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Reducing tax compliance costs through corporate tax base harmonisation in the European Union

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Abstract

The reform proposal of the European Commission for a Common Consolidated Corporate Tax Base, the so-called CCCTB, is expected to significantly reduce the cost of doing business by lowering tax compliance costs for cross border operations within the European Union. However, to date the scarcity of comparable estimates on tax compliance costs has limited the assessment of such reduction. We exploit recently released and unique survey data designed to provide comparable information on corporate tax compliance costs in order to assess the impact of the CCCTB, using a general equilibrium modelling approach. Our results suggest that the reduction in tax compliance costs implied by the CCCTB would be associated with greater economic efficiency, including increases in both welfare and GDP. Member States resulting with the lowest compliance costs before the reform and having large inward foreign investment stock would benefit more from the CCCTB. Cross-border business operations would also benefit more from the CCCTB compared to domestic ones. The impact of the CCCTB on non-EU countries such as the US and Japan would be limited.

JEL classification: H20, H30, C68

Keywords: CCCTB, tax compliance costs, European Union.

1 Introduction

Corporate tax avoidance through global profit shifting has become an economic activity on its own right. A large body of evidence (see in particular Nicodème 2009 and Van 't Riet and Lejour 2018) suggests that cross-border differences in corporate income tax rules are exploited by global corporations, taking benefits of existing inconsistencies and loopholes within the international tax network, through multiple schemes such as transfer pricing, debt shifting and the strategic allocation of intangible assets across tax jurisdictions. This is especially true in the European Union (EU) context, with free capital mobility and fragmented tax policies. The EU member states set their own rules to define tax bases and tax rates, including specific tax rebates on certain types of economic activity and/or differential tax treatment of corporate income generated abroad. In such circumstances, tax planning might be seen as an optimal response in presence of multiple tax jurisdictions. Global tax planning and corporate tax avoidance are costly activities, however. Firms operating across borders must deal with multiple tax jurisdictions and procedures requiring local expertise. These activities represent extra costs such as, for instance, the information needed to deal with foreign tax systems including foreign tax officials and local experts. The costs related to audits, litigations and transfer pricing are especially relevant for companies with subsidiaries in other EU countries, see European Commission (2004). Multinationals therefore face extra-costs compared to firms operating only on their domestic market which can be significant, see Eichfelder and Vaillancourt (2014) for an extensive review. Tax planning also entails broader economic and social costs. They may distort the allocation of resources (most prominently of capital) and move the economy further away from the theoretical first-best allocation that would be obtained in a no-tax world, thus harming production efficiency both globally and at EU level, see Huizinga and Laeven (2008). Tax planning also contributes to the growing social discontent about income inequalities, with tax systems being often perceived as yielding an exorbitant advantage to global corporations over other tax payers, see European Commission (2015) and Tørsløv et al. (2017) for recent evidence.

Yet, tax compliance costs have long been considered as a major hurdle for investments across EU countries, despite a high level of economic integration between them (see for instance European Commission 2001). The European Commission has recently re-launched its Consolidated Common Corporate Tax Base (CCCTB) reform proposal aimed at reducing the cost of business operations at EU-level, focusing in particular on tax compliance costs. It is an ambitious plan, aimed at making EU tax systems more transparent in order to fight profit shifting, enhance efficiency and provide a level playing field across member states; see European Commission (2016) ⁽¹⁾. Following the 2016 proposal made by the European Commission, the harmonisation of corporate tax bases would proceed in two stages. First, corporate tax base would need to be defined the same way across countries (and this definition would apply to multinationals of a given size while remaining optional for other companies). Second, the consolidated reporting would take place at the level of a multinational group via a formula apportionment reflecting the level of multinational 's activities (taking into account the value of property, sales and labour employed in each country), with the possibility to offset losses across affiliates. This proposal was assessed by the European Commission services using the Computable General Equilibrium (CGE) model CORTAX, see Alvarez-Martinez et al. (2016a). Importantly, this assessment was made assuming both identical levels and (post CCCTB) uniform changes in tax compliance costs across countries, in absence of reliable and comparable estimates for all EU countries. This represents a limitation to the extent that, as discussed previously, the impact of the CCCTB is expected to be mediated by a reduction in tax compliance costs which, in turn, partly determine the return obtained from tax avoidance. Countries are also likely to be affected in a different way by

⁽¹⁾ For more information see https://ec.europa.eu/taxation_customs/business/company-tax/common-consolidated-corporate-tax-base-ccctb_en. A previous proposal was made in 2011, see European Commission (2011).

the CCCTB, depending, among other things, on their tax system and reliance on foreign direct investment. The aim of this paper is to overcome this limitation by exploiting a newly released dataset on tax compliance costs from a survey performed by KPMG for the EU Executive Agency for Small and Medium-sized Enterprises (EASME). This data can be used to calibrate country-specific tax compliance costs before and after the CCCTB. Using these data allows us to provide new insights on the economic impact of the CCCTB reform proposal under alternative scenarios for tax compliance cost reduction.

The fall in tax compliance costs resulting from the CCCTB proposal is likely to trigger reactions from companies and governments alike. Representing the complexity of these different reactions is far from trivial, however. With the CCCTB member states would still be able to compete in order to attract investment, but they would do so over tax rates and in a more transparent way, see Mintz (2004) and McLure (2008). Multinationals would have greater freedom to choose their headquarter location even more strategically. This could have potential implications for governments who could adjust their corporate income tax (CIT) rates depending on the changes (expected or realised) in cross-border investment flows, in order to retain or attract new investment, see in particular the analysis and simulation results in Sorensen (2004). The change in tax compliance costs stemming from the CCCTB would therefore potentially impact on investment, including cross-border investment, and could trigger further reactions from governments ⁽²⁾.

The use of a CGE model such as CORTAX is warranted in order to account for these potential impact and interactions, both within and across countries. The CORTAX model is multi-country, it includes all EU member states, the UK, the US, Japan and a tax haven. It also differentiates between domestic and multinational firms and is calibrated taking into account cross-border foreign direct investment (FDI) stocks. The CORTAX model also captures the complexity of the corporate tax system, including the specific treatment of different classes of assets, which ultimately determine the corporate tax bases of multinationals and their affiliates across countries. It also accounts for the possibility to exploit corporate tax rates differences through debt shifting and transfer pricing. In CORTAX tax compliance costs are represented as a given percentage of the labour costs. This modelling choice appears as natural since one may think of compliance costs as effectively being represented by the services provided by specific types of workers such as, e.g., lawyers, accountants, consultants, etc.

Our analysis suggests that the changes in tax compliance costs led by the harmonisation of corporate tax bases would have significant and positive impact on GDP and welfare. We illustrate the mechanisms through which these changes would occur depending on the starting levels and changes in tax compliance costs. Changes in compliance costs would directly impact labour demand since compliance costs are represented by the amount of labour involved into tax compliance activities. The CCCTB would therefore also indirectly impact on the demand for capital, and on the overall production in the economy. In addition, the incentive to supply labour would be altered by changes in wages, thus affecting welfare. When assuming budget-neutrality, we find that the CCCTB would yield a slight increase in the corporate income tax (CIT) rates on average in the EU, affecting marginally the incentives for firms to shift profits across borders. Our results shed light on the linkages between tax compliance costs and the economic impact of the CCCTB proposal, depending on country-specific characteristics. Our simulations suggest, maybe counterintuitively, that the benefits from the CCCTB for those countries

⁽²⁾ The magnitude of these effects is however difficult to predict because the post-reform equilibrium tax rates will largely depend on specific countries' circumstances. Pethig and Wagener (2007) for instance show that the (Nash) equilibrium CIT rates after a CCCTB reform are function of the chosen formula apportionment rule, given that the different components of this formula (i.e. property, sales and labour) have different elasticities with respect to the tax rate. Under the apportionment formula foreseen by the CCCTB proposal, property, sales and labour are weighted one third each. Therefore our analysis does not deal with this specific question, although we acknowledge this is a potentially important issue.

featuring relatively lower tax compliance costs before the reform would also be larger. These countries would therefore gain relatively more from the consolidated corporate tax base. Furthermore, countries hosting more foreign investment before the reform (i.e. with a large FDI stock) would also reap extra benefits from the CCCTB. We also find that the CCCTB would favour multinationals over domestic activities. This result also indicates that domestic firms willing to operate across EU borders would also potentially benefit from the reform. The effects of the CCCTB on non-EU countries are found to be negligible.

The rest of the paper is organised as follows. Section 2 summarises the CCCTB proposal and points out the contribution of the present paper in relation to it and the relevant literature. Section 3 briefly presents the main characteristics of CORTAX and describes the modelling of compliance costs in the CORTAX model. Section 4 describes the data used for modelling tax compliance costs. Section 5 presents the CCCTB simulations and discusses results. Section 6 concludes.

2 The European context and the CCCTB Proposal

The fragmented European corporate tax system imposes a burden on corporate groups that operate across EU countries and must comply with different national tax systems. Martens-Weiner (2006) for instance shows that companies doing business across EU member states face higher compliance costs than those doing business only locally. The recent re-launch of the proposal for harmonising and consolidating corporate tax bases in the EU highlights the potential benefits such measure could have in terms of reducing the cost of tax operations, while providing a greater transparency to national corporate systems (see European Commission 2016).

The European Commission's proposal envisages two main reforms to be implemented in stages: the common corporate tax base (CCTB) and the common consolidated corporate tax base (CCCTB) ⁽³⁾. The first stage would involve a common tax base, introducing common rules for calculating the taxable profits of a company. The aim is to eliminate mismatches between national systems which aggressive tax planners often exploit; and to reduce the administrative burden by having a single definition of the tax base. The second stage would involve the consolidated reporting at the level of a multinational group via a formula apportionment. Consolidation would imply that intra-group transactions would be ignored and the consolidated group profits apportioned by a formula to the jurisdictions where the corresponding economic activity took place. Cross-border companies would be able to offset losses in one member state against profits in another. Both reforms are foreseen to be mandatory for multinationals only, which means that only multinationals will participate in the harmonised tax base.

The expected benefits of corporate tax base harmonisation in the EU have long been debated. Mintz (2004) sees in the reduction of compliance and administrative burdens the ultimate aim of corporate tax base consolidation. The author discusses previous CCCTB reform proposals for the EU (similar in spirit to the 2016 proposal) and envisages its compulsory implementation as the optimal solution. Evans (2003) calls for tax law design to account for the impact of the proposed changes on the operating costs of the tax system. The proposed design would mimic the Canadian system which achieved considerable savings in administrative and compliance costs. McLure (2007) discusses the issues related to the multiplicity of corporate tax systems in the EU and the implications of harmonisation. For him the rationale for harmonisation lies in the drawbacks of the current fragmented tax system in the EU, featuring separate accounting and lack of uniformity in arm's length pricing standards, among others. Corporate tax base harmonisation and consolidation may therefore bring significant reductions in costs of compliance and administration. The PwC's survey (2008) on multinationals provide estimates of the potential impact of the CCCTB on tax compliance costs, confirming a dramatic fall in these costs.

Many interactions must be considered in order to analyse the expected impact of the CCCTB, including between labour and capital markets, between countries, and between firm types, i.e. either domestic firms or multinationals. The effect of these interactions might differ across countries with potential winners and losers, at least in relative terms, given that capital flows imply that countries compete for attracting corporate investment. As capital will likely move more easily across borders, this might also affect labour vs. capital income as well as firms' investment strategies. Last but not least, governments may react to the CCCTB by changing their CIT rate in order to compensate for potential budgetary losses. In the following sections we will discuss why the use of a CGE model such as CORTAX model is warranted in order to carry out such analysis.

⁽³⁾ Note however that throughout the paper we refer to the CCCTB proposal generically and encompassing both stages of the reform.

3 Modelling tax compliance costs using the general equilibrium model CORTAX

3.1 A summary description of the CORTAX model

To perform our analysis, we use CORTAX, a computable general equilibrium model designed to investigate corporate tax reforms in the EU and which was used for the impact assessment of the CCCTB proposals, see Bettendorf et al. (2010) and Alvarez-Martinez et al. (2016a, 2016b). In this section we provide a summary description of the model. A more detailed and mathematical description is provided by the aforementioned authors and Annex B. The CORTAX model covers all EU member states, the USA, Japan and a tax haven. It captures key features of corporate tax regimes, including: the impact on the cost of capital and on investment decisions, a detailed representation of assets depreciation and amortization rules, loss carry forward and loss compensation rules, profit shifting (both across non-haven countries and to a tax haven), debt-equity financing and different deductibilities for financial costs. The model encapsulates the behaviour of all economic agents –households, firms, governments– in the economy, reflecting both the direct and indirect effects of policy changes on macroeconomic variables such as GDP, investment and employment. Three firm categories are modelled: multinationals' headquarters, their subsidiaries located abroad, and domestic firms that only produce in their country of residence. Each country has one representative domestic firm, one multinational headquarter and several subsidiaries, which are owned by headquarters in other countries⁽⁴⁾. Multinational and domestic firms differ to the extent that the former optimise profits globally and may engage in profit shifting activities across borders via transfer pricing. Both domestic and multinational firms may shift profits to a tax haven to reduce their tax liability via debt shifting, however only multinationals are able to, in addition, optimise their profit reporting across countries through transfer pricing through intra-firm trade in intermediate goods⁽⁵⁾. Countries are linked to each other via international trade in goods markets and investment by multinationals. Each firm maximizes its value, equal to the net present value of all future cash flows, subject to the possibilities of the production function and accumulation constraints on physical capital and fiscal depreciation.

The production function is a Cobb Douglas combination of a fixed factor and the value added, which, in turn, is an aggregate of labour and capital using a constant elasticity of substitution (CES) function. Labour is immobile across borders and wages are determined in national labour markets. Capital is assumed to be perfectly mobile internationally so that the return to capital (after corporate taxes) is determined for each country on the world capital market. The fixed factor (land) is location-specific and supplied inelastically. The income from the fixed factor reflects an economic rent.

Households are modelled in an overlapping generation framework with a young and an old generation. Households maximise their inter-temporal utility function subject to a budget constraint, where net savings from young workers (wages, current transfers and negative consumption) are equal to the negative value of net savings from old households. Households' savings are allocated to bonds and stocks, which are imperfect substitutes and have different rates of return. The gross returns to assets are determined on world markets and are assumed to be the same irrespective of the residence of their owner. Total bond and stock holdings are derived from the maximisation of total assets

⁽⁴⁾ Note that the number of firms is not modelled in CORTAX. This simplification still allows the interpretation of the results of the policy simulations by comparing MNEs with domestic firms' situation. Yet the relative importance of domestic vs. foreign firms is represented by the contribution of FDI stock in the total capital stock.

⁽⁵⁾ Note that such modelling strategy naturally comes from the definition of multinational firms, which exchange intermediate products across subsidiaries located in different countries, something that by definition cannot be done by domestic firms.

(combining bonds and equities) subject to their total value. The effects on welfare are calculated using the compensating variation, computed as the additional transfer required by young households to compensate for the change in utility.

Governments keep their budget balanced, with consumption and public debt as fixed shares of GDP. Tax revenues and/or transfer payments adjust to keep a constant public budget. Taxes include indirect taxes on consumption and direct taxes on income from corporate and labour, dividends, capital gains and interest payments. The expenditure side features government consumption, interest payments on public debt and lump-sum transfers. Data and policies of each country are used to replicate the corporate taxation regime, the production structure and household behaviour. This paper uses the calibration of the model performed by Álvarez-Martínez et al. (2016a) for the latest European Commission CCTB proposal (see European Commission 2016).

3.2 Modelling tax compliance costs in CORTAX

Among the alternative corporate tax specifications, the CORTAX model accommodates compliance costs incurred by firms for complying with their corporate tax obligations. In particular, compliance costs are modelled as variable costs and measured as share of the labour force employed for dealing with tax administration. Overhead labour dedicated to tax compliance tasks is designed as a fixed fraction of the productive workers and increases the wage cost by this fraction. It follows that compliance costs proportionally increase in the payroll of the firm. In the following we describe in detail how tax compliance costs potentially influence investment behaviour by firms.

Firms maximise their value $V_t^n(j)$, which is the discounted value of future dividends subject to the possibilities of the production function and accumulation constraints on physical capital (K^n) and fiscal depreciation (D^n):

$$V_t^n(j) = \sum_{s=t}^{\infty} \Lambda(j) \text{Div}_s^n(j) R_s(j) \quad (1)$$

with $n =$ domestic (d), multinational headquarters (m) or subsidiary (f).

$$D_{t+1}^n = I_t^n + (1 - \delta_t) D_t^n \quad (2)$$

$$K_{t+1}^n = I_t^n + (1 - \delta_k) K_t^n \quad (3)$$

R_s represents the overall effect of discounting:

$$R_s(j) \equiv \frac{1}{(1 + \bar{r}_e(j))^{s-t+1}}; \quad \bar{r}_e(j) \equiv \frac{r_e(j,j)}{(1 - \tau_g(j))}; \quad \Lambda(j) \equiv \frac{(1 - \tau_d(j))}{(1 - \tau_g(j))}$$

$\bar{r}_e(j)$ is the discount rate relevant for firms in making decisions and $r_e(j,j)$ is net return on equity in country j for an investor also in country j (the marginal investor is assumed to reside in the home country). $\tau_g(j)$ is the tax rate on capital gains and $\tau_d(j)$ is the tax rate on dividends.

Dividends are defined as follows:

$$\text{Div}_t^n = Y^n - wL^n - (d_b^n \hat{r}_{wb} + c_d^n) K^n - \Pi_t^n - \tau_t^n \hat{\Pi}_t^n - I_t^n + d_{b,t+1}^n K_{t+1}^n - d_{b,t}^n K_t^n \quad (4)$$

Equation (4) reads as follows: total production (Y^n) less labour cost (wage (w) times employment (L^n)), minus the deduction for the cost of debt, which is the deductible fraction of debt (β_b) multiplied by the share of debt financing (d_b^n), and the interest rate (\hat{r}_{wb}) plus the financial distress or agency costs (c_b^n), times the quantity of capital (K^n) less depreciation allowances ($\delta_t D^n$); Π_t^n is the return to fixed factors, $\hat{\Pi}_t^n$ the tax base, τ_t^d the corporate tax rate, I_t^d investment.

The production function Y is a Cobb Douglas combination of the fixed factor (A^{nx}) and value added ($VA(j)^{nx}$):

$$Y^{nx}(j) = A^{nx} (VA(j)^{nx})^{\alpha_V^n} \quad (5)$$

where $A^{nx} = (A_{0x}\omega^n N^y)^{1-\alpha_v^d}$. The fixed factor A_{0x} is weighted by the size of the young generation (N^y). The term ω^n is the exogenous fraction of the fixed factor that is used by domestic, headquarters of subsidiaries corporations.

In the case of subsidiaries (f), there is an intermediate input ($Q(j)^{\alpha_q}$) supplied by their headquarters:

$$Y^{fx}(j) = A^{fx}Q(j)^{\alpha_q}(VA(j)^{fx})^{\alpha_v^f} \quad \text{with } 0 < \alpha_q + \alpha_v^f < 1 \quad (6)$$

Value added is a CES function of labour ($L(j)$) and capital ($K(j)$)

$$VA(j)^{nx} = A_{0x} \left[\alpha_{vl}^n (L(j)^n)^{\frac{\alpha_v^n-1}{\alpha_v^n}} + \alpha_{vk}^n (K(j)^n)^{\frac{\alpha_v^n-1}{\alpha_v^n}} \right]^{\frac{\alpha_v^n}{\alpha_v^n-1}} \quad (7)$$

We derive the demand for the factors of production from the FOC of the firms' maximisation problem. In this paper we are concerned with the demand for labour, which includes a share of overhead labour dedicated to tax compliance activities (α_l in equations (8) and (9) which are for multinational headquarters (m) and subsidiaries (f) in country j, respectively) that will accommodate our alternative estimates for compliance costs. Under competitive markets, the demand for labour equals the marginal productivity of labour with the marginal cost.

$$(1 + \alpha_l)w = \alpha_v^m \left(\frac{Y^m}{VA^m} \right) \alpha_{vl}^m A^{1-\frac{1}{\sigma_v^d}} \left(\frac{VA^m}{L^m} \right)^{\frac{1}{\sigma_v^d}} \quad (8)$$

$$(1 + \alpha_{lj})w(j) = \alpha_v^f \left(\frac{Y^f(j)}{VA^f(j)} \right) \alpha_{vl}^f A^{1-\frac{1}{\sigma_v^d}} \left(\frac{VA^f(j)}{L^f(j)} \right)^{\frac{1}{\sigma_v^d}} \quad (9)$$

with α_l being the fraction of productive workers devoted to tax compliance tasks, α_v the share parameter of value added, α_{vl} the share parameter of labour in value added, σ_v^d the substitution elasticity labour/capital, A the productivity level, w the wage rate, Y production, VA value added, L employed labour.

Modelling tax compliance costs as overhead labour dedicated to tax compliance tasks implies that changes in compliance costs resulting from the implementation of the CCTB and the CCCTB will directly affect the cost and the demand for labour and therefore production. The CCTB and CCCTB might therefore be assimilated to an efficiency gain in production as a lower share of labour would be needed to perform activities which bring no additional economic gains. A reduction of tax compliance costs indirectly increases the average productivity of the workforce while reducing wage costs and the cost of production. Importantly, the reduction in tax compliance costs resulting from the reform is proportional to the multinational sector in the country given that the costs of tax compliance for operating across EU borders is, by definition, only incurred by multinationals. As the multinational sector is proxied on FDI, the fall or removal of compliance costs for subsidiaries will affect more countries with large FDI.

4 Calibration of country-specific tax compliance costs

In order to calibrate tax compliance costs used in the CORTAX model we need to rely on external estimates. Existing studies measuring business tax compliance costs mainly rely on structured surveys with relatively small sample size (Eichfelder and Vaillancourt 2014). These studies suggest that estimates for tax compliance costs tend to decrease with firm size. Internal time effort and personnel expenses are the most relevant part of the burden. The number of cross-country comparative studies is limited, however. Evans et al. (2014) report on exploratory research conducted in four countries (Australia, Canada, South Africa and the United Kingdom) in 2010 and 2011. The European Commission (2004) surveyed seven hundred companies across fourteen member states in 2003 via the European Tax Survey although the low level of responses undermined the representativeness of these results. OECD (2001) catalogues 8,000 small and medium sized enterprises in 11 OECD countries (Australia, Austria, Belgium, Iceland, Mexico, New Zealand, Norway, Portugal, Spain and Sweden). Klun and Blazic (2005) extend their study to Slovenia and Croatia only. The variety of approaches used and the absence of estimates covering a large number of EU countries make it difficult to set a commonly agreed value for tax compliance costs. In its review of existing studies Devereux (2004) reported a range between 2.7% to 4% of corporate income tax revenues collected. The impact assessments conducted by the European Commission in 2011 and 2016 retained the upper end value of these estimates, i.e. 4%, for all EU countries as central estimate, which seemed reasonable in absence of representative survey data. However, the use of a common estimate for tax compliance is likely to limit cross-country differences in the impact of the CCCTB. In addition, as we explain in more detail in the following, more recently available estimates suggest that 4% is likely to represent a lower rather than an upper bound for the cost of tax compliance related to cross-border business in the EU.

In this paper we use a novel and unique study on tax compliance costs by KPMG prepared for the Executive Agency for Small and Medium-sized Enterprises (from now on the EASME/KPMG study) ⁽⁶⁾. This newly released survey covers 20 EU countries in 2014, sampled in stratas according to enterprise size (classified into four size levels: micro, small, medium, large plus super-large) and NACE 1-digit industrial sector (five sectors were considered). The final data set comprises slightly more than 3,000 observations. For each respondent, data about the time spent internally on tax compliance and the monetary cost for outsourced compliance services are provided, together with (among other data) information on turnover, number of employees, gross profit and taxes paid ⁽⁷⁾. Thus, the data is richer than, for example, the World Bank's Doing Business database where only internal time (and not outsourcing costs) is reported ⁽⁸⁾.

Despite the fact that the EASME/KPMG survey focuses on small enterprises, it is designed to provide statistically representative information on medium and large companies as well ⁽⁹⁾. However the survey introduces an upward bias in the estimates because SMEs

⁽⁶⁾ The EASME/KPMG study was published on 12/12/2018 and is available at: <https://publications.europa.eu/s/kVno>.

⁽⁷⁾ The final report by EASME/KPMG does not provide any information about the split between domestic and foreign compliance costs, though the way questions are posed in the survey strongly relate to domestic costs only.

⁽⁸⁾ See <http://www.doingbusiness.org/en/reports/thematic-reports/paying-taxes>.

⁽⁹⁾ The draft 2nd interim report of the EASME/KPMG survey states in particular that: *"The agreed sampling method used is a disproportionate stratified sample, requiring a minimum number of completes per cell and including size and sector strata. This allows sufficient sample sizes to draw conclusions across all sectors and enterprise sizes. A representative sample might have entailed the risk of not being able to make statistically relevant conclusions for larger enterprises. To ensure representativeness for further qualitative analysis, the samples are weighted towards the actual proportion of enterprises."*

are known to face proportionally larger tax compliance costs compared to their size, see European Commission (2004). We therefore employ our estimates to proxy for the relative differences in compliance costs across EU member states, but less so to infer information about the absolute levels. We also aim to exclude companies whose information might not reflect normal (i.e. business as usual) tax compliance costs, in order to calculate country average tax compliance costs. For this we need to exclude very small companies as we aim to represent the average compliance costs for a typical firm. We also want to exclude companies experiencing temporary distress as the information on tax compliance costs might be significantly influenced by temporary circumstances not reflecting business-as-usual conditions. In addition, as the survey only offers a cross-section of firms, no information is available about the level of turnover from past periods, thus we are unable to tell if an observed low turnover is due to the size of the firm or to abnormally low economic performance. Therefore we excluded all respondents with less than 500,000 EUR turnover. We also eliminated the top 5% turnovers to reduce the weight of few, very large companies on the computations of country means. The latter was needed as very few observations comprise very large companies and their size is uneven across countries. This is because the survey's stratification only applies the following selection criterion for the largest firms (the ones falling in the large and super-large bin): these are "those enterprises with >250 employees or >€50 million turnover or >€43 million balance sheet total". Therefore even just one extremely large company sampled in one country might produce an extremely low cost-to-turnover ratio and artificially pull down the mean for that country.

The EASME/KPMG survey also asks about the type of enterprise, thus we could distinguish between stand-alone companies and companies which are part of a group. This is important because belonging to a group might increase the reported figures for the compliance costs (as more tasks need to be performed, for example to deal with cross-border trade), but it might also reduce them (as economies of scale and centralized compliance management may reduce reported costs by the individual affiliate). We only consider enterprises that are subject to corporate taxation ⁽¹⁰⁾. For each country, separately for stand-alone firms and group affiliates, we compute the mean number of hours spent in tax compliance internally divided by turnover, and multiply it by the average hourly cost of labour in that country in 2014 (obtained from Eurostat) to get a measure of euro-equivalent tax compliance costs. We then compute the mean by country (and again, separately for stand-alone firms and group affiliates) of outsourcing costs as a share of turnover, and add them up to the internal costing estimate. In the end, we obtain two series of tax compliance cost figures expressed as shares of turnover, one for stand-alone enterprises and one for group affiliates, for 17 EU countries. Finally to convert the two series into shares of labour costs, which is the way compliance costs are represented in the CORTAX model, we compute for each EU Member the average share of labour costs on turnover using Orbis Bureau van Dijk© data for 2014 ⁽¹¹⁾, and divide our figures by that number. The simple average among the two series is used as an estimate of the tax compliance costs (expressed as a share of labour costs) for each EU Member State. When estimates are not available for a country, we assign the EU GDP-weighted mean to EU countries ⁽¹²⁾.

As discussed above, the previous impact assessments of the CCCTB conducted in 2011 and 2016 considered that tax compliance costs represented 4% of total corporate income

⁽¹⁰⁾ In cases where the number of stand-alone companies for a country was below 10, we used instead enterprises that are not subject to corporate taxes but rather to business taxation. This was the case for four countries: Ireland, Luxembourg, the Netherlands and Slovenia.

⁽¹¹⁾ For more information on the Orbis data, see <https://www.bvdinfo.com/en-gb/our-products/data/international/orbis> .

⁽¹²⁾ These countries are: Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Portugal, Romania, UK.

tax revenues collected which corresponded to a ratio of 0.5% when measuring compliance costs in proportion of labour costs, see Bettendorf and van der Horst (2006) and Alvarez-Martinez (2016a). In addition the past impact assessments assumed that such costs were identical across countries. With the newly released EASME/KPMG survey we find that such cost represent nearly three times the previous estimates, representing on average across countries, 1.38% of total labour cost and 12% of total corporate income tax revenues collected (weighted averages using GDP as weights). With these caveats in mind we designed two alternative baselines for calibrating tax compliance costs in CORTAX. The first baseline is obtained equating the GDP-weighted EU mean of country specific estimates to 1.38% ratio of compliance costs on labour cost or, equivalently, to 12% of corporate tax revenues ⁽¹³⁾. Note though that a cost-to-CIT revenues ratio of 12% is a much larger figure than those commonly found by the literature, see for instance: TAXUD (2004) finding a comparable value of 2.6% for SMEs across several countries; the OECD (2001) finding values between 2% and 7% (as well using a multi-country sample); Eichfelder and Vaillancourt (2014) who report that for SMEs in individual countries this value is usually found to be in the range of 0.4% to 4%, while only in few studies (for New Zealand, Belgium and Croatia) the estimates exceed 10%. Our value of choice of 12% of corporate tax revenues (or equivalently 1.38% of labour cost) must therefore be considered as an upper-bound estimate. In the following we label this as the "New baseline". The second baseline is designed to keep the GDP-weighted EU mean at the level set in the impact assessments of 2011 and 2016 used by the European Commission ⁽¹⁴⁾ and corresponding to compliance costs (as a share of labour costs) equal to 0.5%, or equivalently 4% of compliance costs as a share of corporate tax revenues, while still accommodating estimates that differ across countries as in the newly released EASME/KPMG data. In the following we label the latter as the "Old baseline".

Table 1 shows our country estimates of tax compliance costs used in CORTAX, corresponding to the α_1 in equations (8) and (9). In the "New baseline", the majority of countries end up with higher estimates than the common value, except for Finland, Luxembourg, Spain, Estonia and Slovenia. In the "Old baseline", Austria, Belgium, Germany, Italy, Sweden, Poland and Slovakia are assigned values higher than the average; on the contrary, Finland, France, Luxembourg, the Netherlands, Spain, Estonia and Slovenia are assigned lower than average values. As explained we assign the EU GDP-weighted mean to the remaining countries.

Table 1. Tax compliance costs to total labour cost ratios (baselines)

Country	"New baseline" for tax compliance costs	"Old baseline" for tax compliance costs
Austria	2.02%	0.77%
Belgium	1.73%	0.66%
Denmark	1.38%	0.50%
Finland	0.40%	0.15%
France	1.14%	0.43%

⁽¹³⁾ Instead of calculating country average values we could have considered medians, especially in light of stratification issues mentioned above. However using median values would greatly underrepresent large firms, which are those managing a large share of GDP in the countries considered here.

⁽¹⁴⁾ See Alvarez-Martinez et al. (2016b).

Germany	2.36%	0.90%
Greece	1.38%	0.50%
Croatia	1.38%	0.50%
Ireland	1.38%	0.50%
Italy	1.62%	0.62%
Luxembourg	0.47%	0.18%
Netherland	0.89%	0.34%
Portugal	1.38%	0.50%
Spain	0.31%	0.12%
Sweden	3.69%	1.41%
UK	1.38%	0.50%
Cyprus	1.38%	0.50%
Czech Republic	1.38%	0.50%
Estonia	0.12%	0.05%
Hungary	1.38%	0.50%
Latvia	1.38%	0.50%
Lithuania	1.38%	0.50%
Malta	1.38%	0.50%
Poland	5.61%	2.14%
Slovakia	2.03%	0.77%
Slovenia	0.30%	0.11%
Bulgaria	1.38%	0.50%
Romania	1.38%	0.50%
EU average	1.38%	0.50%

Notes: These values feed into α_1 in equation (8) and (9). The "New baseline" uses the new EASME/KPMG survey to calculate country-specific average values of the tax compliance costs measured as share of total labour costs. The "Old baseline" is pinned to the GDP-weighted EU mean as in the 2016 Impact Assessment of the CCCTB by the European Commission (see Alvarez et al., 2016) while preserving cross-country differences as reflected in the newly released EASME/KPMG data. The EU average figures are GDP-weighted means.

Source: Own calculations.

5 New simulations for the CCTB and CCCTB under alternative tax compliance costs

Implementing the CCTB and CCCTB entails a new set of rules for the definition of a common corporate tax base for member states. In a first stage (CCTB), multinationals will need to define their tax base according to a single common definition. The harmonised tax base is defined as follows: a 12.5 percent straight line depreciation rate for machinery (8 years), a 4 percent rate for industrial buildings (25 years), a 6.67 percent rate for intangibles (15 years) and an average-value pricing for inventories. The net present values of depreciation allowances are calculated in line with the Devereux/Griffith methodology (Devereux and Griffith 2003). For the harmonised tax base, two values are calculated: the first-year allowance and the net present value of other depreciation allowances for each asset class. The ORBIS data from Bureau van Dijk © are then used to calculate the median values by country, based on firm-specific data on asset structures. Tax base harmonisation does not result in identical tax bases for all countries, as each country has a different assets structure. Across member states, this would translate into a narrowing/broadening of the tax base depending on the specific national rules in place before introducing harmonised tax bases. In a second stage (CCCTB), firms will be allowed to consolidate their tax bases across subsidiaries according to a formula apportionment. In the model simulation reforms are tax revenue neutral. We allow CIT rates to adjust ex-ante in order to keep CIT revenues unchanged, therefore before firms' behavioural responses. The government budget is balanced by adjusting transfers to the old generation.

Implementing the CCTB and CCCTB reforms in CORTAX generates the following results, as shown previously in Alvarez et al. (2016). On average in the EU the harmonisation of corporate tax base causes a narrowing of the tax base. The resulting reduction in the cost of capital boosts investment and exerts a positive impact on the productivity of labour, stimulating wages and employment. As a result, GDP and welfare increase. Under the consolidated corporate tax base, additional mechanisms come into play. The shift to the formula apportionment has allocative implications and removes the incentive to shift profits within the EU. However, a large part of the benefits comes from the significant reduction in tax compliance costs that, via the general equilibrium framework, results into higher welfare and GDP by reducing the cost of production. These results were based on the assumption of an equal value for tax compliance costs across countries. In the sequel we discuss the impact our alternative estimates for tax compliance costs have on CCTB and CCCTB respectively for the "new" and "old" baselines for the compliance costs. In Tables A1 to A4 in the Annex we present country-specific results.

5.1 Results for the CCTB

We follow previous impact assessment exercises conducted by the European Commission services and assume that tax compliance costs faced by multinational subsidiaries are lowered by 30% thanks to the CCTB ⁽¹⁵⁾. Results for the CCTB under alternative estimates for tax compliance costs are mainly driven through labour demand, the substitutability between labour and capital and their impact on production. As modelled in equations (8) and (9), reduced tax compliance costs directly lower the increase in wages caused by the new definition of the tax base, via the α_1 coefficient. This translates into a relatively higher demand for labour, as this factor of production become less costly. In a competitive market, changes in labour demand affect the productivity of capital and therefore the substitutability between the two factors of production. More labour-intensive countries will be the most affected. Overall, the boost in demand for the factors of production results in a higher level of production in the economy. On the

⁽¹⁵⁾ The choice of assuming the same 30% reduction for the CCTB, and 100% for the CCCTB, comes from the need to guarantee comparability of results with previous works. In the following sub-section 5.4 we consider alternative cost reductions.

supply side, workers respond by supplying more labour. Welfare in the economy improves.

Under the assumption of ex-ante revenue neutrality, corporate tax rates faced by firms (adjusted for profit shifting to tax haven) are modified to compensate for changes in the tax base resulting from the implementation of the common definition. In particular, countries experiencing a narrowing of the tax base raise their CIT rate to compensate for the loss in the collected revenues; examples are UK, Poland and Germany. Contrarily, countries like Belgium and Estonia experience a fall in their CIT rates, in response to the broadening of their tax bases. At EU level we record a narrowing of the tax base, which reduces the marginal effective tax rate; and slightly higher average corporate tax rate that increases the burden on capital, which distorts firm decisions, but is also levied on pure rents which is non-distortionary ⁽¹⁶⁾. Overall, at EU level, the distortive impact of the corporate tax rate on the cost of capital is slightly mitigated. Changes in CIT rates across countries also modify incentives to engage in profit shifting (see Equations in the Annex). The extent to which profit shifting affects the tax base depends on the size of the bilateral FDI stocks, as they represent a proxy of intra-firm trades. Therefore, tax revenues in countries with important FDI stocks are relatively more affected by profit shifting than countries with small FDI stocks.

Comparing results for the CCTB across scenarios, we find a larger positive impact under the "new baseline" than under the "old baseline" for tax compliance costs (Table 2). Tax compliance activities can be considered distortive and therefore harmful to economic efficiency. This efficiency gain impacts positively on all variables except for employment that records a slightly smaller increase compared to the old baseline. Although there is a greater absolute reduction in compliance costs brought about by the CCTB under the new baseline than under the old baseline, these costs are still higher in absolute terms after the CCTB with the new baseline than under the old baseline. This higher compliance cost both before and after the CCTB under the new baseline dampens the increase in employment stimulated by the increase in production. However, higher wages positively affect welfare.

⁽¹⁶⁾ The version of the CORTAX model we employ here assumes that multinational firms set their FDI at the margin, but they perform FDI in all countries modelled. An alternative specification, which we do not explore in this paper, could assume instead a discrete choice framework where multinationals may also decide where to perform FDI. In the latter case taxing pure rents might be distortionary.

Table 2. Economic effects for the EU of the CCTB reform

	CCTB "New baseline" for tax compliance costs	CCTB "Old baseline" for tax compliance costs
Cost of capital (% points change)	-0.078	-0.077
Investment (percentage change)	1.14	1.074
Wage (percentage change)	0.332	0.283
Employment (percentage change)	0.103	0.107
GDP (percentage change)	0.383	0.332
Welfare (% GDP)	0.117	0.079

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs.

Source: Own simulations.

With new estimates of tax compliance costs that differ across countries, the benefits due to their reduction also differ. Since some countries benefit more than others, they gain a relative competitive advantage for attracting foreign investment. Countries benefiting less from the CCTB might thus be worse off. Our results suggest that countries featuring lower baseline compliance costs are better off. Under the "new baseline" all countries are better-off after the CCTB compared to the "old baseline"; however the benefit decreases for countries with larger baseline compliance costs. Therefore, the top ranked are Luxembourg, the Netherlands and Spain; as opposed to the lower ranked Sweden, Germany and Italy. Across baselines, results suggest that countries with large presence of multinational subsidiaries (large FDI) see the effect amplified. Examples are Luxembourg, Finland, Sweden and Belgium. Outside of the EU, the spillover effect on Japan and US is negligible.

5.2 Results for the CCCTB

Consolidation is expected to bring major benefits in terms of reduced costs for tax compliance, even though the size of the reduction is difficult to predict. When simulating the impact of the CCCTB, we assume that compliance costs paid by subsidiaries fall to zero (this assumption will then be amended in the following sub-section 5.4). However, several effects need to be disentangled when analysing the CCCTB in combination with alternative assumptions on compliance costs, as the consolidated base will also remove any incentive to shift profits across EU and allow for loss consolidation. Accommodating country-specific estimates for compliance costs introduces heterogeneity across countries, mostly in terms of benefits from the consolidated tax base. Aggregate responses to the reform are significantly larger under the "new baseline" than under the "old baseline" (Table 3), highlighting the role of compliance costs in generating benefits under the CCCTB. Since compliance costs are modelled as variable costs, their removal reduces the cost of production and exerts a positive impact on GDP and welfare.

Table 3. Economic effects for the EU of the CCCTB reform

	CCCTB "New baseline" for tax compliance costs	CCCTB "Old baseline" for tax compliance costs
Cost of capital (% points change)	-0.087	-0.083
Investment (percentage change)	1.27	0.925
Wage (percentage change)	0.67	0.436
Employment (percentage change)	0.246	0.258
GDP (percentage change)	0.505	0.269
Welfare (% GDP)	0.196	0.023

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs

Source: Own simulations.

Country results (Tables A2, A4) are driven by the relative level of tax compliance costs in the baseline and the presence of foreign subsidiaries in the country. The relative size of multinationals in national production compared to domestic firms also plays a role. The economic impacts are amplified or weakened depending on the size of FDI stock and therefore the presence of multinational subsidiaries in the country. Countries with many subsidiaries will also be more responsive to the CCCTB than countries with only few ones. Examples are Poland, Italy and Germany, countries with relatively small shares of multinationals in national production, where the reduction in the relatively large estimates of tax compliance costs is not fully transmitted to employment and GDP. By contrast, in Luxembourg, Malta, Finland, Denmark and Belgium, the large size of subsidiaries hosted in the country ends up reinforcing the effect of reduced tax compliance costs. Results suggest that countries hosting more foreign subsidiaries and countries with relative lower baseline compliance costs benefit more from the CCCTB, with significant gains in terms of GDP, employment and welfare. The reduction in tax compliance costs resulting from the reform benefits also non-EU countries operating in the European market, although these impacts are, here again, negligible.

5.3 Comparing multinationals vs. domestic firms

An important dimension of the analysis is to differentiate between domestic and multinational firms. This particularly follows from the scope of the reform that will be mandatory for multinationals only. Firms will therefore be affected differently depending of their type. In the sequel we analyse the extent to which the CCTB and CCCTB might favour multinationals over domestic firms. Alternatively, our analysis can also be used to determine the incentives domestic firms may have to engage into foreign direct investment as a result of the reduction in tax compliance costs brought about the CCTB and CCCTB.

Domestic firms (or, alternatively, domestic investment) will not benefit from the reduction in tax compliance costs since, by definition, they do not operate across

borders. The asymmetric framework of the reform will result in a competitive advantage for multinationals, due to the fall in their production costs ⁽¹⁷⁾. Results concerning production changes by firm type indicate a significant shift in favour of multinationals under the CCCTB proposal (Table 4). The key benefit to multinationals from the consolidated tax base is the lowering of tax compliance costs which more than offsets the additional costs resulting from the removal of profit shifting within the EU. Under the CCTB the impact is rather small. Results are amplified under the scenario using the new baseline for tax compliance costs.

Table 4. Effect on production by category of firm

	CCTB "New baseline" for tax compliance costs	CCTB "Old baseline" for tax compliance costs	CCCTB "New baseline" for tax compliance costs	CCCTB "Old baseline" for tax compliance costs
Domestic	-1.37	-0.29	-20.75	-16.82
Multinational	2.71	1.21	26.41	20.68

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs

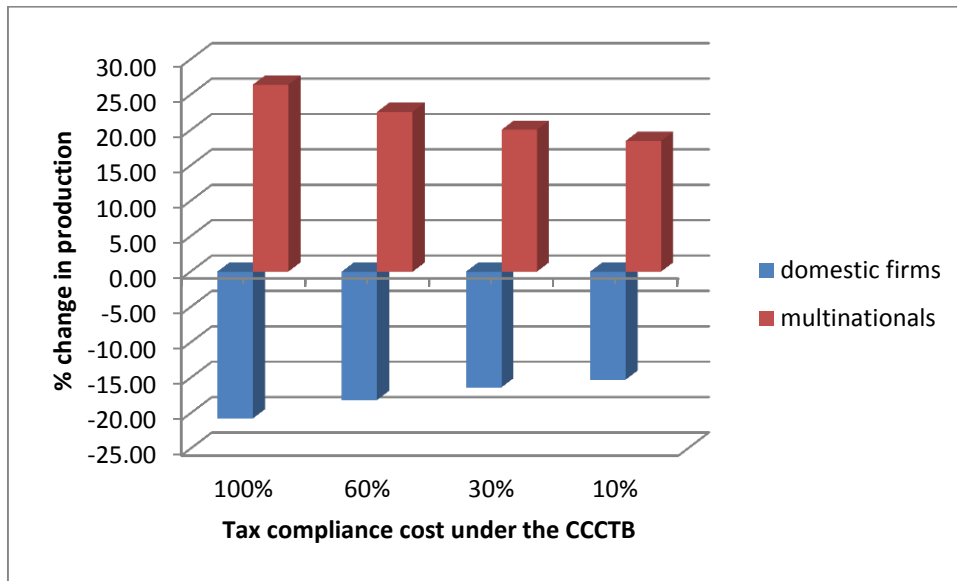
Source: Own simulations.

5.4 Varying compliance costs reduction from the reforms

We also checked whether the differential impact of the CCCTB between domestic firms and multinationals depend on the assumption regarding the decrease in compliance costs. In order to verify how dependent our results are with respect to such an assumption, we design scenarios for the CCCTB reform under different compliance costs reductions set at 100%, 60% and 10% of the baseline values and compared them with the results under the 100% reduction corresponding to the value used in previous impact assessments conducted by the European Commission services. As Figures 1 and 2 show, the larger the reduction in tax compliance costs, the larger the shift in production from domestic firms to multinationals. The latter also applies the larger the initial compliance cost (as in Figure 1 compared to Figure 2) in terms of total labour costs.

⁽¹⁷⁾ The legal proposal foresees the possibility for domestic firms to opt in. However, in our analysis we do not model this option. Therefore, results must be interpreted with this caveat in mind.

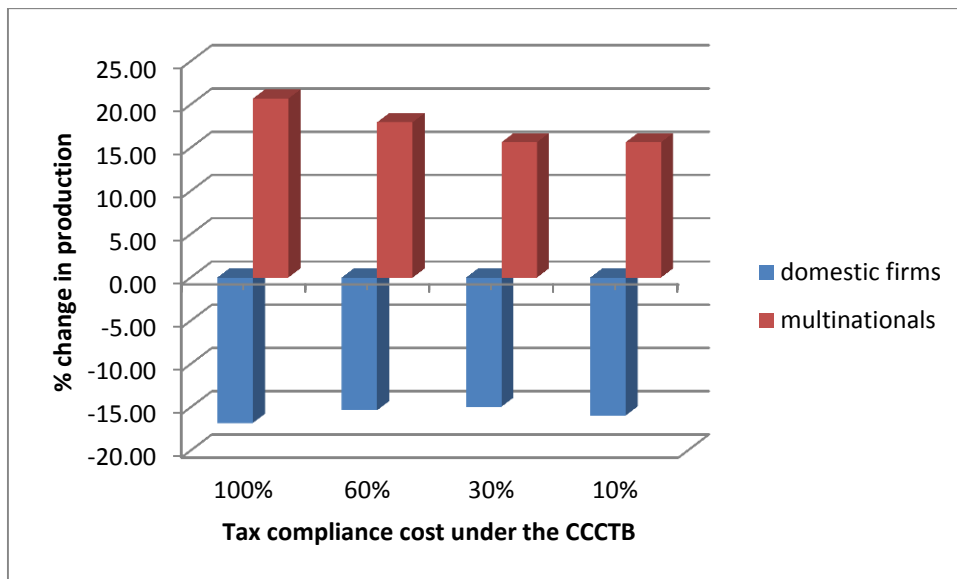
Figure 1. Effect on production by category of firm, CCCTB
 "New baseline" for tax compliance costs



Source: own simulations, 2019.

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs

Figure 2. Effect on production by category of firm– CCCTB
 "Old baseline" for tax compliance costs



Source: Own simulations, 2019.

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs

As noted previously, these results do not mean that domestic firms would necessarily be penalised under the CCCTB. As a matter of fact, the results of the survey conducted by the European Commission in 2003 suggested that tax compliance costs were significantly higher for cross-border operations of SMEs vs. large multinationals, see European Commission (2004). Domestic firms, usually SMEs, would therefore also benefit from the

reduction in tax compliance costs via the CCCTB for potential cross-border operations. This is confirmed by our results. However, since our model does not allow firms to change their status, e.g. a domestic firm becoming a multinational, we can only infer such interpretation based on comparative statics. Our analysis suggests therefore that the cost of cross-border investment would fall in relative terms compared to domestic investment, thus potentially benefiting also domestic firms (or SMEs) willing to engage into foreign direct investment.

6 Conclusions

This paper sheds light on the macroeconomic effects of expected reductions in tax compliance costs, brought about by the harmonisation of corporate tax bases in the EU (under the so-called CCTB proposal), the consolidated reporting of corporate revenues and the possibility for multinationals to offset losses across EU Member States (as under the so-called CCCTB proposal). Past impact assessments of these reforms were based on the assumption that both pre-reform tax compliance costs (measured as share of labour costs) and post-reform variations were identical across countries. Such assumption was due to the absence of reliable country-specific estimates of tax compliance costs. These costs are likely to differ across countries due to institutional differences, however. As a result, some countries are likely to gain relatively more from the harmonisation of corporate tax bases.

In this paper we exploit a unique dataset measuring tax compliance costs across several EU countries from a recent survey commissioned by the EU agency EASME, in order to shed light on the possible macroeconomic impact of the CCTB and CCCTB proposals using a general equilibrium framework. In contrast to previous impact assessments conducted by the European Commission, these data allows us to calculate country-specific tax compliance costs and therefore allows us to bring more differentiated analysis across countries. We use these new data in order to calibrate the CORTAX model used in previous impact assessments of the CCCTB proposal. The CORTAX model captures the many interactions (including across countries) through which the reduction in tax compliance costs linked to the implementation of the CCTB and CCCTB would potentially impact EU countries. We model tax compliance costs as a constant share of labour cost. The CCTB and CCCTB might therefore be assimilated to an efficiency gain in production since a lower share of labour would be needed to perform activities (i.e. activities relative to tax compliance) which bring no additional economic value added.

Our simulation results support the view that the reduction in compliance costs implied by these reforms would be associated with greater economic efficiency as fewer resources (in terms of labour) need to be allocated to tax compliance activities. The mechanism channel operates through the labour market and the direct impact that changes in the cost of labour exert on employment: a reduction of tax compliance costs indirectly increases the average productivity of the workforce while reducing wage costs and the cost of production. The reduction in tax compliance costs following the reform is also proportional to the multinational sector in the country given that the CCCTB would apply to multinationals only and that these firms would no longer have to comply with different corporate tax regimes for their cross-country operations. All else constant, we find that countries having lower compliance costs in the baseline benefit more from the reforms, because they are the ones that will end up with the larger fall in labour costs resulting from the reforms. Our results also suggest that countries with a large number of inward foreign investments are the more responsive to the CCCTB. This is due to the link between compliance costs and the cost of capital, as the reduction of the latter induces more investment from multinationals into their foreign affiliates. Finally, we show that the CCCTB reform would cause a shift in production, with multinationals benefiting to the detriment of domestic firms, although this would depend on the reduction in compliance cost effectively achieved through the CCCTB. The latter result also indicates that domestic firms willing to undertake cross-border investment would also benefit from the reduction in tax compliance costs brought about the CCCTB.

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List of abbreviations and definitions

BEPS Base erosion and profit shifting

CCTB Common corporate tax base

CCCTB Common consolidated corporate tax base

CES Constant elasticity of substitution

CGE Computable general equilibrium

CIT Corporate income tax

CORTAX A CORporate TAXation-focused computable general equilibrium model

CPB Centraal Planbureau, Netherlands

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Annexes

Annex 1. Country results

CITrate	= percentage point change in the corporate tax rate faced by multinational headquarters (accounting for profit shifting to tax haven and, in the case of C(C)CTB, consolidation of corporate accounts)
CoC	= percentage point change in the cost of capital, average across all firms
K	= percentage change in total capital stock
W	= percentage change in the wage rate
Empl	= percentage change in total employment
GDP	= percentage change in gross domestic product
RevCIT	= change in the corporate tax revenue in % of GDP
Revtax	= change in total tax revenue in % of GDP
Welf	= change in compensating variation in % of GDP (positive value reflects a welfare gain)

Note: See footnote Table 1 for a definition of the baseline scenarios for the tax compliance costs

Table A1. CCTB - New baseline for tax compliance costs

	CITrate	CoC	K	W	Empl	GDP	RevCIT	Revtax	Welf
Austria	1.97	-0.06	0.98	0.37	0.08	0.40	-0.15	0.01	0.16
Belgium	-11.09	0.05	-0.86	0.21	-0.47	0.41	0.12	0.06	0.48
Denmark	-1.32	0.03	-0.22	0.09	-0.08	0.16	0.06	0.06	0.14
Finland	-1.59	0.04	-0.15	0.08	-0.01	0.18	0.03	0.06	0.06
France	-2.67	0.08	-0.80	-0.10	-0.16	-0.13	0.13	0.03	0.08
Germany	2.43	-0.08	1.12	0.36	0.12	0.41	-0.15	0.00	0.11
Greece	-4.13	0.07	-1.18	-0.44	-0.18	-0.51	0.13	-0.05	-0.11
Croatia	-9.19	0.17	-2.57	-0.78	-0.24	-0.37	0.35	0.03	-0.21
Ireland	-0.05	0.00	0.11	0.15	-0.07	0.31	0.03	0.06	0.15
Italy	-1.42	-0.07	1.16	0.51	0.15	0.50	-0.29	-0.06	0.18
Luxembourg	-0.31	0.00	0.35	0.32	-0.01	0.40	-0.26	-0.16	0.23
Netherlands	1.31	-0.06	0.95	0.37	0.07	0.32	-0.13	0.02	0.14
Portugal	-3.52	0.09	-1.19	-0.30	-0.16	-0.23	0.16	0.04	-0.02
Spain	1.70	-0.09	1.64	0.52	0.25	0.65	-0.23	-0.01	0.10
Sweden	-1.12	0.03	-0.40	0.05	-0.23	0.04	0.08	0.02	0.28
United Kingdom	8.36	-0.49	6.21	1.23	0.61	1.29	-0.79	-0.20	0.15
Cyprus	0.00	0.03	-0.56	-0.16	-0.13	-0.16	0.14	0.07	0.02
Czech Rep	-0.73	0.02	-0.13	-0.01	-0.02	0.06	0.03	0.02	0.01
Estonia	-9.49	0.13	-2.12	-0.80	-0.24	-0.59	0.22	-0.08	-0.18
Hungary	0.31	0.00	0.13	0.06	0.03	0.18	-0.02	0.01	0.01
Latvia	-4.69	0.07	-1.05	-0.41	-0.13	-0.34	0.10	-0.04	-0.12
Lithuania	-4.69	0.12	-2.15	-0.90	-0.31	-0.90	0.34	0.04	-0.21
Malta	1.30	-0.05	1.11	0.60	0.10	0.72	-0.14	0.03	0.22
Poland	2.58	-0.08	1.29	0.46	0.17	0.58	-0.15	0.01	0.11
Slovakia	-3.82	0.06	-0.96	-0.35	-0.12	-0.26	0.12	-0.01	-0.09
Slovenia	-0.67	0.01	-0.10	0.03	0.00	0.12	0.02	0.03	0.02
Bulgaria	0.00	0.02	-0.38	-0.15	-0.07	-0.10	0.11	0.06	-0.02
Romania	-0.10	0.01	-0.08	-0.03	0.01	0.03	0.01	0.00	-0.03
USA	0.00	0.00	-0.01	0.00	0.00	0.01	0.01	0.01	0.00
Japan	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
EU	0.69	-0.08	1.14	0.33	0.10	0.38	-0.17	-0.02	0.12

Table A2. CCCTB - New baseline for tax compliance costs

	CITrate	CoC	K	W	Empl	GDP	RevCIT	Revtax	Welf
Austria	-0.02	-0.13	0.92	0.66	0.13	0.44	-0.34	-0.07	0.29
Belgium	-3.32	0.56	-2.47	0.51	-0.78	-0.81	-0.18	-0.21	0.90
Denmark	1.69	0.12	0.17	0.81	0.08	0.65	-0.24	0.09	0.43
Finland	0.02	0.08	1.04	1.11	0.24	1.04	-0.17	0.34	0.42
France	-5.00	-0.01	0.44	0.47	-0.01	0.66	-0.21	-0.05	0.30
Germany	-0.10	-0.16	0.70	0.44	0.10	0.33	-0.35	-0.17	0.19
Greece	-1.11	0.15	-0.44	-0.07	-0.02	-0.20	0.01	-0.02	-0.02
Croatia	-8.70	0.18	-1.59	0.44	-0.04	-0.31	0.15	0.30	0.35
Ireland	11.50	0.28	-0.53	0.88	0.21	-0.55	-0.24	0.05	0.31
Italy	-1.43	0.14	-0.52	0.14	-0.10	-0.14	-0.08	-0.06	0.17
Luxembourg	-0.50	-0.07	0.03	0.34	0.54	1.15	-0.98	-0.80	-0.32
Netherlands	2.80	-0.05	2.03	1.66	-0.15	0.50	-0.27	0.29	1.03
Portugal	-0.54	0.16	-0.39	0.35	-0.02	0.04	-0.07	0.03	0.24
Spain	-0.03	-0.19	2.33	0.77	0.70	1.15	-0.62	-0.20	-0.13
Sweden	0.14	0.05	-0.49	0.86	-0.79	-0.27	-0.20	-0.11	1.38
UK	4.93	-0.65	6.90	1.81	1.21	1.70	-1.40	-0.43	-0.15
Cyprus	5.57	0.13	-0.75	0.25	0.06	-0.25	-0.02	0.06	0.09
Czech Rep	0.89	0.05	-0.01	0.42	0.23	0.16	-0.10	0.07	0.00
Estonia	-5.66	0.25	-0.71	0.26	-0.01	-0.22	-0.02	0.06	0.15
Hungary	0.56	-0.01	0.40	0.50	0.32	0.36	-0.17	0.09	0.01
Latvia	-1.34	0.12	-0.32	0.18	0.05	-0.04	0.04	0.10	0.06
Lithuania	-2.40	0.19	-0.43	0.06	0.03	-0.15	0.02	0.04	0.00
Malta	-2.85	-0.20	3.32	1.87	0.48	2.96	-0.56	-0.01	0.54
Poland	2.56	-0.10	1.39	0.71	0.51	0.63	-0.37	-0.08	-0.04
Slovakia	-0.91	0.10	-0.22	0.30	0.02	-0.06	0.02	0.11	0.14
Slovenia	0.37	0.03	0.02	0.51	0.15	0.23	-0.02	0.19	0.17
Bulgaria	0.29	0.03	0.22	0.56	0.20	0.03	0.00	0.17	0.14
Romania	0.65	0.02	0.01	0.28	0.15	0.09	-0.03	0.08	0.04
USA	0.00	0.00	0.01	0.00	0.01	0.02	0.02	0.02	-0.02
Japan	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	-0.01
EU	0.03	-0.09	1.27	0.67	0.25	0.51	-0.41	-0.11	0.20

Table A3. CCTB – Old baseline for tax compliance costs

	CITrate	CoC	K	W	Empl	GDP	RevCIT	Revtax	Welf
Austria	2.02	-0.06	0.91	0.30	0.10	0.34	-0.14	0.00	0.09
Belgium	-10.99	0.05	-0.88	0.11	-0.39	0.37	0.12	0.05	0.36
Denmark	-1.21	0.03	-0.38	-0.04	-0.07	0.02	0.07	0.03	0.05
Finland	-1.46	0.04	-0.39	-0.07	-0.04	-0.03	0.05	0.01	-0.01
France	-2.59	0.09	-0.91	-0.17	-0.16	-0.21	0.14	0.02	0.03
Germany	2.45	-0.08	1.11	0.33	0.14	0.41	-0.15	0.00	0.08
Greece	-4.13	0.07	-1.19	-0.45	-0.18	-0.52	0.13	-0.05	-0.11
Croatia	-9.19	0.17	-2.60	-0.84	-0.25	-0.48	0.34	0.00	-0.23
Ireland	-0.02	0.00	0.04	0.07	-0.04	0.22	0.03	0.04	0.08
Italy	-1.39	-0.07	1.16	0.49	0.15	0.48	-0.28	-0.06	0.16
Luxembourg	-0.19	0.00	0.13	0.11	0.02	0.21	-0.25	-0.21	0.06
Netherlands	1.44	-0.06	0.78	0.25	0.09	0.20	-0.12	0.00	0.06
Portugal	-3.48	0.09	-1.23	-0.34	-0.16	-0.27	0.17	0.03	-0.04
Spain	1.70	-0.09	1.53	0.49	0.22	0.60	-0.21	-0.01	0.10
Sweden	-1.02	0.03	-0.41	-0.04	-0.13	0.04	0.08	0.03	0.11
United Kingdom	8.42	-0.49	6.10	1.16	0.61	1.21	-0.77	-0.21	0.10
Cyprus	0.00	0.03	-0.57	-0.20	-0.12	-0.21	0.14	0.06	-0.01
Czech Rep	-0.71	0.02	-0.20	-0.06	-0.03	-0.02	0.03	0.01	0.00
Estonia	-9.46	0.13	-2.25	-0.87	-0.26	-0.70	0.23	-0.10	-0.19
Hungary	0.34	0.00	0.05	0.01	0.03	0.10	-0.01	-0.01	-0.02
Latvia	-4.69	0.07	-1.09	-0.44	-0.13	-0.40	0.10	-0.05	-0.13
Lithuania	-4.69	0.12	-2.20	-0.93	-0.32	-0.96	0.34	0.03	-0.22
Malta	1.58	-0.04	0.72	0.29	0.10	0.40	-0.10	-0.01	0.06
Poland	2.60	-0.07	1.23	0.43	0.17	0.53	-0.15	0.00	0.09
Slovakia	-3.79	0.06	-1.01	-0.39	-0.13	-0.32	0.12	-0.03	-0.10
Slovenia	-0.62	0.02	-0.16	-0.02	-0.01	0.03	0.02	0.01	0.00
Bulgaria	0.00	0.02	-0.42	-0.18	-0.08	-0.16	0.11	0.05	-0.03
Romania	-0.09	0.01	-0.11	-0.06	0.01	-0.02	0.01	-0.01	-0.04
USA	0.00	0.00	-0.01	0.00	-0.01	0.01	0.01	0.01	0.01
Japan	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
EU	0.73	-0.08	1.07	0.28	0.11	0.33	-0.16	-0.03	0.08

Table A4. CCCTB – Old baseline for tax compliance costs

	CITrate	CoC	K	W	Empl	GDP	RevCIT	Revtax	Welf
Austria	0.33	-0.12	0.48	0.32	0.20	0.16	-0.26	-0.09	0.00
Belgium	-3.38	0.56	-2.33	0.19	-0.45	-0.81	-0.17	-0.23	0.45
Denmark	1.84	0.13	-0.53	0.21	0.09	0.03	-0.15	-0.04	0.04
Finland	0.29	0.09	0.03	0.41	0.13	0.22	-0.10	0.10	0.12
France	-4.60	0.01	0.02	0.20	-0.03	0.34	-0.15	-0.09	0.15
Germany	0.31	-0.15	0.58	0.31	0.18	0.26	-0.30	-0.15	0.03
Greece	-1.07	0.15	-0.47	-0.10	-0.02	-0.23	0.02	-0.02	-0.04
Croatia	-8.65	0.18	-1.64	0.15	-0.06	-0.55	0.11	0.15	0.19
Ireland	11.08	0.27	-0.89	0.50	0.27	-0.85	-0.20	0.01	0.02
Italy	-1.35	0.15	-0.51	0.06	-0.06	-0.20	-0.08	-0.07	0.09
Luxembourg	-0.31	-0.07	-0.83	-0.39	0.51	0.32	-0.92	-0.98	-0.79
Netherlands	2.87	-0.05	1.30	1.13	-0.09	0.07	-0.22	0.16	0.69
Portugal	-0.59	0.16	-0.51	0.22	-0.01	-0.10	-0.07	-0.01	0.15
Spain	0.08	-0.19	1.73	0.57	0.59	0.82	-0.55	-0.23	-0.15
Sweden	0.19	0.05	-0.36	0.47	-0.24	-0.11	-0.15	-0.04	0.55
United Kingdom	5.07	-0.64	6.02	1.38	1.17	1.19	-1.32	-0.50	-0.40
Cyprus	5.16	0.12	-0.78	0.08	0.07	-0.42	-0.01	0.02	-0.01
Czech Rep	0.92	0.06	-0.33	0.18	0.16	-0.14	-0.07	0.02	-0.06
Estonia	-5.52	0.25	-1.07	-0.04	-0.07	-0.50	-0.02	-0.04	0.05
Hungary	0.73	0.00	-0.01	0.24	0.25	0.03	-0.12	0.02	-0.08
Latvia	-1.33	0.12	-0.47	0.00	0.01	-0.24	0.03	0.03	0.00
Lithuania	-2.40	0.19	-0.61	-0.11	-0.01	-0.33	0.01	-0.02	-0.05
Malta	-2.01	-0.17	2.20	0.94	0.51	1.95	-0.50	-0.16	0.02
Poland	2.16	-0.11	0.97	0.52	0.47	0.39	-0.32	-0.08	-0.12
Slovakia	-0.95	0.10	-0.39	0.12	0.01	-0.24	0.01	0.05	0.06
Slovenia	0.44	0.03	-0.18	0.27	0.10	-0.07	-0.02	0.10	0.07
Bulgaria	0.28	0.03	0.00	0.40	0.14	-0.15	0.00	0.12	0.09
Romania	0.66	0.02	-0.12	0.17	0.11	-0.05	-0.02	0.05	0.01
USA	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	-0.01
Japan	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	-0.01
EU	0.17	-0.08	0.93	0.44	0.26	0.27	-0.36	-0.14	0.02

Annex 2. The CORTAX model

CORTAX is a computable general equilibrium model originally developed by Bettendorf and van der Horst (2006). Álvarez-Martínez et al. (2016a) included some modelling extensions and recalibrated the model to the base year 2012.

CORTAX accounts for all main economic agents in the economy: firms, households, government and the foreign sector.

Each country accommodates one representative domestic firm, one multinational headquarter and subsidiaries owned by headquarters located in the other countries.¹⁸ The difference between domestic and multinational headquarters and the subsidiaries is the role of intermediate inputs and their capability to shift profits across countries. The parent company can shift profits to countries with low corporate income tax rates charging a transfer price for intermediate deliveries that deviates from the equivalent price that would be charged if it had been an inter-firm transaction (the 'arms-length' price). In order to ensure an interior solution, and following previous studies, a convex cost function is specified to describe the costs associated with the manipulation of transfer prices.

$$c_q = \frac{|p_q - 1|^{1+\varepsilon_q}}{1+\varepsilon_q} \quad (\text{A.1})$$

While the expression for transfer price is as follows:

$$\frac{\partial c_q}{\partial p_q} (1 - \tau_\pi^m) = \tau_\pi^f - \tau_\pi^m \quad (\text{A.2})$$

With τ_π^m the tax rate at headquarter level and τ_π^f the tax rate at subsidiary level.

The model also captures the role of tax havens through the relation between domestic CIT rates and a low tax rate in the tax haven. The tax haven is represented by a hypothetical country where profit shifted therein can be expressed as follows:

$$\pi = A(\tau_p - \tau_{ph})^{1+\gamma} \quad (\text{A.3})$$

Where π is the share of profit shifted to the tax haven, τ_{ph} is the low CIT rate in the tax haven and γ is the elasticity of profit shifting to the tax haven. A is a parameter for the calibration.

In the model, labour and land are immobile factors in each country and capital (and capital revenues) is perfectly mobile within the EU. The return to capital (after tax) is fixed by world capital markets. The supply of the fixed factor is location-specific and inelastic, and revenues generated are accounted for as economic rents.

The model accommodates old and young households that maximize their inter-temporal utility subject to their budget constraint. The optimal consumption path and labour supply are obtained from the first order conditions. Household savings are allocated to bonds and stocks, which are imperfect substitutes and have different rates of return. The returns to assets are determined on world markets and are assumed to be the same irrespective of the residence of their owner.

Intra-temporal households' utility is calculated as a CES combination of consumption and leisure of an old and a young generation. The intertemporal utility (U_t) is a Log-CES function of old (v^o) and young (v^y) intratemporal utility functions.

$$U_t = \frac{1}{1-1/\sigma_u} \left[(v_t^y)^{1-\frac{1}{\sigma_u}} + \frac{\rho_0}{\rho_u} (v_t^o)^{1-\frac{1}{\sigma_u}} \right] \sum_{\tau=0}^{T-1} \left(\frac{1+g_a}{\rho_u} \right)^\tau \quad (\text{A.4})$$

¹⁸ Note that the number of firms is not modelled in CORTAX. This simplification still allows the interpretation of the results of the policy simulations by comparing MNEs with domestic firms' situation. Yet the relative importance of domestic vs. foreign firms is represented by the contribution of FDI stock in the total capital stock.

Where σ_u measures the degree of substitutability between consumption and leisure across years, ρ is a discount rate and g_a is a growth rate. Households maximize this utility subject to their life-time budget constraint:

$$\bar{w}_t l + tr_t^y - (1 + \tau_c)c_t^y = - \left(\frac{1+g_a}{\rho_s} \right)^T [\pi_t^0 + tr_t^o - (1 + \tau_c)c_t^o] \quad (A.5)$$

With \bar{w}_t being the after tax wage rate and tr_t^y being the current transfers received by young households. The terms c_t^y and c_t^o are consumption by the young and old generations and τ_c is the corresponding consumption tax rate. The term π_t^0 is the revenue generated by the fixed factor and received by old households, which are the owners of this factor.

The variation of welfare is calculated as the compensating variation, which is the variation in transfers received by young households required to reach the initial level of utility after a shock. The compensating variation is calculated as a percentage of GDP.

$$\text{compensating variation} = - \frac{tr_f^y(U_t^0) - tr_t^y(U_t^0)}{GDP_0} \quad (A.6)$$

Where $tr_f^y(U_t^0)$ are the transfers received after the shock that keep the initial utility level of households and $tr_t^y(U_t^0)$ are the transfers before the shock. GDP_0 is the Gross domestic product in the base case scenario.

Government is an intermediate agent. The budget is balanced, with consumption and public debt as fixed proportions of GDP. Lump-sum transfers to households (including transfer to the old and young generations) are also fixed. Tax revenues include indirect taxes on consumption and direct taxes of income from corporate and labour, dividends, capital gains and interest.

Finally, the foreign sector is an intermediate sector that accounts for the Balance of Payments adjustment. It captures the capital account, with the registration of net foreign assets, plus the trade balance, net foreign earnings on equities and bonds and FDI.

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