP	4.3	-0.1	0.0	-2.5	0.0	-0.2	0.4	2.0	0.2	0.6	0.2
CZE	11.2	-0.3	0.0	-5.9	-0.1	-0.4	1.8	5.9	0.7	2.4	0.8
EST	16.1	-1.4	0.1	1.0	-0.3	-0.6	4.5	10.4	1.1	4.4	1.3
HUN	6.8	-0.1	0.0	-3.7	0.0	-0.3	0.8	3.2	0.4	1.1	0.4
LVA	7.9	-0.1	0.0	-1.8	0.0	-0.3	1.1	3.6	0.6	1.4	0.5
LTU	8.3	-0.2	0.0	-1.9	0.0	-0.3	1.2	4.1	0.6	1.6	0.6
MLT	11.3	-0.7	0.0	-7.4	-0.5	-0.7	2.1	9.5	0.6	2.5	0.7
POL	8.7	-0.1	0.0	-4.8	0.0	-0.3	1.0	4.1	0.6	1.6	0.5

SVK	8.4	-0.2	0.0	-3.0	0.0	-0.3	1.4	4.2	0.6	1.8	0.7
SVN	10.6	-0.3	0.0	-4.8	-0.1	-0.4	1.4	5.1	0.7	1.8	0.7
BGR	4.8	0.0	0.0	-1.9	0.0	-0.2	0.5	2.0	0.3	0.8	0.3
ROM	7.3	-0.1	0.0	-2.4	0.0	-0.3	0.8	3.2	0.4	1.1	0.3

Table B.25: Unilateral CBIT, ex-ante corporate tax rate adjustment (consumption tax ex-post) and larger share of profits in the economy

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	-9.4	0.1	0.0	-6.1	0.1	0.2	-0.6	-2.8	-0.5	-1.1	-0.3
BEL	-18.0	0.4	0.0	-7.9	0.6	0.4	-1.2	-5.8	-0.7	-2.0	-0.5
DNK	-8.0	0.1	0.0	-8.6	0.1	0.2	-0.5	-2.9	-0.4	-1.0	-0.2
FIN	-7.6	0.1	0.0	-8.0	0.1	0.2	-0.5	-2.6	-0.5	-1.0	-0.1
FRA	-10.8	0.2	0.0	-9.4	0.2	0.3	-0.6	-3.8	-0.6	-1.3	-0.2
DEU	-13.7	0.2	0.0	-8.8	0.3	0.4	-0.8	-4.4	-0.7	-1.7	-0.3
GRC	-8.4	0.0	0.0	-7.0	0.0	0.2	-0.6	-2.5	-0.5	-1.2	-0.2
IRL	-4.4	0.0	0.0	-3.9	-0.1	0.1	-0.4	-1.5	-0.2	-0.6	-0.2
ITA	-15.4	0.1	0.0	-8.1	0.1	0.4	-1.0	-4.9	-0.9	-1.9	-0.5
LUX	-6.4	1.0	0.0	-12.6	1.0	0.0	-0.4	-5.0	-0.8	-2.1	1.4
NLD	-8.2	0.3	0.0	-7.1	0.2	0.2	-0.7	-3.1	-0.5	-1.2	0.0
PRT	-9.1	0.1	0.0	-7.3	0.1	0.3	-0.6	-3.5	-0.3	-0.8	-0.2
ESP	-10.1	0.1	0.0	-9.2	0.1	0.3	-0.5	-3.1	-0.4	-1.1	-0.1
SWE	-9.6	0.2	0.0	-7.6	0.2	0.3	-0.6	-3.5	-0.4	-1.1	-0.3
GBR	-10.0	0.3	0.0	-7.3	0.2	0.5	-0.6	-4.2	-0.2	-0.8	-0.2
CYP	-2.5	0.0	0.0	-3.7	0.0	0.1	-0.2	-0.9	-0.1	-0.3	0.0
CZE	-6.4	0.0	0.0	-8.9	0.0	0.1	-0.3	-1.7	-0.3	-0.8	0.0
EST	-13.5	0.1	0.0	-6.2	0.0	0.3	-1.9	-4.6	-0.7	-2.1	-1.0
HUN	-4.6	0.0	0.0	-5.0	0.0	0.1	-0.3	-1.5	-0.3	-0.6	-0.1
LVA	-5.4	0.0	0.0	-5.0	0.0	0.1	-0.4	-1.6	-0.3	-0.7	-0.2
LTU	-5.9	0.0	0.0	-6.7	0.0	0.1	-0.5	-1.8	-0.3	-0.8	-0.2
MLT	-9.6	0.1	0.0	-12.9	0.2	0.1	-0.3	-3.8	-0.5	-1.1	0.3
POL	-5.0	0.0	0.0	-6.5	0.0	0.1	-0.3	-1.4	-0.3	-0.6	-0.1
SVK	-5.8	0.0	0.0	-6.4	0.0	0.1	-0.4	-1.8	-0.4	-0.8	-0.1
SVN	-6.6	0.0	0.0	-8.2	0.0	0.1	-0.4	-1.8	-0.4	-0.7	-0.1

BGR	-2.9	0.0	0.0	-3.4	0.0	0.1	-0.2	-0.9	-0.2	-0.4	-0.1
ROM	-5.6	0.0	0.0	-5.1	0.0	0.2	-0.4	-1.8	-0.3	-0.6	-0.2

Table B.26: Including tax haven and discrete location with smaller elasticities, unilateral ACE with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate (a)	Rev_CIT (y)	Rev_tax (y)	Debt (a)	Shift_CIT (y)	CoC (r)	Wage (r)	Capital (r)	Employm. (r)	GDP (r)	Welfare (y)
AUT	16.5	-0.6	0.0	-3.8	-0.4	-0.3	0.9	4.3	0.4	1.3	0.0
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	15.8	-0.6	0.0	-2.9	-0.4	-0.4	0.8	4.2	0.2	0.9	0.0
FIN	14.5	-0.4	0.0	-4.1	-0.4	-0.4	0.8	3.9	0.3	1.2	0.1
FRA	19.9	-1.4	0.0	-4.8	-1.3	-0.6	1.0	6.4	0.3	1.4	-0.7
DEU	18.6	-1.8	0.0	-4.7	-1.3	-0.6	2.1	8.5	0.6	2.6	-0.4
GRC	15.5	-0.2	0.0	-3.2	-0.1	-0.3	1.4	4.8	0.6	2.0	0.6
IRL	8.8	-0.3	0.0	-2.3	-0.1	-0.2	0.4	2.6	0.0	0.3	-0.1
ITA	17.7	-1.3	0.0	-4.5	-0.4	-0.6	2.3	8.9	0.8	2.8	0.5
LUX	6.3	-1.9	0.0	-7.6	-2.1	-0.6	0.4	4.3	0.1	0.9	-2.1
NLD	14.1	-1.7	0.0	-4.1	-1.4	-0.4	1.0	4.5	0.1	1.0	-1.3
PRT	17.3	-0.6	0.0	-3.5	-0.3	-0.5	0.7	5.7	0.2	0.7	-0.1
ESP	18.8	-0.6	0.0	-6.3	-0.5	-0.5	0.9	5.5	0.3	1.5	-0.1
SWE	17.5	-1.2	0.0	-3.3	-1.0	-0.5	0.9	5.6	0.2	0.9	-0.7
GBR	16.6	-1.2	0.0	-3.8	-0.9	-0.5	0.9	6.4	0.1	0.8	-0.6
CYP	6.6	-0.1	0.0	-2.3	0.0	-0.2	0.2	1.6	0.1	0.3	0.1
CZE	16.7	-0.2	0.0	-5.4	-0.1	-0.4	0.9	4.1	0.3	1.4	0.4
EST	13.0	-1.1	0.0	-0.3	-0.1	-0.5	2.7	6.2	0.4	2.3	0.8
HUN	10.1	-0.2	0.0	-3.6	-0.1	-0.2	0.4	2.4	0.2	0.6	0.1
LVA	13.2	-0.2	0.0	-1.1	0.0	-0.3	1.0	3.5	0.4	1.3	0.5
LTU	14.1	-0.2	0.0	-1.0	0.0	-0.3	1.2	4.1	0.4	1.5	0.6
MLT	18.7	-0.5	0.0	-6.5	-0.6	-0.6	0.7	5.6	0.2	1.3	0.0
POL	12.6	-0.1	0.0	-4.6	0.0	-0.3	0.6	3.0	0.3	1.1	0.3

SVK	12.3	-0.1	0.0	-2.6	-0.1	-0.3	0.9	3.0	0.3	1.2	0.5
SVN	18.1	-0.2	0.0	-4.1	-0.1	-0.4	1.0	4.1	0.4	1.3	0.4
BGR	7.0	0.0	0.0	-1.7	0.0	-0.1	0.4	1.4	0.2	0.5	0.2
ROM	13.2	-0.2	0.0	-1.7	0.0	-0.3	0.7	3.2	0.3	0.9	0.3

Table B.27: Including tax haven and discrete location with smaller elasticities, unilateral CBIT with ex-ante corporate tax rate adjustment (consumption tax ex-post)

	CIT_rate	Rev_CIT	Rev_tax	Debt	Shift_CIT	CoC	Wage	Capital	Employm.	GDP	Welfare
AUT	-11.3	0.1	0.0	-6.0	0.1	0.1	0.1	-1.1	0.0	0.0	0.2
BEL	-24.1	0.4	0.1	-6.4	0.6	0.3	1.7	-1.1	0.6	2.1	2.0
DNK	-10.0	0.1	0.0	-8.4	0.1	0.1	0.3	-1.0	0.0	0.2	0.5
FIN	-9.3	0.1	0.0	-7.8	0.1	0.1	0.2	-0.9	-0.1	-0.1	0.3
FRA	-13.8	0.2	0.0	-9.1	0.3	0.2	0.3	-1.4	0.1	0.2	0.6
DEU	-17.0	0.2	0.0	-8.5	0.3	0.2	0.3	-1.7	0.0	0.1	0.5
GRC	-10.0	0.0	0.0	-6.9	0.0	0.1	-0.2	-1.3	-0.2	-0.5	0.0
IRL	-4.8	0.1	0.0	-3.9	0.0	0.1	0.2	-0.9	0.1	0.3	0.2
ITA	-19.2	0.1	0.0	-7.9	0.2	0.2	0.1	-2.2	-0.1	-0.1	0.3
LUX	-6.9	1.1	0.0	-12.3	1.1	0.0	0.8	-3.4	-0.1	-0.5	2.4
NLD	-9.8	0.4	0.0	-7.0	0.2	0.2	0.3	-1.3	0.0	0.2	0.8
PRT	-12.0	0.2	0.0	-7.1	0.1	0.2	0.2	-1.8	0.1	0.3	0.3
ESP	-12.4	0.1	0.0	-8.9	0.2	0.1	0.4	-1.1	0.1	0.3	0.5
SWE	-12.1	0.3	0.0	-7.5	0.2	0.2	0.4	-1.2	0.2	0.6	0.7
GBR	-13.4	0.3	0.0	-7.1	0.2	0.3	0.2	-2.5	0.1	0.3	0.4
CYP	-3.0	0.0	0.0	-3.6	0.0	0.0	0.0	-0.5	0.0	0.0	0.0
CZE	-7.6	0.0	0.0	-8.7	0.0	0.0	0.3	-0.5	-0.1	0.0	0.3
EST	-13.7	0.1	0.0	-6.1	0.1	0.2	-0.3	-1.5	0.0	-0.2	-0.2
HUN	-5.4	0.0	0.0	-5.0	0.0	0.1	0.0	-0.7	0.0	-0.1	0.1
LVA	-6.4	0.0	0.0	-5.0	0.0	0.1	-0.2	-1.0	-0.1	-0.3	-0.1
LTU	-7.2	0.0	0.0	-6.6	0.0	0.1	-0.2	-1.1	-0.2	-0.4	-0.1

MLT	-11.8	0.1	0.0	-12.5	0.2	-0.1	0.8	-1.1	-0.1	0.2	1.0
POL	-5.9	0.0	0.0	-6.4	0.0	0.1	0.0	-0.6	-0.1	-0.2	0.1
SVK	-6.8	0.0	0.0	-6.3	0.0	0.1	0.0	-0.8	-0.1	-0.2	0.1
SVN	-8.2	0.0	0.0	-8.0	0.0	0.1	0.0	-0.7	-0.1	-0.1	0.1
BGR	-3.4	0.0	0.0	-3.3	0.0	0.0	-0.1	-0.4	-0.1	-0.1	0.0
ROM	-7.0	0.0	0.0	-5.0	0.0	0.1	-0.1	-1.0	-0.1	-0.2	0.0

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