# APPENDIX A: METHODOLOGY

The methodology used in this report is that proposed by Devereux and Griffith (1998). It has been widely used in the academic literature as well as by the European Commission and the OECD.

The approach is to consider the implications for corporate taxation of an increase in the capital stock and inventories of a business financed by a proportionate increase in each source of finance. Thus, each asset is increased in proportion to its existing weight in the capital stock, and the increase is financed by debt in proportion to the existing use of debt.

In this report, we analyse two tangible fixed assets, plant and machinery and buildings, intangible assets and inventories. We use data from the annual reports of just under 300,000 European companies from the ORBIS database to identify appropriate weights for each asset. Details of this procedure are described in Devereux and Loretz (2008). The weights used are based on the average size of each asset in these companies, and the average use of debt. The resulting weights are as follows.

| | |
|---|---|
| Plant and Machinery | 25.6% |
| Buildings | 24.0% |
| Intangible assets | 8.7% |
| Inventories | 41.7% |
| | |
| Proportion financed by debt | 35.0% |

To calculate the effective average tax rate (EATR), we identify the cash flows associated with a one-period investment in a composite of the four assets, financed by debt and equity[12], where we assume a given rate of return on the composite investment. Applying the tax allowances and rates described below allows us to calculate the pre-tax and post-tax net present value of the investment in each country. Devereux and Griffith (1998) define a measure of the EATR to be the difference between the two scaled by the present value of the income stream. This measure has the property that it is equal to the EMTR (defined below) for an investment that just breaks even, but tends towards the statutory tax rate as the rate of profit increases.

To calculate the effective marginal tax rate (EMTR) we analyse the same investment. However, instead of fixing a rate of profit and calculating the net present value, we instead identify the rate of profit that would be required for the investment to break even in the

[12] We do not analyse personal taxes, and so the treatment of retained earnings and new equity issues is the same.

presence and absence of tax - that is the cost of capital. In the absence of taxation, the cost of capital is the sum of the required financial rate of return (or discount rate) and the depreciation rate of the composite asset. The cost of capital is typically raised by introducing tax. We define the EMTR to be the change in the cost of capital arising from introducing the tax, expressed as a proportion of the cost of capital in the absence of tax.

This procedure requires values of several parameters. We fix these to be the same across all countries, so that differences in effective tax rates depend only on differences in tax regimes. The values chosen here are similar to those used elsewhere in the literature, notably by the European Commission;[13] this makes our estimates comparable with those used elsewhere. The values are as follows.

Economic deprecation rate (declining balance rate)

| | |
|---|---|
| Plant and Machinery | 17.5% |
| Buildings | 3.1% |
| Intangible assets | 15.35% |
| Inflation rate | 2.5% |
| Real discount rate | 5% |
| Pre-tax rate of return (for EATR only) | 20% |

Information on statutory tax regimes was collected primarily from country tax reports of the International Bureau of Fiscal Documentation. This was supplemented from other sources, in particular Devereux et al (2010) and various issues of the Ernst and Young Worldwide Corporate Tax Guide. As far as possible we identify the tax regime in place on 1st January of each year.

We use data on the main rate of corporation tax at national and sub-national levels, including information on whether one is deductible in calculating the other. We use information on capital allowance rates for the different assets.

To make comparisons as fair as possible between countries, we attempt to identify the tax treatment in each country of three specific assets: an item of plant and machinery deemed to have a useful life of 7 years; an industrial building deemed to have a useful life of 25 years; and the purchase of a patent deemed to have a useful life of 10 years. This is again the same approach as used in studies for the European Commission.[14] Definitions of acceptable allowances vary considerably between countries. In some cases there is a clear acceptable rate – in January 2011, for example, the UK permitted a 20% declining balance rate of plant and machinery, a 1 percent straight line rate of industrial buildings and a 25 percent declining balance rate for the purchase of a patent. However, many

13 See Devereux et al (2010).

14 See Devereux et al (2010).

countries offer more elaborate schedules, and some rely on the notion of the useful life of the asset for tax purposes: hence the need to define this for the assets we model.

Finally, we also record the acceptable valuation of inventories in each country. The UK tax system, for example, uses the FIFO method which implies that increases in the price of inventories between periods are subject to tax.

In all cases where there is some choice within the tax regime, we assume that the company would use the most tax advantageous approach.

We do not record the entire dataset of tax rates and allowances here. These data are available on the CBT website at www.sbs.ox.ac.uk/centres/tax/Pages/Reports.asp.

# APPENDIX B:

**Ranking of capital allowances for investment in each fixed asset, 2012.**

| Ranking | Country | Capital allowances plant and machinery (%) | Ranking | Country | Capital allowances industrial buildings (%) | Ranking | Country | Capital allowances intangibles (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | Netherlands | 96.5 | 1 | Greece | 67.9 | 1 | Italy | 96.5 |
| 2 | Canada | 96.5 | 2 | Belgium | 65.0 | 2 | Switzerland | 90.4 |
| 3 | Greece | 92.1 | 3 | Slovak Republic | 64.9 | 3 | Belgium | 86.8 |
| 4 | South Korea | 92.1 | 4 | India | 61.1 | 4 | Slovak Republic | 86.8 |
| 5 | South Africa | 91.9 | 5 | Spain | 55.1 | 5 | Luxembourg | 86.8 |
| 6 | Portugal | 88.7 | 6 | Switzerland | 55.1 | 6 | Poland | 86.8 |
| 7 | Turkey | 87.8 | 7 | South Africa | 54.3 | 7 | France | 86.8 |
| 8 | United States | 87.3 | 8 | Indonesia | 54.3 | 8 | Hungary | 86.8 |
| 9 | Czech Republic | 87.2 | 9 | Mexico | 54.3 | 9 | Germany | 86.8 |
| 10 | Luxembourg | 87.1 | 10 | China | 54.3 | 10 | Sweden | 85.8 |
| 11 | Slovenia | 86.8 | 11 | Portugal | 54.3 | 11 | Czech Republic | 84.0 |
| 12 | Israel | 86.8 | 12 | South Korea | 54.3 | 12 | Spain | 83.3 |
| 13 | Slovak Republic | 86.8 | 13 | Israel | 54.3 | 13 | India | 82.5 |
| 14 | Spain | 86.5 | 14 | France | 54.3 | 14 | **United Kingdom** | **82.5** |
| 15 | Russia | 86.2 | 15 | Czech Republic | 54.2 | 15 | Denmark | 81.1 |
| 16 | Iceland | 85.8 | 16 | Russia | 52.7 | 16 | Iceland | 80.6 |
| 17 | Sweden | 85.8 | 17 | Finland | 51.5 | 17 | Japan | 78.4 |
| 18 | Switzerland | 85.8 | 18 | Australia | 47.5 | 18 | Israel | 78.4 |
| 19 | France | 85.8 | 19 | Turkey | 47.5 | 19 | Netherlands | 73.5 |

| Ranking | Country | Capital allowances plant and machinery (%) | Ranking | Country | Capital allowances industrial buildings (%) | Ranking | Country | Capital allowances intangibles (%) |
|---|---|---|---|---|---|---|---|---|
| 20 | Australia | 85.0 | 20 | Brazil | 47.5 | 20 | Finland | 73.5 |
| 21 | Finland | 82.5 | 21 | Ireland | 47.5 | 21 | Brazil | 73.5 |
| 22 | Denmark | 82.5 | 22 | Denmark | 47.5 | 22 | Slovenia | 73.5 |
| 23 | Hungary | 82.3 | 23 | Sweden | 47.5 | 23 | Austria | 73.5 |
| 24 | Belgium | 82.2 | 24 | Luxembourg | 47.5 | 24 | Ireland | 73.5 |
| 25 | Austria | 81.1 | 25 | Iceland | 47.4 | 25 | South Korea | 73.5 |
| 26 | Saudi Arabia | 79.5 | 26 | Italy | 45.8 | 26 | New Zealand | 73.5 |
| 27 | Ireland | 78.4 | 27 | Saudi Arabia | 41.1 | 27 | China | 73.5 |
| 28 | **United Kingdom** | **77.9** | 28 | Slovenia | 38.7 | 28 | Mexico | 73.5 |
| 29 | Norway | 77.9 | 29 | Austria | 38.7 | 29 | Portugal | 73.5 |
| 30 | Japan | 76.7 | 30 | Germany | 38.7 | 30 | Greece | 73.5 |
| 31 | Italy | 75.7 | 31 | Norway | 37.0 | 31 | Norway | 73.5 |
| 32 | Brazil | 73.5 | 32 | Canada | 35.7 | 32 | Argentina | 73.5 |
| 33 | Mexico | 73.5 | 33 | United States | 34.6 | 33 | Russia | 73.5 |
| 34 | China | 73.5 | 34 | Chile | 33.4 | 34 | Indonesia | 66.8 |
| 35 | Argentina | 73.5 | 35 | Netherlands | 33.4 | 35 | United States | 62.9 |
| 36 | Poland | 73.5 | 36 | Poland | 33.4 | 36 | Turkey | 62.8 |
| 37 | Germany | 73.5 | 37 | New Zealand | 30.4 | 37 | Saudi Arabia | 58.9 |
| 38 | New Zealand | 72.9 | 38 | Argentina | 27.5 | 38 | South Africa | 54.3 |
| 39 | India | 71.4 | 39 | Japan | 27.5 | 39 | Australia | 54.3 |
| 40 | Indonesia | 66.8 | 40 | Hungary | 27.5 | 40 | Canada | 51.5 |
| 41 | Chile | 62.8 | 41 | **United Kingdom** | **0.0** | 41 | Chile | 0.0 |