CORPORATE INCOME TAX REFORM IN THE EU[1]

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Abstract

Using CORTAX, a computable general equilibrium (CGE) model designed to assess the economic impact of corporate taxation, we examine the possible economic impacts of uncoordinated and coordinated changes in national corporate tax rates among a group of economies (the EU), that are tightly associated through international trade and investment. The aim is to contribute to the ongoing debate about the desirability, modality and likely impact of alternative policy solutions to the challenges posed by tax competition and aggressive tax planning. Corporate income tax rate reforms generate substantial responses within the implementing country as well as beyond its own borders. Harmonisation of CIT rates involves winners and losers, and as such, may be best pursued gradually and as part of a broader package of corporate tax reform.

1. Introduction

There are increasing calls for corporate tax reforms across the EU, motivated by evidence of a current system that is unfair and inefficient. Uncoordinated national tax regimes can feature tax loopholes and inconsistencies in the treatment of corporate profits across borders resulting into strategic tax planning by multinational corporations. There is growing recognition of these issues and a renewed impetus to address them. The European Commission has put forward an ambitious Action Plan on Corporate Taxation (EC, 2015) and attempts are being made to improve international coordination of national corporate tax policies through the OECD Base Erosion and Profit Shifting (BEPS) Project.

In this paper, we evaluate the effects of hypothetical changes in corporate income tax (CIT) rate on EU economies using CORTAX, a computable general equilibrium (CGE) model specifically designed to investigate national and international corporate tax policies. The model captures the key features of the corporate tax regimes including investment decisions, loss compensation, multinational profit shifting and financing decisions. CORTAX is a multi-regional model including all 28 EU member states, the USA and Japan, and featuring a tax haven. It encapsulates the behaviour of all economic agents, reflecting both the direct and indirect effects of policy changes on macroeconomic variables, such as GDP, investment and employment. The CORTAX model was originally built by the Centraal Planbureau (CPB) in the Netherlands (Bettendorf and van der Horst, 2006 and Bettendorf et al., 2009), based on the OECDTAX model (Sorensen, 2001). Using CORTAX we show some of the

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first-order effects of hypothetical changes in tax rates in a group of economies (the EU) that are tightly associated through international trade and investment. The aim is to contribute to the ongoing debate about the desirability and likely impact of alternative policy solutions to the challenges posed by aggressive tax planning.

We simulate the impact of removing differences in corporate tax rates across EU countries and their effect on tax competition considering both uncoordinated and coordinated changes. We first consider simulations where one country raises or lowers its rate in isolation. We simulate an upward adjustment in a low CIT tax economy, namely Ireland, up to the level of a high CIT tax rate economy, namely Germany. These two countries represent polar examples since Ireland has the lowest statutory CIT rate in the EU and Germany, which is the largest country in the Union, among the highest. We then simulate the reverse case, where Germany reduces its rate to the Irish level. In each case, we observe the impact on the country affected as well as the international spillover effects. The third simulation harmonises CIT tax rates across EU to an EU average rate. For each of the three simulations, revenue neutrality is maintained by adjusting labour taxes to compensate for any resulting revenue increase or shortfall. In addition, sensitivity analysis is performed, ensuring budget neutrality through adjusting transfer to pensioners or government expenditure.

The unilateral simulations reveal that a tax shift from labour tax to corporate tax (Ireland) has a negative impact on GDP, whilst the reverse case, a tax shift from corporate tax to labour tax (Germany) has a positive impact on GDP. On the other hand, the impact on (after-tax) wages moves in the opposite direction. The German CIT rate simulation causes larger spillover effects compared to the Irish simulation, with all other countries' GDP being negatively affected to some degree. Nevertheless, the benefits to Germany are sufficient positive to slightly raise the EU GDP.

The third simulation, where CIT rates are harmonised across the EU, tends to suggest that a tax shift from corporate tax to labour tax raises GDP, whilst the opposite tax shift lowers GDP. The aggregate impact is a small fall in the EU GDP. This result broadly holds for the alternative budget-neutral closures. A benefit of CIT rate harmonisation is that it removes much of the incentive to engage in profit shifting.

We conclude that corporate income tax rates can generate substantial responses within the implementing country as well as beyond its own borders. Harmonisation of CIT rates would likely involve winners and losers, and as such, may be best pursued gradually and as part of a broader package of corporate tax reform

2. Properties of CORTAX

In this section, we described the structure of CORTAX and its calibration, presenting the data sources used as well as the European tax systems.

2.1 Structure of CORTAX

The CORTAX model has been designed to simulate the economic impact of national and international tax policy reforms, including the international harmonisation of national tax policies. CORTAX allows simulations of the effects of corporate tax changes within a framework that takes into account the transactions between firms (domestic and multinationals), households and governments. In the model, each country is assumed to have the same structure in terms of consumption, savings, production and public finances. Countries are linked to each other via international trade in goods markets and investment by MNEs. Firms are divided into three categories: MNE´s headquarters, their subsidiaries located abroad and domestic firms that only produce in their country of residence. Multinationals and domestic firms differ to the extent that the former optimise profits globally and are engaged in profit shifting activities across borders. On the other hand, domestic firms pay their corporate taxes in their country of residence according to the revenues generated in this country only. The effects of reforms can be expressed as changes in GDP, household consumption, business investment and fiscal revenue.

The model is elaborated using data from different data sources. In the present exercise, the model has been constructed with a database for the year 2012. The structural descriptions offered here, as well as aspects of the calibration follow Bettendorf et al. (2009). The data sources used are Eurostat, the OECD, UN, ZEW-Mannheim for tax codes, including asset-specific corporate tax credit and allowances. Company-level information on investment by asset type and source of financing are obtained from the Bureau van Dijk Orbis database (see section 2.3.1). In parameters related to the company behaviour, for example, regarding profit shifting, they closely correspond to insights offered by empirical literature. Likewise, the model incorporates empirical insights on tax compliance costs, which are set to be at 4% of corporate tax revenue for all firms.

The model captures the behaviour of all the agents in the economy: Households, Firms (domestic, multinationals headquarters and subsidiaries), the Government and the Foreign sector as follows.

Households

There are two types of households: old and young. Their lifetime is 40-year periods each and their behaviour remains the same during the whole period. Households maximise their intra-temporal utility function $U(t)$ with v^y being the utility of young generation and v^0 the utility of old generation:

$$U(t) = \frac{1}{1 - {}^{1}/_{\sigma_u}} \left[\sum_{\tau=0}^{T-1} \frac{v^y(t+\tau)^{1-{}^{1}/_{\sigma_u}}}{\rho_u^\tau} + \frac{\rho_0}{\rho_u^\tau} \sum_{\tau=0}^{T-1} \frac{v^0(t+T+\tau)^{1-{}^{1}/_{\sigma_u}}}{\rho_u^\tau} \right]$$

$$= \frac{1}{1-{}^{1}/_{\sigma_u}} \left[v^y(t)^{1-{}^{1}/_{\sigma_u}} + \frac{\rho_0}{\rho_u^\tau} v^0(t+T)^{1-{}^{1}/_{\sigma_u}} \right] \sum_{\tau=0}^{T-1} \left(\frac{1+g_a}{\rho_u} \right)^\tau \qquad (1)$$

where ρ_u^τ is the rate of time preference, σ_u the intertemporal substitution elasticity and g_a the productivity growth rate.

This maximisation is subject to an intra-temporal budget constraint where net savings from young workers (wages, current transfers and negative consumption), in the left side of equation (1), are equal to negative value of net savings from all households. Young households receive income from labour $\bar{w}(t)l$ and other transfers while old households do not work and only receive income from transfers $\left(tr^0(t)\right)$ and the fixed factor $\left(\pi^0(t)\right)$ as described by Equation (2):

$$\bar{w}(t)l + tr^y(t) - (1+\tau_c)c^y(t) = -\left(\frac{1+g_a}{\rho_s}\right)^\tau \left[\pi^0(t) + tr^0(t) - (1+\tau_c)c^0(t)\right] \qquad (2)$$

The intra-temporal utility function is composed by consumption (c^y) and leisure $\left(\hat{l}\right)$ included in equation:

$$v^y(\tau) = \begin{cases} \left[c^y(\tau)^{\frac{\sigma_l - 1}{\sigma_l}} + \alpha_l \left(A_l(\tau)\hat{l}(\tau) \right)^{\frac{\sigma_l - 1}{\sigma_l}} \right]^{\frac{\sigma_l}{\sigma_l - 1}} & \sigma_l \neq 1 \\ c^y(\tau)^{\frac{1}{1+\alpha_l}} \left(A_l(\tau)\hat{l}(\tau) \right)^{\frac{\alpha_l}{1+\alpha_l}} & \sigma_l = 1 \end{cases} \qquad (3)$$

In this equation α_l is the weight of leisure in utility and σ_l is a intra-temporal substitution elasticity.

The optimal consumption path and labour supply can be obtained from the first order conditions (FOC). In accordance with the empirical literature, the model assumes that substitution effects dominate and the uncompensated elasticity of labour supply is positive.

Households´ savings are allocated to bonds and stocks, which are imperfect substitutes and have different rates of return. Returns to assets are determined on the world markets and are assumed to be the same irrespective of the residence of their owner. Total bonds and stock holdings are derived from the maximisation of total assets CES combination of bonds (b) and equities (e) subject to their total value:

$$A = \left[\alpha^{\frac{-1}{\sigma_s}} b^{\frac{\sigma_s + 1}{\sigma_s}} + \alpha^{\frac{-1}{\sigma_s}} e^{\frac{\sigma_s + 1}{\sigma_s}} \right]^{\frac{\sigma_s}{\sigma_s + 1}} \qquad (4)$$

such that $\rho_s A = \rho_b b + \rho_e e$

where A is total assets,σ_s the substitution elasticity bonds/equities and ρ_s the gross revenue from assets.

The effects on welfare are calculated using the compensating variation, defined as the difference in transfers received by young households required to compensate the change in utility. It is presented as a percentage of GDP.

Firms

In CORTAX there are two types of firms, domestic and multinationals, with the latter disaggregated into headquarters and subsidiaries. Each country has one representative domestic firm, one multinational headquarter and several subsidiaries, which are owned by headquarters in other countries.[2] Firms maximise their value (equation 5), which is the discounted stream of dividends, subject to the possibilities of the production function and accumulation constraints on fiscal and physical capital depreciation (equations 6 and 7).

$$V_t^n(j) = \sum_{s=t}^{\infty} \Lambda(j) Div_s^n(j) R_s(j) \quad (5)$$

With n=domestic, multinational headquarters or subsidiary, Div_s^n dividends and R_s the overall effect of discounting:

$$R_s(j) \equiv \frac{1}{(1+\bar{r}_e(j))^{s-t+1}} \quad (5.1)$$

$$\bar{r}_e(j) \equiv \frac{r_e(jj)}{(1-\tau_g(j))} \quad (5.2)$$

$$\Lambda(j) \equiv \frac{(1-\tau_d(j))}{(1-\tau_g(j))} \quad (5.3)$$

Where $\bar{r}_e(j)$ represents the discount rate relevant for firms in making decisions, r_e is net return on equities, $\tau_g(j)$ is the tax rate on capital gains and $\tau_d(j)$ the tax rate on dividends.

$$D_{t+1} = I_t + (1-\delta_t)D_t \quad (6)$$

$$K_{t+1} = I_t + (1-\delta_t)K_t \quad (7)$$

For the maximization of firms' value the optimal demands for the production factors (labour, capital and the fixed factor) as well as the debt ratio are derived.

The production function is a Cobb Douglas combination of the fixed factor $(\omega^m N^y)$ and the value added, (VA^{mx}), which is a CES aggregate of labor (L^m) and capital (K^m). The only difference between domestic and multinational headquarters and the subsidiaries is the role of intermediate inputs. The production maximization problem for domestic firms and multinational is defined as:

$$Y^{mx} = A^{mx}(VA^{mx})^{\alpha_v^m} \quad (8)$$

With:

$$A^{mx} = (A_{0x}\omega^m N^y)^{1-\alpha_v^m} \quad (8.1)$$

$$VA^{mx} = A_{0x}\left[\alpha_{vl}^m (L^m)^{\frac{\alpha_v^m-1}{\alpha_v^m}} + \alpha_{vk}^m (K^m)^{\frac{\alpha_v^m-1}{\alpha_v^m}}\right]^{\frac{\sigma_v^m}{\alpha_v^m-1}} \quad (8.2)$$

With m equal to domestic and headquarters. While for subsidiaries it is:

[2] 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.

$$Y^{fx}(j) = A^{fx}(j)A_0^{\alpha_q}Q(j)^{\alpha_q}\left(VA^{fx}\right)^{\alpha_v^f} \text{ with } 0 < \alpha_q + \alpha_v^f < 1 \quad (9)$$

With:

$$A^{fx} = \left(A_{0x}\omega^f N^y\right)^{1-\alpha_v^f-\alpha_q} \quad (9.1)$$

$$VA^{fx}(j) = A_{0x}\left[\alpha_{vl}^f\left(L^f\right)^{\frac{\alpha_v^f-1}{\alpha_v^f}} + \alpha_{vk}^f\left(K^f\right)^{\frac{\alpha_v^f-1}{\alpha_v^f}}\right]^{\frac{\sigma_v^f}{\alpha_v^f-1}} \quad (9.2)$$

Where Y^{fx} is total output, A^{fx} the output contribution of the fixed factor and Q intermediate inputs. σ_v^f is the substitution elasticity between productive factors.

Multinationals maximise the sum of the value of the headquarter and of its subsidiaries. While labour and the land are immobile factors, capital and capital revenues are perfectly mobile across countries. The return to capital (after source taxes) is fixed by world capital markets. The supply of the location-specific production factor (i.e. fixed factor) is inelastic and revenues generated are accounted as economic rents. Additionally, multinationals are wholly owned by households in the home country, which implies that countries can partly export the tax burden to foreign households by taxing subsidiaries. Therefore the efficiency loss of tax shifting activities also affects households´ disposable income. The aggregate production is calculated as the sum of production in all industries net of intermediate inputs in foreign subsidiaries:

$$Y(i) = q\left[Y^{dg}(i) + Y^{mg}(i) + \sum_{j\neq i} Y^{fg}(i,j)\right] + (1-q)\left[Y^{db}(i) + Y^{mb}(i) + \sum_{j\neq i} Y^{fb}(i,j)\right] - \sum_{j\neq i} p_q(j,i)Q(j,i) \quad (10)$$

Where (q) is the probability of a good event (shock) and $(1-q)$ the probability of a bad event. $Y^{dg}(i)$ the domestic production, $Y^{mg}(i)$ the production of parent companies and $\sum_{j\neq i} Y^{fg}(i,j)$ the production of subsidiaries.

Corporate investment is financed by either retained earnings or by issuing bonds. CORTAX does not allow the issuing of new shares. Decisions on the source of finance are based on the difference between the after-tax cost of debt and equity. The marginal cost of debt finance increases alongside the debt share.

Corporate taxes are equal to the statutory CIT tax rate τ_π multiplied by the tax base Π, which is defined as follows:

$$\Pi = \mathrm{Y} - \mathrm{wL} - (\beta_\mathrm{b}\,\mathrm{d_b}\mathrm{R_b} + c_\mathrm{b})\mathrm{K} - (\delta_\mathrm{t} + \beta_\mathrm{e}(1-\mathrm{d_b})\mathrm{R_e})\mathrm{D} - \varphi\mathrm{I} - \mathrm{PQ} - \frac{(1-\mathrm{q})}{(1+\pi)(1+\mathrm{g_y})}\mathrm{F_{t-1}} \quad (11)$$

Where the taxable corporate income are the returns to the fixed factors, Π, and they are equal to total output, Y, less labour cost (wage, w, times employment, L), less deduction for the cost of debt (the deductible fraction of debt, (β_b , times the share of debt financing, $\mathrm{d_b}$, times the interest rate, $\mathrm{R_b}$, plus

the cost of financial distress, c_b, all times the quantity of capital, K), less depreciation allowances (the depreciation of capital for tax purposes, δ_t, times the stock of capital net of amortizations and depreciations D), less equity allowances (the deductible fraction of equity, β_e, times the share of equity financing, $1 - d_b$, times the opportunity cost of equity, R_e, times the stock of depreciation allowances, D), less the amount of investments that can be expensed immediately (the rate of immediate expensing, φ, times the investment level, I), less value of intermediate inputs (of price, P, and quantity, Q), less the value of losses carried forward (the probability of having made a loss in the previous period, 1 – q, times the loss made in that period, Ft-1, depreciated by inflation, π, and the growth rate, g_y). Loss carried forward is explained in further detail at the end of this section.

Finally, dividends are defined as follows:

$$Div_t = Y - wL - (\beta_b d_b R_b + c_b)K - \Pi - \tau_\pi \Pi - I + (d_b K)_{t+1} - (d_b K)_t \quad (12)$$

Among the alternative corporate tax specifications, the model incorporates the compliance costs incurred by firms for attending their corporate tax obligations. These costs are included as the amount of new workers required to carry out these tasks. Consequently there are two types of labour: workers production output and workers for tax administration. The latter are measured as a fixed share of the productive labour force. They increase in proportion to the size of the firm's payroll.

Profit shifting. The model allows the parent company to charge a transfer price for intra-firm deliveries that deviates from the equivalent price that would be charged if it had been an inter-firm transaction (the 'arms-length' price). Specifically, there is an incentive in place to set an artificial price in order to shift profits from high-tax to low-tax countries. In order to ensure an interior solution, a convex cost function is specified to describe the costs associated with the manipulation of transfer prices. In this way, profit shifting to countries with very low corporate tax rates becomes increasingly costly at the margin. The expression for transfer prices is as follows:

$$\frac{\partial c_q}{\partial p_q}(1 - \tau_\pi^m) = \tau_\pi^f - \tau_\pi^m \quad (13)$$

With c_q cost of shifting profits, p_q transfer price, τ_π^m tax rate at headquarter level and τ_π^{mf} tax rate at subsidiary level.

Bilateral foreign direct investment (FDI) stocks determine the initial size of subsidiaries. FDI is defined as the equity-financed part of foreign capital

$$FDI(i,j) = \left(1 - d_b^f(i,j)\right) K^f(i,j) \quad (14)$$

With d_b^f being the debt ratio.

Tax haven. The model includes a tax haven, which features a low tax rate set at 5%. Domestic firms shift profits to the tax haven depending on the tax rates differential, as describe in the equation:

$$\pi = A\left(\tau_p - \tau_{ph}\right)^{1+\gamma} \quad (15)$$

With τ_{ph} CIT rate in the tax haven, γ elasticity of profit shifting to the tax haven and, A parameter for the calibration.

Losses and loss carry forward. At the benchmark, all firms are all equal and there are no negative extra profits, but there are random shocks affecting their revenues that can be attributed to, e.g., business cycle evolutions. These shocks may result in losses that can be carried forward in the model. Firms' decisions on inputs are made before knowing whether they will be subject to a random shock and are therefore based only on expected output values and expected marginal productivities. The probabilities of profit and loss are assumed to be independent across years because shocks are not correlated over time. CORTAX allows for losses to be carried forward for one year. While this underestimates the actual opportunities for loss compensation over more than one year, at the same time the assumption of independent shocks tends to overestimate losses that can be offset. Appendix A in Bettendorf et al. (2009) discusses this issue in further detail.

Public Sector

Government is an intermediate agent in CORTAX. There is a balanced budget where consumption and public debt are a fixed proportion of GDP and lump-sum transfers are also fixed. In this case, the issue of new debt due to economic growth covers the increase of public deficit. On the other hand, tax revenues include indirect taxes on consumption and direct taxes of income from corporate and labour, dividends, capital gains and interest. Government consumption and government debt as a share of GDP are maintained constant after a reform.

Equilibrium

In the model, all markets are in equilibrium in the base year. There is only one representative homogeneous good, which is traded in a perfect competitive world market. Therefore countries cannot exert market power and their terms of trade are fixed. The price of this good is the "numeraire" in the model. With respect to asset markets, bonds (and equities) of different origins are perfect substitutes and are freely traded on world markets. The return to these assets is therefore fixed for every country. At the same time, debt and equity are not perfect substitutes. Regarding the foreign sector, the current account equals the change in the net foreign asset position for each country so that the balance of payments is equal to zero.

2.2 Calibration of CORTAX

2.2.1 Data sources and preparation

For the sake of continuity we generally used the same data sources as in the original calibration undertaken by the CPB, see Bettendorf and van der Horst (2006). The year 2012 data was chosen as reference year for the calibration, as it represented a good compromise between timeliness and completeness. Following the initial calibration (Bettendorf and van der Horst, 2006) the countries covered include the EU's 28 member states, the United States and Japan. In a small number of cases alternative data sources were used, or reference year, or missing values imputed. These differences are all documented below and in Annex A (macroeconomic indicators).

Tax information

CIT receipts as a percentage of GDP are from European Commission (2014, Table 18). Additional tax revenue statistics, expressed in national currency and as a percentage of GDP, are from the OECD (Dataset: Revenue Statistics - Comparative tables). Implicit tax rates on consumption are from Eurostat (2014, p.255). Statutory Corporate Income Tax (CIT) rates are from ZEW (2012, p.2) Tax rates on dividends, interest and capital gains upon disposal of shares are from ZEW (2012, pp. A24-A26). Implicit tax rate on labour income have been estimated using the EUROMOD microsimulation model.

Firm-level data from the Orbis database

Information on balance sheets and ownership structure from the Orbis database provided by Bureau Van Dijk was used. Although Orbis is a firm-level database, for the purposes of the calibration it is only used to produce national-level estimates of debt shares and of corporate investment shares (by type of asset) so as to calculate relevant corporate tax parameters such as the cost of capital (financed via equity or debt).

In keeping with an earlier calibration of CORTAX (Bettendorf et al, 2009) the sample was narrowed down to firms reporting total assets larger than two million US dollars and to firms who had complete information on investment on tangibles and intangibles. This leaves 1,005,188 companies based in the EU28, the United States and Japan. Many of these companies are subsidiaries belonging to multinational groups. Unconsolidated accounts are used as these best describe the actual investment behaviour of multinational enterprise subsidiaries across EU member states. If necessary (e.g. to test specific hypotheses) the companies accounts can be consolidated at the level of multinational groups making use of information on each company's Global Ultimate Owner (GUO).

For these companies we obtained data on their asset structure, including inventories (Orbis variable name "Stock"), fixed tangible assets, fixed intangible assets, total assets. While in principle Orbis contains information on corporate investments in buildings and machinery (Orbis variables "Plant and Machinery", "Transport Equipment"), in practice this information was missing for many companies.

Table 2.1. Summary Statistics of Orbis Investment Shares, 2012

	Buildings	Machinery	Intangibles	Stocks	Land	No. of companies
Austria	31.6%	27.0%	5.1%	25.3%	11.0%	25,316
Belgium	28.2%	32.8%	5.2%	23.1%	10.6%	41,077
Bulgaria	30.7%	24.3%	2.8%	30.6%	11.6%	8,735
Cyprus	22.5%	26.9%	3.7%	40.1%	6.8%	134
Czech Republic	28.2%	32.9%	2.6%	25.7%	10.7%	15,120
Germany	23.8%	30.3%	4.0%	32.1%	9.9%	124,911
Denmark	15.6%	31.5%	5.4%	40.8%	6.6%	9,619
Spain	27.0%	23.7%	5.2%	32.3%	11.7%	98,010
Estonia	27.7%	28.4%	5.1%	30.6%	8.2%	2,222
Finland	27.1%	24.5%	9.3%	29.8%	9.2%	11,314
France	18.8%	24.8%	19.5%	30.6%	6.4%	84,491
United Kingdom	34.3%	21.0%	7.2%	23.3%	14.2%	100,189
Greece	26.6%	28.9%	5.5%	29.5%	9.6%	10,524
Croatia	34.7%	23.2%	3.5%	28.4%	10.2%	5,303
Hungary	26.1%	31.5%	4.4%	28.3%	9.6%	9,305
Ireland	35.7%	20.9%	6.0%	23.7%	13.7%	9,393
Italy	19.8%	25.3%	9.9%	37.2%	7.8%	167,922
Lithuania	28.1%	25.9%	3.2%	35.4%	7.4%	1,522
Luxembourg	33.1%	20.7%	14.5%	20.3%	11.5%	3,027
Latvia	30.7%	27.8%	2.6%	27.4%	11.5%	3,154
Malta	29.6%	25.9%	7.6%	26.2%	10.6%	749
Netherlands	24.1%	43.5%	7.4%	16.1%	8.8%	59,580
Poland	28.9%	28.3%	3.8%	31.0%	8.0%	21,741
Portugal	21.2%	27.7%	4.3%	37.9%	8.9%	19,508
Romania	28.6%	30.4%	2.1%	26.8%	12.0%	13,616
Slovak Republic	35.2%	25.7%	2.6%	23.4%	13.0%	8,178
Slovenia	25.8%	36.6%	4.1%	26.4%	7.1%	2,774
Sweden	27.3%	24.8%	8.3%	30.1%	9.6%	10,989
Japan	22.1%	38.5%	3.2%	27.4%	8.8%	105,429
USA	29.0%	14.5%	2.4%	41.9%	12.1%	31,336
EU(weighted average)	25.5%	27.1%	7.7%	29.9%	9.8%	868,423
Total	**27.4%**	**27.6%**	**5.7%**	**29.4%**	**9.9%**	**1,005,188**

Source: Orbis

As information on the shares of investment directed into these two assets is necessary for the estimation of tax parameters, we estimate them using information on the Orbis-derived total quantity of investment on tangibles, multiplied by the sector-shares on buildings and machinery provided by Eurostat (Eurostat variable codes sbs_na_con_r2, sbs_na_dt_r2, sbs_na_ind_r2, sbs_is_inv_r2).

For those countries and sectors for which this information was not available in Eurostat (principally France, Latvia and Malta) in common with established practice (Egger et al., 2008; Devereux and Loretz, 2008; Bettendorf et al. 2009) we estimate them by multiplying Orbis-derived total quantity of investment on tangibles by the sector-shares on buildings and machinery provided by McKenzie et al. (1998). Table 2.1 provides summary statistics on the Orbis data used.

Orbis was also used to approximate corporate debt shares, calculated as the ratio of the sum of current and non-current liabilities over total assets.

2.2.2 European Tax Systems and Model Baseline

In a model designed to appraise the impact of tax reforms, the initial structure of the tax systems concerned is extremely important. In the present calibration CORTAX is using tax data for 2012, implying that subsequent simulations of EU reforms produce outcomes relative to tax systems as they were in 2012. The baseline also describes economic changes induced by these reforms, as simulated by the model.

Corporate tax rates

Figure 2.1 presents prevalent corporate income tax rates across the EU. These averaged at 23% in 2012, but with considerable variation across the EU, from a high 37% in France to a low 10% in Cyprus and Bulgaria.

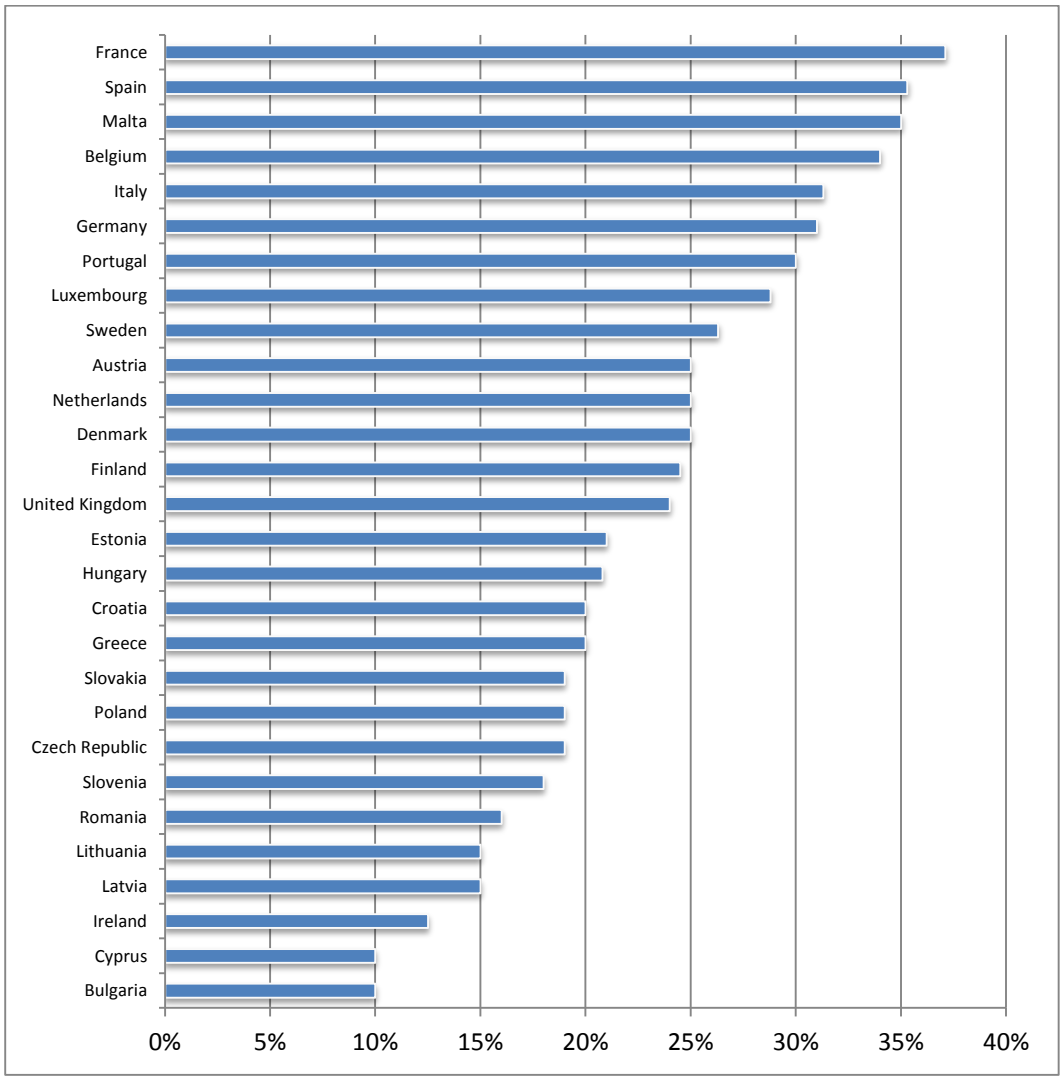
Fiscal depreciation

Differences in depreciation rules and inventory valuation mean that tax bases vary considerably across the EU. We have used information on tax laws of EU countries reported in ZEW (2012) to calculate relevant parameters such as the cost of capital. Table 2.2 summarises this information, presenting both rates and the rules for the calculation of annual allowances (declining balance [DB] or straight line [SL]). In 2012 most countries allowed SL depreciation for investments in buildings and intangibles (corresponding to prevalent rules for the depreciation of a patent), whereas for machinery the rules are more varied. Estonia has no depreciation scheme applicable, due to its unique corporate taxation rules.

Using information reported in Table 2.2 we calculate for each asset the net present value of the depreciation allowances as a share of the purchase price of the investment. Higher percentages denote more generous fiscal depreciation rules for that particular type of asset. Using shares of investment by different classes of assets from Orbis (as reported in Table 2.1) we then calculate a weighted average of these values for each of the one million firms considered. Finally, we calculate country-level medians to use in CORTAX. The choice of medians over means is in keeping with the previous calibration and has the attractive feature of minimising the influence of outliers. Table 2.3 presents

country-level medians of firm-specific allowances, for the first year and net present value. Net present values vary considerably, from a low 12% in the United Kingdom to just over 60% in the Netherlands, though most countries are in the 40-50% range.

Figure 2.1 Corporate tax rates in EU countries, 2012



Source: ZEW (2014), "Effective Tax Levels Using Devereux/Griffith Methodology", p. 2

Effective marginal tax rates

The relationship between corporate taxation and investment in CORTAX is determined by the cost of capital. The effective marginal tax rate (EMTR) is a measure of the cost of capital, defined as the difference in the cost of capital in the presence and in the absence of tax, as a percentage of the tax-inclusive cost of capital. The EMTR effectively summarises several parameters of the tax system, such as the statutory tax rate, depreciation allowances, treatment of inventories and depreciation of financial costs. CORTAX calculates the EMTR for both equity- and debt-financed investment. The

mode of financing is very important. Unlike equity finance, nominal interest is deductible for the corporate tax base allowing for more generous EMTR for debt-financed investment. To get a handle on how investment was actually financed by firms in 2012 we use Orbis to calculate average debt-share of investment across countries (Figure 2.2). These range from a high of almost 0.7 in Italy to a low of 0.4 in Lithuania.

Table 2.2 Depreciation schemes and inventory valuation in corporate tax systems in the EU, 2012

	Buildings (number of years in brackets)	**Machinery** (number of years in brackets)	**Intangibles** (number of years in brackets)	**Inventory valuation**
Austria	SL 3% (33.33)	SL 14.29% (7)	SL 10% (10)	LIFO
Belgium	DB 10% (7) SL 5% (9.6)	DB 28.57%(2) SL 14.29% (3)	SL 20% (5)	LIFO
Bulgaria	SL 4% (25)	SL 30% (3.33)	SL 15% (6.67)	average
Croatia	SL 10% (10)	SL 50% (2)	SL 50% (2)	average
Cyprus	SL 4% (25)	SL 20% (5)	SL 20% (5)	FIFO
Czech Rep	DB 30 years	DB 6 years	SL 16.66% (6)	average
Denmark	SL 4% (25)	DB 25% (n.a.)	SL 100% (1)	FIFO
Estonia	n.a.	n.a.	n.a.	LIFO
Finland	DB 7% (n.a.)	DB 25% (n.a.)	SL 10% (10)	FIFO
France	SL 5% (20)	DB 32.14% (4) SL 7.07% (3)	SL 20% (5)	average
Germany	SL 3% (33.33)	SL 14.29% (7)	SL 20% (5)	LIFO
Greece	SL 8% (12.5)	DB 42.86% (4) SL 10.7% (1)	SL 10% (10)	LIFO
Hungary	SL 2% (50)	SL 50% (2)	SL 50% (2)	average
Ireland	SL 4% (25)	SL 12.5% (8)	SL 10% (10)	average
Italy	SL 2% (1) SL 4% (24.5)	SL 12.5% (7.5) SL 6.25% (1)	SL 33.33% (3)	LIFO
Latvia	DB 10% (n.a.)	DB 40% (n.a.)	SL 20% (5)	average
Lithuania	DB 25% (n.a.)	DB 40% (n.a.)	DB 66.66% (n.a.)	LIFO
Luxembourg	SL 4% (25)	DB 30% (4) SL 8% (3)	SL 20% (5)	LIFO
Malta	SL 12% (1) SL 2% (44)	SL 20% (5)	SL 10% (10)	FIFO
Netherlands	SL 2.5% (40)	SL 14.29% (7)	SL 20% (5)	LIFO
Poland	SL 2.5% (40)	SL 10% (10)	SL 20% (5)	LIFO
Portugal	SL 5% (20)	DB 35.71% (n.a.)	SL 10% (10)	average
Romania	SL 2.5% (40)	SL 50% (1) SL 8.33% (6)	SL 50% (1) SL 5.55% (9)	LIFO
Slovakia	DB 20 years	DB 6 years	SL 20% (5)	average
Slovenia	SL 3% (33.33)	SL 20% (5)	SL 10% (10)	average
Spain	SL 3% (33.33)	DB 28.57% (4) SL 8.68% (3)	DB 25% (6) SL 4.45% (4)	average
Sweden	SL 4% (25)	DB 30% (n.a.)	DB 30% (n.a.)	FIFO
UK	n.a.	DB 18% (n.a.)	SL 10% (10)	FIFO

Source: ZEW (2014), pp. A15-A21.

Table 2.3 Summary information about the NPV of fiscal depreciation schemes in % of the purchase price

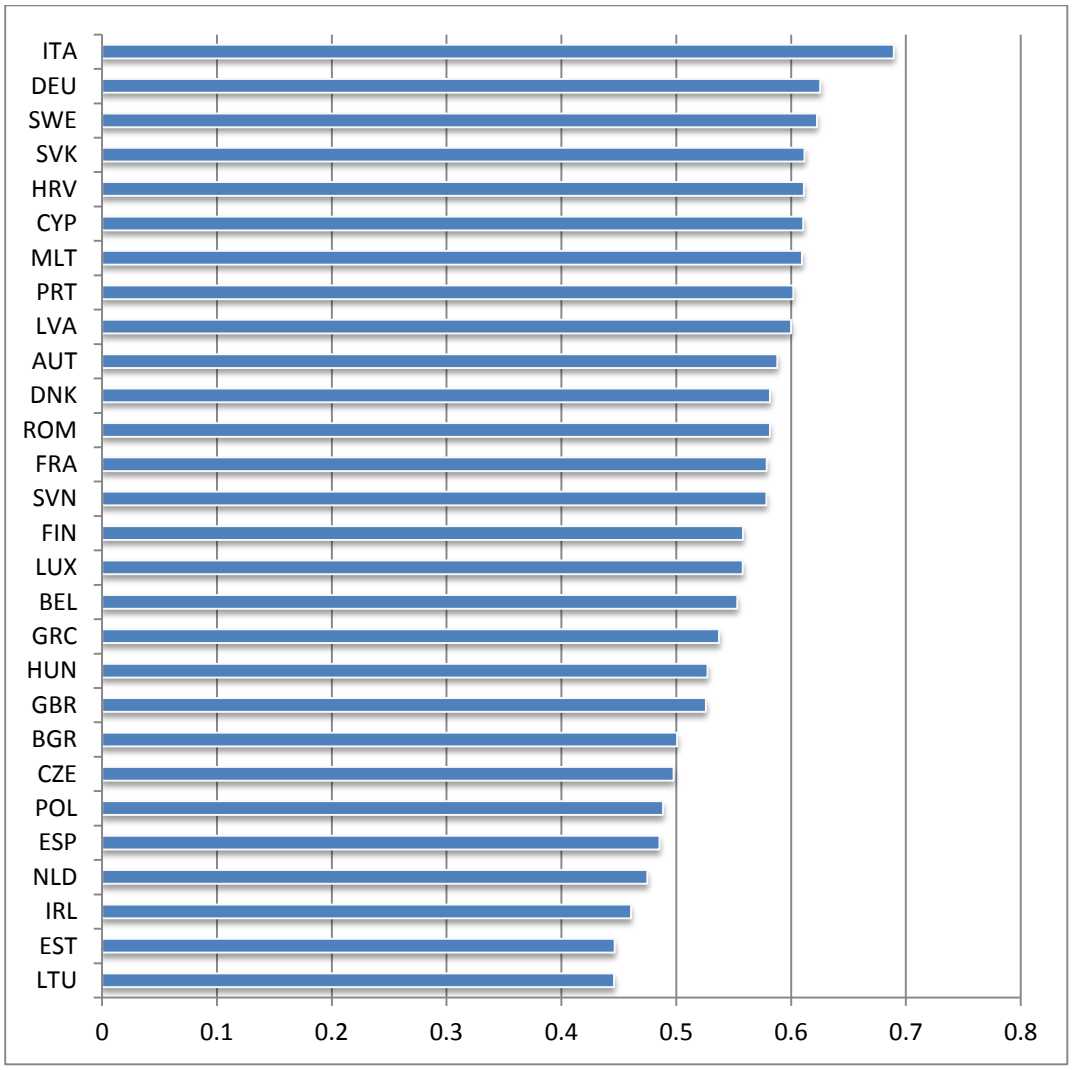
	First year tax depreciation	Net present value of allowances
Austria	3.92%	43.10%
Belgium	5.17%	57.01%
Bulgaria	6.89%	49.01%
Croatia	13.89%	62.52%
Cyprus	7.01%	44.04%
Czech Republic	4.98%	49.68%
Denmark	6.55%	45.11%
Estonia	0.00%	0.00%
Finland	7.88%	49.41%
France	5.05%	53.00%
Germany	3.95%	43.10%
Greece	6.32%	57.04%
Hungary	16.43%	39.93%
Ireland	4.24%	47.84%
Italy	2.02%	46.73%
Latvia	11.91%	55.40%
Lithuania	20.57%	59.70%
Luxembourg	3.57%	48.47%
Malta	10.07%	41.76%
Netherlands	8.51%	60.74%
Poland	3.84%	38.99%
Portugal	8.32%	49.83%
Romania	16.50%	41.43%
Slovak Republic	5.46%	54.81%
Slovenia	8.85%	52.05%
Spain	3.07%	43.45%
Sweden	6.88%	48.61%
United Kingdom	2.71%	12.42%
Europe – weighted average	4.92%	43.03%
Standard deviation	4.79%	13.10%

Note: To better represent contemporary conditions, we assumed inflation=1.875%, risk-free real interest rate=1.5% and return on equity=3% (i.e. 25% lower than the values assumed by CPB).

Source: National-level median values using ZEW depreciation schemes and weighted by Orbis investment shares.

Using information on the debt-share of each country, CORTAX calculates a weighted average of EMTRs for debt and equity finance (Figure 2.3). This can be interpreted as a summary indicator of how distortionary the corporate tax system is for marginal investment decisions. On one end, the United Kingdom and Spain have the highest average EMTR whereas on the other end, Croatia has a negative EMTR.

Figure 2.2 Average debt-asset ratio of firms in EU countries, 2012

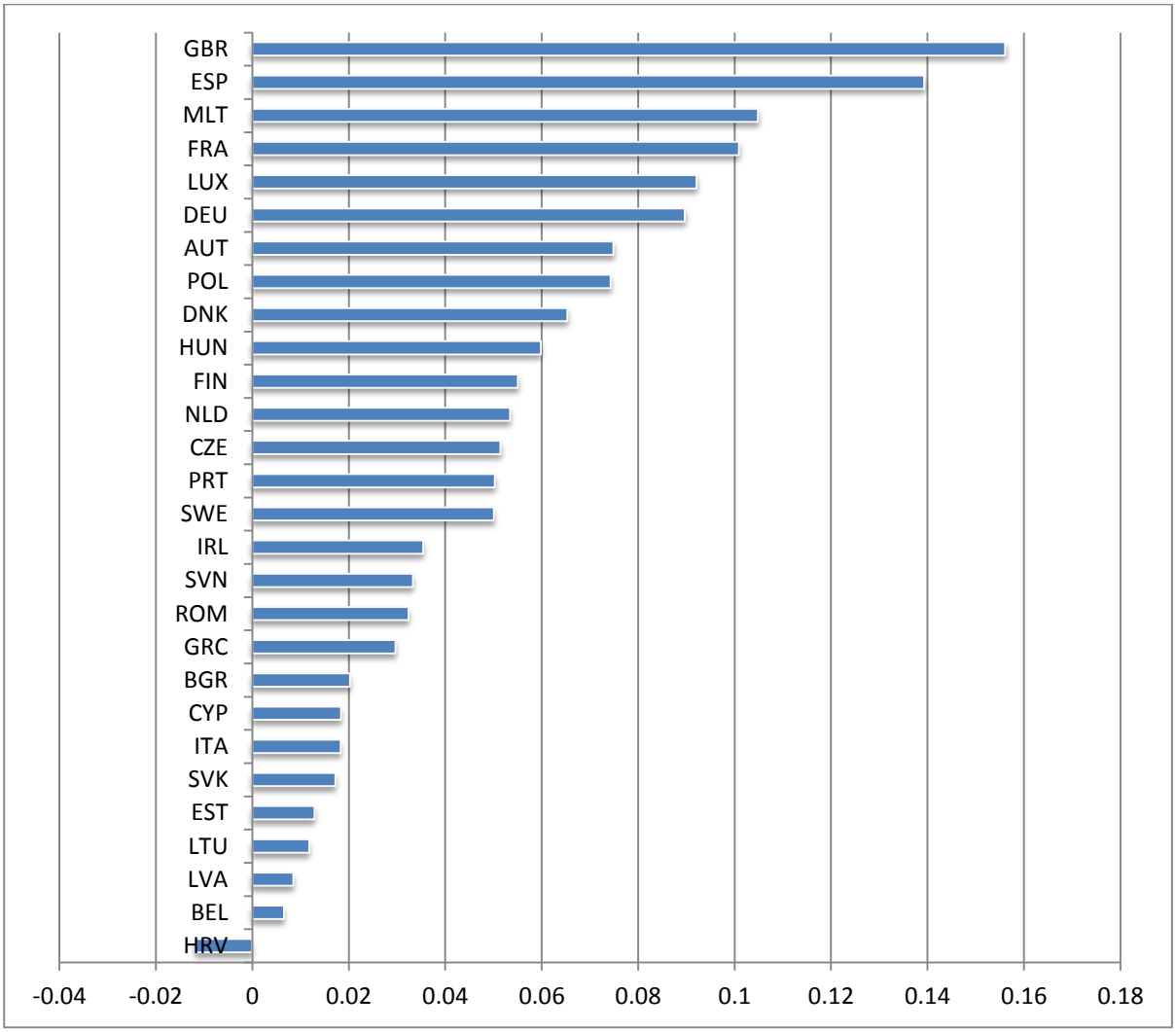


Source: National-level averages from Orbis

Corporate tax revenue

The CORTAX baseline simulates corporate tax revenues in each country. To determine 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. To calculate deductible costs we use capital shares from national accounts, fiscal depreciation rates from Table 2.3, a nominal interest rate of 4.5% and debt shares from Figure 2.2.

Figure 2.3 Average EMTR in EU countries, 2012

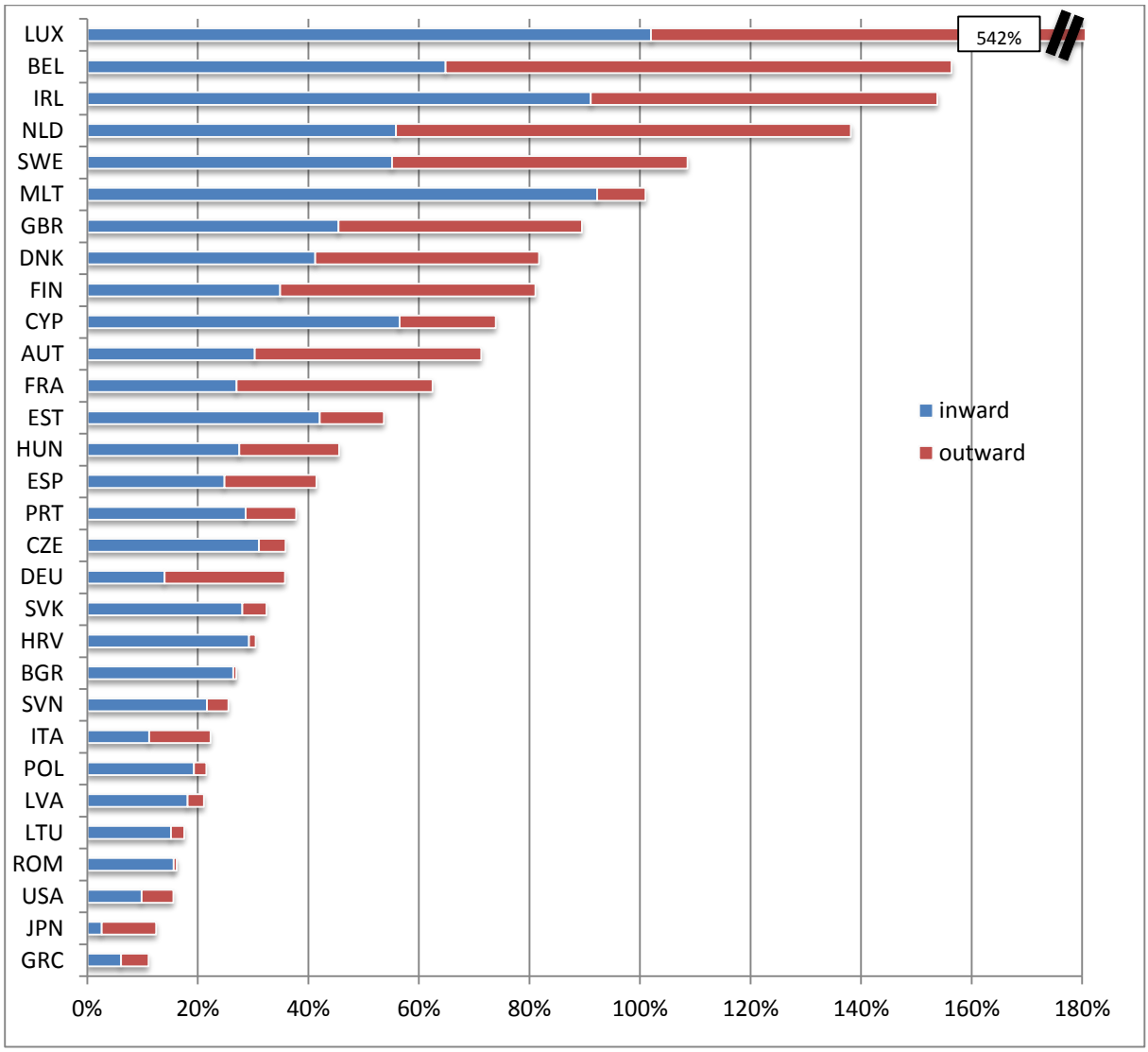


Source: CORTAX

Country code:

AUT	Austria	GBR	United Kingdom
BEL	Belgium	CYP	Cyprus
DNK	Denmark	CZE	Czech Rep
FIN	Finland	EST	Estonia
FRA	France	HUN	Hungary
DEU	Germany	LVA	Latvia
GRC	Greece	LTU	Lithuania
HRV	Croatia	MLT	Malta
IRL	Ireland	POL	Poland
ITA	Italy	SVK	Slovakia
LUX	Luxembourg	SVN	Slovenia
NLD	Netherlands	BGR	Bulgaria
PRT	Portugal	ROM	Romania
ESP	Spain	USA	USA
SWE	Sweden	JPN	Japan

Figure 2.4 Inward and outward FDI in % of GDP in EU countries, 2012



Source: Eurostat, adjusted for CYP, MLT, LUX and NLD according to non-SPE figures by the OECD and UNCTAD.

3. Simulation results

In this section uncoordinated and coordinated CIT rate reforms are performed and their economic impact assessed. Opposite uncoordinated tax policies, such as CIT rate cuts and increases, are investigated, taking two representative countries as reference: Germany and Ireland. In such a way, the economic impact of moving from high-to-low and low-to-high tax rate regimes is analysed. An economic environment is set where, first Ireland increases its statutory CIT rate set at 12.5% to the German rate of 31%; and then, Germany reduces its CIT rate to the Irish level. A third simulation is presented, where CIT rates across EU are harmonised to an average EU rate equal to 27.7%. In all simulations, a tax-shift between capital and labour is designed to maintain government budget neutrality. Results account for profit shifting across countries and for the existence of a tax haven. The main tables in the section display the effects on, among others, GDP, employment and welfare by country, as well as, inbound and outbound flows across EU countries and the percentage variation of profit shifting from domestic firms to tax haven. Finally, a sensitivity analysis on the closure to keep the government budget balanced is discussed in the last subsections. In particular, it is assumed that transfers to old and government expenditures are allowed to change to meet budget neutrality.

3.1. Increasing the statutory CIT rate in Ireland

CIT rate differentials across countries have been behind tax planning activities at the firm level and tax competition among governments. Ireland, in particular, is recognised as one of the countries with large inbound of profit shifting due to its CIT rate, set at 12.5% among the lowest in the EU (Figure 2.1) and 19 percentage points below the statutory CIT rate of Germany, the largest economy in the EU. The economic effects of rising in isolation corporate taxation in Ireland to the level of Germany are assessed and displayed in Table 3.1.

Moving the CIT rate in Ireland to the German level translates into an increase of 16.11 pp, which directly causes the cost of capital to rise by 0.45 pp, with the result of cutting down the demand for capital. The marginal productivity of labour falls and also wages do. The increase in the CIT rate causes more CIT revenues to be collected and a tax-shift from labour to capital to occur. Wages further contract due to the resulting decrease in the Irish labour tax rate, which adjusts to accommodate changes in the CIT revenues and so maintain government budget neutrality. The cut down of wages reduces production costs on one side; but disincentives labour supply on the other side. The net result is a slight lift in employment. The dramatic fall of capital exerts a negative impact on the Irish GDP, which records a significant contraction.

Turning to the spillover effects of the tax reform, Luxembourg slightly reacts with an increase in capital, employment and GDP and the main reason behind is the size of FDI stocks with respect to GDP. In all other countries, the impact, even though negligible, tends to be positive, mainly due to the fall in the outbound profit shifting.

Table 3.1. Economic effects of raising CIT in Ireland

	CIT rate	CoC	Capital	Wage	Employ-ment	GDP	CIT revenue	Tax revenue	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0.02	0.01	0	0.01
Finland	0	0	0.02	0	0.02	0.03	0.02	0	0.02
France	0	0	0	0	0.01	0.02	0.01	0	0.01
Germany	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0
Croatia	0	0	0	0	0	0	0	0	0
Ireland	18.5	0.45	-6.05	-4.28	0.37	-3.06	2.16	-0.03	-0.87
Italy	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0.18	-0.02	0.19	0.29	0.14	0.01	0.16
Netherlands	0	0	0.02	0	0.02	0.08	0.02	0	0.02
Portugal	0	0	0	0	0	0.01	0	0	0
Spain	0	0	0	0	0.01	0.01	0.01	0	0
Sweden	0	0	0	0	0	0.02	0.01	0	0.01
UK	0	0	0	0	0	0.02	0.01	0	0.01
Cyprus	0	0	0	0	0	0	0	0	0
Czech republic	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0.01	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0.01	0.01	0	0.01
Poland	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0.01	0	0	0
Romania	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0
EU	**0.15**	**0**	**-0.05**	**-0.04**	**0.01**	**-0.01**	**0.03**	**0**	**0**

Table 3.2 reports profit shifting across EU countries and to tax haven. Allocation of capital across countries depends on the tax rates, which directly affect the net return to capital. Results show that the increase in the CIT rate causes profits to move away in particular to tax haven, as well as causes other countries to redirect profit towards locations other than Ireland, such as the Netherlands, United Kingdom and Luxembourg. The outflow of capital from the country reduces the remuneration of labour with a resulting loss of income to the residents.

Table 3.2 Profit shifting

	Profit shifting headquarters to subsidiaries				Profit shifting domestic firms to tax haven
	Baseline		CIT reform in Ireland		
	(Millions of Euro)				%
	Subsidiary				Domestic
	IN	OUT	IN	OUT	
Austria	338.7	-9.7	339.1	-9.0	-0.11
Belgium	376.5	-585.4	376.5	-585.4	-0.16
Denmark	146	-26.5	153.4	-13.9	-0.11
Finland	115	-3.6	117.0	-0.9	0.08
France	0	-3865	0.0	-3,682.7	0.11
Germany	443.9	-725.1	444.0	-681.3	-0.18
Greece	77.6	-0.6	78.7	0.0	0.31
Croatia	80.4	-1.5	81.1	-1.1	0.31
Ireland	1077.9	-0.1	79.7	-229.7	329.40
Italy	352.6	-427.1	352.7	-388.5	-0.06
Luxembourg	66	-85.3	71.8	-52.4	0.07
Netherlands	1364.4	-227.6	1,469.8	-51.2	-0.11
Portugal	122.8	-90.6	123.8	-75.3	0.18
Spain	67.7	-1174.7	67.7	-1,120.7	-0.08
Sweden	201.8	-199.7	216.9	-163.5	0.14
UK	3453	-179.7	3,566.2	-30.6	-0.24
Cyprus	46.9	0	47.2	0.0	-1.15
Czech republic	362.9	-1.8	362.9	-1.8	0.11
Estonia	26.8	-2.2	27.1	-2.0	-0.16
Hungary	261.6	-1.2	261.6	-1.2	0.32
Latvia	32.1	-0.3	34.1	-0.1	0.00
Lithuania	43.4	-0.1	43.8	-0.1	0.00
Malta	0.3	-44.9	0.3	-44.7	0.15
Poland	870	-6.1	877.4	-3.0	0.11
Slovakia	139.1	-1.7	141.5	-0.7	0.11
Slovenia	75.1	-0.1	75.2	-0.1	-0.13
Bulgaria	163.3	0	169.4	0.0	-1.15
Romania	279.5	-1.6	282.7	-1.0	0.24

3.2. Reducing the statutory CIT rate in Germany

In this subsection we simulate the reduction of the statutory CIT rate in Germany to the level of Ireland. Results, reported in Table 3.3, suggest that a significant fall in the German CIT rate reduces the cost of capital and boosts investment by 5.57%. The raise of capital spurs the marginal productivity of labour and raises wages, therefore stimulating labour supply. However, the increase in labour taxation to compensate for the lost CIT revenues lifts the cost of labour. The overall impact is a slight fall in employment. Capital accumulation translates into an increase in production and GDP. Welfare increases by 0.33 as a percentage of GDP.

Table 3.3. Economic effects of reducing CIT in Germany

	CIT rate	CoC	Capital	Wage	Employ-ment	GDP	CIT revenue	Tax revenue	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	-0.1	0.01	-0.11	-0.28	-0.08	0	-0.1
Belgium	0	0	-0.02	0.01	-0.03	-0.07	-0.03	0	-0.03
Denmark	0	0	-0.03	0	-0.03	-0.11	-0.04	0	-0.04
Finland	0	0	-0.03	0	-0.04	-0.08	-0.03	0	-0.03
France	0	0	-0.03	0.02	-0.06	-0.15	-0.07	0	-0.07
Germany	-18.5	-0.43	5.57	3.39	-0.65	1.62	-2.15	0.02	0.33
Greece	0	0	0	0	0	-0.02	0	0	0
Croatia	0	0	0	0	0	-0.07	-0.01	0	-0.01
Ireland	0	0	-0.03	-0.01	-0.02	-0.11	-0.01	0	-0.01
Italy	0	0	-0.02	0	-0.02	-0.04	-0.02	0	-0.03
Luxembourg	0	0	-0.43	0.03	-0.46	-0.52	-0.25	-0.01	-0.21
Netherlands	0	0	-0.05	0.01	-0.06	-0.24	-0.06	0	-0.06
Portugal	0	0	0	0	-0.01	-0.03	-0.01	0	-0.01
Spain	0	0	-0.01	0.01	-0.02	-0.06	-0.03	0	-0.02
Sweden	0	0	-0.03	0.01	-0.04	-0.13	-0.05	0	-0.05
UK	0	0	-0.02	0	-0.02	-0.12	-0.04	0	-0.03
Cyprus	0	0	0	0	0	-0.02	0	0	0
Czech republic	0	0	-0.01	0	-0.01	-0.1	-0.02	0	-0.02
Estonia	0	0	0	0	0	-0.02	0	0	0
Hungary	0	0	-0.03	0	-0.03	-0.19	-0.03	0	-0.05
Latvia	0	0	0	0	0	-0.02	0	0	0
Lithuania	0	0	-0.01	0	0	-0.03	0	0	0
Malta	0	0	0.15	0.15	0.02	-0.71	-0.25	-0.01	-0.21
Poland	0	0	-0.01	0	-0.01	-0.06	-0.01	0	-0.01
Slovakia	0	0	-0.01	0	-0.01	-0.06	-0.01	0	-0.01
Slovenia	0	0	-0.01	0	0	-0.04	-0.01	0	-0.01
Bulgaria	0	0	-0.01	0	0	-0.03	0	0	0
Romania	0	0	-0.01	0	0	-0.04	0	0	-0.01
USA	0	0	0.01	0	-0.01	-0.02	-0.01	0	-0.01
Japan	0	0	0	0	0	-0.01	-0.01	0	0
EU	**-3.10**	**-0.07**	**0.92**	**0.57**	**-0.13**	**0.19**	**-0.46**	**0**	**0.04**

The unilateral policy reform of Germany, the largest economy in the EU with trade and FDI flows all over across the EU, generates spillover, causing most of the EU countries to be affected by the German tax reform, and the EU-weighted average results to be driven by the German results.

In the previous simulation, setting a high tax rate in Ireland exacerbates outbound profit shifting to tax haven, as well as incentive other countries to relocate their capital flows. In the current simulation, the reduction of the CIT rate in Germany has modest decreasing effect on profit shifting, with the result of increasing total CIT revenues.

Table 3.4 Profit shifting

	Profit shifting headquarters to subsidiaries				Profit shifting domestic firms to tax haven
	Baseline		CIT reform in Germany		
	(Millions of Euro)				%
	Subsidiary				Domestic
	IN	OUT	IN	OUT	
Austria	338.7	-9.7	167.0	-298.6	0
Belgium	376.5	-585.4	375.8	-725.4	0
Denmark	146	-26.5	99.9	-104.2	0
Finland	115	-3.6	89.3	-42.0	0
France	0	-3865	0.0	-5,476.5	0
Germany	443.9	-725.1	4,553.1	0.0	-76.75
Greece	77.6	-0.6	54.6	-12.8	0
Croatia	80.4	-1.5	57.4	-13.7	0
Ireland	1077.9	-0.1	961.1	-0.1	0
Italy	352.6	-427.1	352.3	-728.3	0
Luxembourg	66	-85.3	61.7	-109.7	0
Netherlands	1364.4	-227.6	1,038.0	-774.5	0
Portugal	122.8	-90.6	119.6	-134.6	0
Spain	67.7	-1174.7	67.5	-1,591.5	0
Sweden	201.8	-199.7	130.9	-369.9	0
UK	3453	-179.7	2,763.3	-1,088.0	0
Cyprus	46.9	0	43.3	0.0	0
Czech republic	362.9	-1.8	242.4	-52.2	0
Estonia	26.8	-2.2	24.9	-3.5	0
Hungary	261.6	-1.2	117.9	-92.7	0
Latvia	32.1	-0.3	27.3	-0.9	0
Lithuania	43.4	-0.1	32.1	-1.4	0
Malta	0.3	-44.9	0.3	-110.5	0
Poland	870	-6.1	649.7	-98.1	0
Slovakia	139.1	-1.7	102.9	-16.8	0
Slovenia	75.1	-0.1	65.5	-3.2	0
Bulgaria	163.3	0	142.9	0.0	0
Romania	279.5	-1.6	218.1	-12.4	0

3.3. Harmonising the statutory CIT rates in the EU

In this simulation statutory CIT rates across Europe are harmonised to an EU weighted-average tax rate of 27.7%. Results are presented in Table 3.5. Significant increases in the tax rates are observed in Bulgaria and Cyprus, followed by Ireland, and by Latvia and Lithuania. However, Ireland registers the most dramatic drop in GDP, due to the highest rise in the cost of capital, which reduces investment and capital. The raise in the CIT rate is responsible for a significant outflow of profit to tax haven. On the contrary, sharp declines of the CIT rates are registered in France, Spain and Malta. Lower rates reduce the cost of capital and stimulate investments; but also entail a loss in CIT revenues

and a tax shift from capital to labour. This, coupled with the increase in the marginal productivity of labour, causes employment to fall. However, the positive effect on capital prevails, with the result that GDP raises.

Table 3.5. Economic effects of homogenizing CIT in the EU

	CIT rate	CoC	Capital	Wage	Employ-ment	GDP	CIT revenue	Tax revenue	Welfare	Profit shifting to tax haven
	pp	pp	%	%	%	%	% of GDP			%
Austria	2.70	0.07	-0.93	-0.57	0.07	-0.41	0.32	-0.01	-0.12	14.71
Belgium	-6.30	-0.01	-0.02	0.18	-0.18	-0.04	-0.12	0	0.06	-23.03
Denmark	2.70	0.06	-0.74	-0.38	0.05	-0.27	0.23	0	-0.1	14.71
Finland	3.20	0.07	-0.7	-0.41	0.09	-0.22	0.26	0	-0.08	18.18
France	-9.40	-0.26	2.71	1.34	-0.17	0.9	-0.72	0.01	0.43	-30.56
Germany	-3.30	-0.08	1.11	0.66	-0.08	0.33	-0.38	0	0.12	-13.65
Greece	7.70	0.1	-1.18	-1	0.36	-0.27	0.67	0	-0.04	59.18
Croatia	7.70	-0.04	0.67	0.15	0.15	0.13	0.03	0	0.06	59.18
Ireland	15.20	0.36	-4.91	-3.48	0.34	-2.51	1.82	-0.03	-0.62	271.43
Italy	-3.60	-0.02	0.1	0.22	-0.17	-0.07	-0.19	0	-0.04	-14.60
Luxembourg	-1.10	-0.03	0.15	0.28	-0.28	-0.07	-0.27	0	-0.04	-4.88
Netherlands	2.70	0.07	-0.61	-0.36	0.01	-0.45	0.13	-0.01	-0.18	14.71
Portugal	-2.30	-0.03	0.41	0.25	-0.06	0.07	-0.19	0	0.01	-9.65
Spain	-7.60	-0.26	3.5	2.15	-0.17	1.2	-1.07	0.02	0.51	-26.42
Sweden	1.40	0.02	-0.29	-0.15	0.03	-0.07	0.11	0	-0.01	7.34
UK	3.70	0.23	-2.55	-1.06	0.02	-0.89	0.55	-0.01	-0.34	21.24
Cyprus	17.70	0.26	-3.82	-2.64	0.42	-1.66	1.71	-0.02	-0.13	532.43
Czech rep	8.70	0.22	-2.84	-1.93	0.22	-1.14	1.09	-0.02	-0.26	72.06
Estonia	6.70	0.04	0.01	-0.32	0.27	0	0.29	0	-0.02	47.17
Hungary	6.90	0.18	-2.38	-1.58	0.18	-0.94	0.89	-0.01	-0.24	50.00
Latvia	12.70	0.06	-0.38	-0.71	0.57	0.07	0.65	0	0.12	157.14
Lithuania	12.70	0.08	-0.67	-0.86	0.5	-0.06	0.74	0	0.03	157.14
Malta	-7.30	-0.19	2.55	1.62	-0.1	1.37	-0.67	0.02	0.46	-25.48
Poland	8.70	0.31	-4.17	-2.76	0.24	-1.58	1.47	-0.03	-0.41	72.06
Slovakia	8.70	0.06	-0.75	-0.74	0.32	-0.26	0.55	0	0.01	72.06
Slovenia	9.70	0.17	-1.82	-1.05	0.26	-0.54	0.77	-0.01	-0.09	87.20
Bulgaria	17.70	0.29	-4.07	-2.96	0.57	-1.44	1.92	-0.03	-0.17	532.43
Romania	11.70	0.2	-2.71	-2.02	0.47	-0.87	1.28	-0.01	-0.1	129.41
USA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Japan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU	**0**	**0.01**	**-0.18**	**-0.13**	**0.01**	**-0.12**	**-0.02**	**0.00**	**0.03**	**-**

Looking at the EU average impact, GDP slightly contracts but welfare stays slightly positive. Setting a common tax rate completely removes the incentive to engage in profit shifting within EU. Some tax planning is still registered to tax haven as reported in the last column of Table 3.5. Again, we observe that an increase tax rate is associated with a positive sign in profit shifting to tax haven; and vice

versa. Results on tax revenues suggest that harmonised rate happens to be close to the one that ensures revenue-neutrality on EU average.

3.4 Sensitivity analysis

In the previous simulations, government balance neutrality is maintained by allowing tax on labour to change. In this subsection, we perform a sensitivity analysis of the results by assuming two alternative closures of the model: transfers to old (Tables B3.1-B3.3) and, government expenditure (Tables B3.4-B3.6). Tables are displayed in the Annex.

Closing the model via transfers to old exerts a main impact on household utility and welfare, as well as on the cost of labour and employment. Changes in transfers directly affect household disposable income and the missing compensation on tax on labour amplifies the negative result. Both channels drive results for the whole set of simulations.

The results of the simulations when using government expenditure show figures very similar to those of the central case for the unilateral reforms (Table B3.4 and Table B3.5). It is the reduction of CIT for Germany compensated with government expenditures, Table B3.5, what differs more from the central case. The reason is that reducing government expenditures directly impacts production and therefore employment and GDP. Given the size of the German economy in the EU, these positive results are transferred to the EU average.

4. Conclusions

Uncoordinated national tax regimes have resulted into a broad range of statutory CIT rates across EU, with values ranging from 10% to 37%. This has led to strategic tax planning by multinational corporations with the aim to reduce the tax burden. On this regard, evidence suggests a rise to the bottom, with countries competing over profits by reducing their statutory tax rates on corporate profits.

This paper evaluates the economic impact of changing the corporate income tax rate in the EU, accounting for the role played by profit shifting. The analysis is performed using CORTAX, a computable general equilibrium model featuring 28 EU member states, USA, Japan and a tax haven, designed to evaluate the economic impact of corporate tax reforms. The aim is to contribute to the ongoing debate about the desirability and likely impact of alternative policy solutions to the challenges posed by aggressive tax planning and tax competition.

The paper analyses both uncoordinated and coordinated changes in the tax regime. In particular, it considers the case of uncoordinated tax changes, by simulating an upward adjustment in Ireland, a low CIT tax economy, and a downward adjustment in Germany, one of the countries with highest CIT rates and the largest economy in the EU. These simulations represent two opposing cases of rather drastic policy changes, which although not realistic, serve to uncover an interesting set of not

always intuitive impacts. Additionally, a third scenario simulates a coordinated policy change, whereby all EU member states choose to harmonise their CIT rates at the EU average level.

Results accounts for the main channels through which policy reforms affect the economy such as: profit shifting, investment distortion, and tax shift between corporate and labour taxation. Uncoordinated tax reforms significantly impact the country-specific national economy, although generate a negligible impact on the aggregate EU macro variables because of spillover effects. Coordinated tax reform removes the incentive to engage in profit shifting across EU and causes some countries to be better off while others to be worse off. In conclusion, results suggest that, across all reform scenarios, countries are better off when moving from a high to a lower CIT tax rate.

All simulations have been evaluated under alternative model closures, using as compensating variable tax on labour in the central case and transfers to old and government expenditures in the sensitivity analysis. These variables change in order to counteract the positive and negative effect the CIT reform may have on government budget balance. In general, results are quite robust and persist under different closure rules.

Annex A. Macroeconomic indicators used in the calibration

Population and Employment

Population and employment statistics used in the calibration come from the United Nations. Figures for population aged 20+ have been summed from the five year age groups reported in UNECE (2015) (EU countries and USA) and UNESCAP (2015) (Japan). Figures for population aged 15-64 have been summed from the five year age groups reported under the medium fertility projections of the World Population Prospects (UN 2013). Additional employment statistics, on annual hours worked, number of employees, number of self-employed and total employment are from Eurostat (database tables lfsi_emp_a, lfsq_eegaed, lfsq_esgaed, lfsq_ewhan2), except for the United States and Japan for which we use 2011 values (latest available) from the OECD (2009). Data on number of persons engaged, number of employees, total hours worked by persons engaged and total hours worked by employees are from the World Input Output Database (2015) (the successor of KLEMS) as documented in Timmer et al. (2015).

National accounts

National accounts data using the expenditure and income approaches are from the OECD (2015) and Eurostat (database tables: gov_a_main, nama_gdp_c, gov_10dd_edpt1 and ert_bil_eur_a for exchange rates). Purchasing power parity (PPPs) exchange rates are from the IMF (2015) and Eurostat (database table prc_ppp_ind). General government consolidated gross debt as a percentage of GDP is from DG ECFIN's Ameco Database.

National accounts data on labour and capital income shares determine the capital and labour parameters for the calibration of the model. The location-specific production factor is set at 2.5% of value added in each country, a value which was necessary for CORTAX to produce a reasonable result in terms of the corporate tax to GDP ratio. A sensitivity analysis with a lower share (1.5%) was not found to produce qualitatively distinct results (reported in Bettendorf et al., 2009).

Foreign Direct Investment

The CORTAX model requires bilateral FDI positions as part of the calibration. For these, we start with the Eurostat bilateral positions. Data on Foreign Direct Investment (FDI) flows by country of origin and country of receipt are from Eurostat (financial account, direct investment, reporting economy, database table bop_fdi_pos_r2). However, Germany, Luxembourg, Iceland, Switzerland, Cyprus and Japan do not report the country of origin for about half of the 30 countries considered. For the remaining countries information is missing only for about 2-4 countries of origin, typically those from outside the EU. Following the original calibration practice (Bettendorf and van der Horst, 2006): (a) Missing values on inwards FDI were filled using the corresponding relationship from the outwards FDI table. In effect, information on FDI that is not reported by the receiving economy is obtained using information reported by the originating economy.

(b) For a small number of country pairs where neither inward nor outward information was available, FDI was approximated using information on the FDI behaviour of similarly-sized and/or neighbouring countries. For instance, inwards FDI to Luxembourg from Germany has been approximated by looking at the corresponding relationship between Luxembourg and Austria: First calculating Austrian FDI into Luxembourg as a share of total Austrian FDI in the EU and then multiplying this share by the total amount of German FDI in the EU.

For some countries, however there the FDI data raised concern given the relative importance of special purpose entity (SPE) activity. While SPEs are typically used by companies to isolate the firm from financial risk, they can also be used for debt shifting purposes between related parties, see Dharan (2002). We check all country aggregates and, in our case, there is concern about the values obtained for CYP, MLT, LUX and NLD. [3] In order to correct for this, we use non-SPE data where available. The first choice of source for this data is the OECD Benchmark Definition 4 (BMD4), which provides data on FDI specifically for SPEs and non-SPEs.[4] The most recent data set was released in March 2015, and currently provides data for 2013 only at an aggregate level (bilateral flows are not given). Furthermore data is only available for select countries. Of the four countries, only LUX has non-SPE FDI data listed for OECD BMD4,[5] and the inward and outward positions are adjusted based on these data. The UNCTAD FDI data also removes SPEs. For the remaining three countries, we check against the UNCTAD non-SPE totals.[6] [7] Based on these figures, adjustments are made to the inward position for Cyprus and the outward position for Cyprus, Malta and the Netherlands.

[3] Ireland was also considered, but the UNCTAD non-SPE data did not suggest that the Eurostat figures were excessive, and the OECD BMD4 data are not given.

[4] The OECD data claim to set "the world standard for collecting direct investment statistics". Based on the arguments made (see http://www.oecd.org/investment/fdibenchmarkdefinition.htm for details), we consider this our preferred source for non-SPE FDI data aggregates.

[5] We use the directional principle data, which is adjusted to 2012 using the growth/reduction in assets over this period. The figures are total inward and outward positions with the rest of the world. Therefore, these are adjusted for the share of positions for the EU and USA and Japan out of the rest of the world, based on UNCTAD shares estimates http://unctad.org/Sections/dite_fdistat/docs/webdiaeia2014d3_LUX.pdf.

[6] The inward and outward FDI stocks are available here: http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx.

[7] As for Luxembourg, the data are adjusted by the share of the inward and outward positions for the EU and USA and Japan out of the world totals.

Annex B. Additional results: sensitivity analysis

Table B3.1. Economic effects of raising CIT in Ireland compensated with Transfers to old

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0.01	0.01	0	0
Finland	0	0	-0.01	0	-0.01	0	0.02	0.02	0.01
France	0	0	-0.01	0	-0.01	0	0.01	0.01	0
Germany	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0
Croatia	0	0	0	0	0	0	0	0	0
Ireland	18.5	0.45	-7.5	-4.21	-1.23	-4.54	2.1	0.75	-1.23
Italy	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	-0.09	-0.01	-0.08	0.03	0.13	0.12	0.08
Netherlands	0	0	-0.01	0	-0.01	0.05	0.02	0.02	0.01
Portugal	0	0	0	0	0	0.01	0	0	0
Spain	0	0	0	0	0	0	0	0	0
Sweden	0	0	-0.01	0	-0.01	0.01	0.01	0.01	0.01
UK	0	0	0	0	0	0.01	0.01	0.01	0.01
Cyprus	0	0	0	0	0	0	0	0	0
Czech rep	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0.01	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0
Malta	0	0	-0.01	0	-0.01	0	0.01	0.01	0.01
Poland	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0.01	0	0	0
Romania	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0
EU	**0.15**	**0**	**-0.07**	**-0.04**	**-0.01**	**-0.03**	**0.03**	**0.01**	**-0.01**

Table B3.2. Economic effects of reducing CIT in Germany compensated with Transfers to old

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	0.05	0.01	0.04	-0.14	-0.07	-0.06	-0.04
Belgium	0	0	0.03	0.01	0.02	-0.02	-0.03	-0.02	-0.01
Denmark	0	0	0.02	0	0.02	-0.06	-0.04	-0.03	-0.02
Finland	0	0	0.01	0	0.01	-0.04	-0.03	-0.02	-0.01
France	0	0	0.07	0.02	0.05	-0.05	-0.07	-0.05	-0.03
Germany	-18.5	-0.43	7.49	3.32	1.2	3.45	-2.12	-0.74	0.95
Greece	0	0	0	0	0	-0.02	0	0	0
Croatia	0	0	0.01	0	0.01	-0.06	-0.01	-0.01	-0.01
Ireland	0	0	-0.01	-0.01	0	-0.09	-0.01	-0.02	-0.01
Italy	0	0	0.02	0	0.02	-0.01	-0.02	-0.01	-0.01
Luxembourg	0	0	0.06	0.01	0.05	-0.04	-0.23	-0.22	-0.04
Netherlands	0	0	0.04	0.01	0.03	-0.15	-0.06	-0.05	-0.03
Portugal	0	0	0.01	0	0.01	-0.02	-0.01	-0.01	-0.01
Spain	0	0	0.03	0.01	0.02	-0.02	-0.03	-0.02	-0.01
Sweden	0	0	0.03	0	0.03	-0.06	-0.05	-0.04	-0.03
UK	0	0	0.02	0	0.02	-0.08	-0.03	-0.03	-0.02
Cyprus	0	0	0	0	0	-0.02	0	0	0
Czech rep	0	0	0.01	0	0.01	-0.08	-0.02	-0.01	-0.01
Estonia	0	0	0	0	0	-0.01	0	0	0
Hungary	0	0	0.03	0	0.03	-0.13	-0.03	-0.03	-0.03
Latvia	0	0	0	0	0	-0.02	0	0	0
Lithuania	0	0	0	0	0	-0.03	0	0	0
Malta	0	0	0.39	0.14	0.26	-0.47	-0.24	-0.17	-0.18
Poland	0	0	0.01	0	0.01	-0.05	-0.01	-0.01	-0.01
Slovakia	0	0	0.01	0	0.01	-0.05	-0.01	-0.01	-0.01
Slovenia	0	0	0	0	0	-0.03	-0.01	-0.01	-0.01
Bulgaria	0	0	0	0	0	-0.03	0	0	0
Romania	0	0	0	0	0	-0.03	0	0	0
USA	0	0	0.02	0	0.01	-0.01	-0.01	-0.01	-0.01
Japan	0	0	0	0	0	0	-0.01	0	0
EU	**-3.1**	**-0.07**	**1.28**	**0.56**	**0.22**	**0.54**	**-0.45**	**-0.17**	**0.17**

Table B3.3. Economic effects of homogenizing CIT in the EU compensated with Transfers to old

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	2.70	0.07	-1.13	-0.56	-0.14	-0.61	0.31	0.07	-0.2
Belgium	-6.30	-0.01	0.12	0.18	-0.03	0.1	-0.12	-0.06	0.12
Denmark	2.70	0.06	-0.87	-0.38	-0.08	-0.39	0.22	0.06	-0.15
Finland	3.20	0.07	-0.87	-0.4	-0.09	-0.39	0.26	0.08	-0.15
France	-9.40	-0.26	3.13	1.33	0.24	1.31	-0.71	-0.16	0.58
Germany	-3.30	-0.08	1.39	0.65	0.2	0.6	-0.37	-0.11	0.21
Greece	7.70	0.1	-1.88	-0.97	-0.37	-0.98	0.66	0.31	-0.23
Croatia	7.70	-0.04	0.56	0.16	0.05	0.03	0.03	0.09	0.04
Ireland	15.20	0.36	-6.19	-3.42	-1.06	-3.82	1.77	0.66	-0.94
Italy	-3.60	-0.02	0.35	0.21	0.08	0.18	-0.19	-0.09	0.05
Luxembourg	-1.10	-0.03	0.53	0.27	0.11	0.31	-0.26	-0.16	0.08
Netherlands	2.70	0.07	-0.62	-0.36	0	-0.46	0.13	0	-0.19
Portugal	-2.30	-0.03	0.57	0.24	0.1	0.22	-0.19	-0.1	0.05
Spain	-7.60	-0.26	4.26	2.12	0.58	1.93	-1.04	-0.31	0.72
Sweden	1.40	0.02	-0.37	-0.15	-0.05	-0.15	0.11	0.04	-0.04
UK	3.70	0.23	-2.81	-1.05	-0.26	-1.15	0.54	0.18	-0.41
Cyprus	17.70	0.26	-5.31	-2.58	-1.17	-3.16	1.67	0.79	-0.47
Czech rep	8.70	0.22	-3.56	-1.9	-0.55	-1.87	1.06	0.41	-0.46
Estonia	6.70	0.04	-0.3	-0.3	-0.05	-0.32	0.29	0.18	-0.1
Hungary	6.90	0.18	-2.99	-1.56	-0.46	-1.55	0.86	0.22	-0.47
Latvia	12.70	0.06	-1.26	-0.67	-0.33	-0.8	0.63	0.38	-0.1
Lithuania	12.70	0.08	-1.47	-0.83	-0.34	-0.87	0.73	0.45	-0.13
Malta	-7.30	-0.19	2.96	1.6	0.31	1.77	-0.65	-0.25	0.53
Poland	8.70	0.31	-5.28	-2.71	-0.95	-2.72	1.42	0.54	-0.7
Slovakia	8.70	0.06	-1.34	-0.71	-0.29	-0.84	0.54	0.27	-0.13
Slovenia	9.70	0.17	-2.42	-1.02	-0.36	-1.14	0.76	0.33	-0.28
Bulgaria	17.70	0.29	-5.75	-2.89	-1.25	-3.16	1.87	1.02	-0.5
Romania	11.70	0.2	-3.96	-1.97	-0.86	-2.14	1.24	0.54	-0.44
USA	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0
EU	**0**	**0.01**	**-0.24**	**-0.13**	**-0.08**	**-0.19**	**-0.02**	**0.02**	**0.05**

Table B3.1. Economic effects of raising CIT in Ireland compensated with government expenditure

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0.01	0.01	0.01	0
Finland	0	0	0.01	0	0.01	0.01	0.02	0.02	-0.01
France	0	0	0	0	0	0.01	0.01	0.01	0
Germany	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0
Croatia	0	0	0	0	0	0	0	0	0
Ireland	18.5	0.45	-6.48	-4.26	-0.1	-3.5	2.14	0.98	-2.28
Italy	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0.05	-0.01	0.05	0.16	0.14	0.14	-0.06
Netherlands	0	0	0.01	0	0.01	0.07	0.02	0.02	-0.01
Portugal	0	0	0	0	0	0.01	0	0	0
Spain	0	0	0	0	0	0.01	0.01	0.01	0
Sweden	0	0	0	0	0	0.02	0.01	0.01	0
UK	0	0	0	0	0	0.02	0.01	0.01	0
Cyprus	0	0	0	0	0	0	0	0	0
Czech rep	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0.01	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0.01	0.01	0.01	0
Poland	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0.01	0	0	0
Romania	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0
EU	**0.15**	**0**	**-0.05**	**-0.04**	**0**	**-0.02**	**0.03**	**0.02**	**-0.03**

Table B3.2. Economic effects of reducing CIT in Germany compensated with government expenditure

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	0	0	-0.02	0.01	-0.03	-0.21	-0.07	-0.08	0.03
Belgium	0	0	0	0.01	-0.01	-0.05	-0.03	-0.03	0.01
Denmark	0	0	-0.01	0	-0.02	-0.1	-0.04	-0.04	0.02
Finland	0	0	-0.02	0	-0.02	-0.06	-0.03	-0.03	0.02
France	0	0	0.01	0.02	-0.02	-0.11	-0.07	-0.07	0.02
Germany	-18.5	-0.43	6.4	3.36	0.14	2.41	-2.13	-0.99	1.92
Greece	0	0	0	0	0	-0.02	0	0	0
Croatia	0	0	0	0	0	-0.07	-0.01	-0.01	0
Ireland	0	0	-0.02	-0.01	-0.02	-0.1	-0.01	-0.02	0.01
Italy	0	0	0	0	0	-0.02	-0.02	-0.02	0
Luxembourg	0	0	-0.19	0.02	-0.2	-0.28	-0.24	-0.26	0.22
Netherlands	0	0	-0.02	0.01	-0.03	-0.21	-0.06	-0.07	0.03
Portugal	0	0	0	0	0	-0.03	-0.01	-0.01	0
Spain	0	0	0.01	0.01	-0.01	-0.05	-0.03	-0.03	0.01
Sweden	0	0	-0.01	0.01	-0.02	-0.11	-0.05	-0.05	0.02
UK	0	0	-0.01	0	-0.01	-0.11	-0.04	-0.04	0.02
Cyprus	0	0	0	0	0	-0.02	0	0	0
Czech rep	0	0	-0.01	0	0	-0.09	-0.02	-0.02	0
Estonia	0	0	0	0	0	-0.02	0	0	0
Hungary	0	0	0	0	0	-0.16	-0.03	-0.03	0
Latvia	0	0	0	0	0	-0.02	0	0	0
Lithuania	0	0	0	0	0	-0.03	0	0	0
Malta	0	0	0.17	0.15	0.04	-0.69	-0.25	-0.21	0.04
Poland	0	0	-0.01	0	0	-0.06	-0.01	-0.01	0
Slovakia	0	0	0	0	0	-0.06	-0.01	-0.01	0
Slovenia	0	0	0	0	0	-0.04	-0.01	-0.01	0
Bulgaria	0	0	-0.01	0	0	-0.03	0	0	0
Romania	0	0	0	0	0	-0.03	0	-0.01	0
USA	0	0	0.01	0	0	-0.02	-0.01	-0.01	0.01
Japan	0	0	0	0	0	0	-0.01	-0.01	0
EU	**-3.1**	**-0.07**	**1.07**	**0.57**	**0.02**	**0.34**	**-0.46**	**-0.23**	**0.39**

Table B3.3. Economic effects of homogenizing CIT in the EU compensated with government expenditure

	CIT_rate	CoC	Capital	Wage	Employm.	GDP	Rev_CIT	Rev_tax	Welfare
	pp	pp	%	%	%	%	% of GDP	% of GDP	% of GDP
Austria	2.70	0.07	-1.04	-0.56	-0.04	-0.52	0.31	0.09	-0.3
Belgium	-6.30	-0.01	0.04	0.18	-0.11	0.02	-0.12	-0.08	0.19
Denmark	2.70	0.06	-0.78	-0.38	0.01	-0.31	0.23	0.08	-0.24
Finland	3.20	0.07	-0.77	-0.41	0.02	-0.29	0.26	0.11	-0.26
France	-9.40	-0.26	2.87	1.34	-0.01	1.06	-0.72	-0.23	0.8
Germany	-3.30	-0.08	1.23	0.65	0.04	0.45	-0.37	-0.15	0.36
Greece	7.70	0.1	-1.42	-0.99	0.11	-0.51	0.67	0.41	-0.61
Croatia	7.70	-0.04	0.64	0.16	0.13	0.1	0.03	0.09	-0.06
Ireland	15.20	0.36	-5.29	-3.46	-0.08	-2.9	1.81	0.87	-1.87
Italy	-3.60	-0.02	0.22	0.21	-0.05	0.05	-0.19	-0.12	0.16
Luxembourg	-1.10	-0.03	0.34	0.27	-0.09	0.12	-0.27	-0.19	0.28
Netherlands	2.70	0.07	-0.61	-0.36	0.01	-0.46	0.13	0	-0.19
Portugal	-2.30	-0.03	0.45	0.25	-0.02	0.11	-0.19	-0.12	0.17
Spain	-7.60	-0.26	3.75	2.14	0.09	1.44	-1.06	-0.44	1.14
Sweden	1.40	0.02	-0.32	-0.15	0	-0.1	0.11	0.05	-0.09
UK	3.70	0.23	-2.61	-1.06	-0.04	-0.94	0.55	0.23	-0.65
Cyprus	17.70	0.26	-4.14	-2.63	0.08	-1.98	1.7	1	-1.43
Czech rep	8.70	0.22	-3.07	-1.92	-0.03	-1.37	1.08	0.48	-0.96
Estonia	6.70	0.04	-0.1	-0.31	0.16	-0.11	0.29	0.21	-0.33
Hungary	6.90	0.18	-2.68	-1.57	-0.14	-1.25	0.88	0.27	-0.75
Latvia	12.70	0.06	-0.68	-0.69	0.27	-0.22	0.64	0.49	-0.56
Lithuania	12.70	0.08	-0.88	-0.85	0.28	-0.27	0.74	0.56	-0.69
Malta	-7.30	-0.19	2.59	1.62	-0.06	1.41	-0.67	-0.32	0.89
Poland	8.70	0.31	-4.51	-2.75	-0.12	-1.93	1.46	0.7	-1.41
Slovakia	8.70	0.06	-0.94	-0.73	0.12	-0.45	0.54	0.36	-0.48
Slovenia	9.70	0.17	-2.04	-1.04	0.04	-0.75	0.77	0.4	-0.68
Bulgaria	17.70	0.29	-4.47	-2.94	0.13	-1.85	1.91	1.18	-1.76
Romania	11.70	0.2	-3.15	-2	0	-1.33	1.26	0.69	-1.12
USA	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0
EU	**0**	**0.01**	**-0.18**	**-0.13**	**0**	**-0.12**	**-0.02**	**0.01**	**0.03**

References

Bettendorf, L. and van der Horst, A. (2006), "Documentation of CORTAX", CPB Memorandum, No. 161, Netherlands Bureau for Economic Policy Analysis.

Bettendorf, L., van der Horst, A., de Mooij, R., Devereux, M and Loretz, S. (2009), "The economic effects of EU-reforms in corporate income systems", Study for the European Commission Directorate General for Taxation and Customs Union, Contract No. TAXUD/2007/DE/324, October.

European Commission (2015), "A Fair and Efficient Corporate Tax System in the European Union: 5 Key Areas for Action", COM(2015) 302 final, http://ec.europa.eu/taxation_customs/resources/documents/taxation/company_tax/fairer_corporate_taxation/com_2015_302_en.pdf

Sorensen, P.B., (2001), "OECDTAX - A Model of Tax Policy in the OECD Economy". Technical Working Paper, Economic Policy Research Unit, University of Copenhagen, November 2001.