

2 Methodology

2.1 The European Tax Analyzer Model

The European Tax Analyzer is a computer program for a model firm that calculates and compares effective average tax burdens for companies located in different jurisdictions.¹ The current version covers the tax systems of 27 member states. Since the standard model firm is designed as a corporation, the effective average tax burden can be calculated at the level of the corporation as well as at the level of the shareholders. This study will exclusively consider the effective average tax burden at the corporate level. The effective average tax burden is derived by simulating the development of a corporation over a ten year period. For the computation of the effective average tax burden the model uses the economic data of the corporation and tax data as inputs.

The European Tax Analyzer Model was approved in an earlier study for the European Commission (see Jacobs & Spengel, 2002). The following description therefore highlights only the basic assumptions and the most recent amendments to this approach. The European Tax Analyzer calculates and compares effective average tax burdens for companies over a period of ten years. The development of the corporation is based on the initial capital stock and estimates for its future development (corporate planning).

Initial capital stock: The capital stock includes the firm's total assets and liabilities which are either new or have already existed before. The assets consist of real estate, office and factory buildings, plant and machinery, office equipment, intangibles (patents and royalties), financial assets, shares in other corporations (both domestic and foreign), inventories, trade debtors, cash funds and deposits. The liabilities include new equity capital, long-term and short-term debt, and trade creditors.

Development of capital stock: Corporate planning furnishes data about the expected development of the capital stock over the simulation period of ten years. Estimates are based on periodical assumptions for production and sales, acquisition of goods, staff expenditure (e.g. number of employees, wage per employee and pension costs), other receipts and expenses (e.g. expenses for

¹ For detailed descriptions of the model see Spengel, 1995; Jacobs and Spengel, 1996; Meyer, 1996; Stetter, 2005; Gutekunst, 2005; Hermann, 2006.

R&D), investment, distribution and costs of financing. Goods are assumed to be either stocked or sold on the market in the same period as they are produced. Therefore, multi-period production is possible. Additional assumptions are made for material and labour with regard to production costs. It is further assumed that depreciable assets (i.e. buildings, plant and machinery, office equipment and intangibles) are run down at the end of their expected economic life. Reinvestments in new assets are made at that point based on the historical costs of the deposited assets adjusted for inflation. The model's assumptions regarding investment make sure that the initial capital stock at least remains constant. In addition to differing rates of price increases, other macro-economic data considered are credit and debit interest rates, exchange rates for the given countries and the costs of energy and electricity.

Corporate finance: The initial capital stock contains new equity as well as both long and short term debt capital. Since the corporate plans, *inter alia*, make assumptions about the distribution policy, the company can be financed by retained earnings (e.g. the distribution rate is below 100%) in addition to new equity and debt financing. If the national tax codes allow for internal book reserves (e.g. book reserves for bad debts), the money put into these reserves can also serve as a source of internal financing.

For the sake of comparability, it is assumed that the model firm always shows identical data before any taxation. Due to this necessary assumption any differences between pre- and post-tax data in the model can be solely attributed to the applied national taxation rules.

2.2 Computation of the Effective Average Tax Burden

The measures for tax base and for tax burden are expressed in currency units. The effective tax burden is the difference between the pre-tax and post-tax value of the firm at the end of the simulation period (i.e. period 10). The value of the firm is represented by the equity, which includes the capital stock and the cumulative net income of each of the ten periods. At the end of period 10, the tax value of assets and liabilities may differ from their fair value, depending on the tax rules which are to be applied. These hidden reserves and liabilities are added to the taxable income in period 10 and are taxed accordingly. As a consequence, only the effects of different tax accounting rules on the liquidity are taken into account. Remaining loss carry forwards at the end of the simulation are dissolved liquidity-related whereas a devaluation of 50 per cent is made if there are no restrictions for the use of loss carry forwards and a devaluation of 75 per cent if there are any restrictions. The computation of the absolute effective average tax burden requires two steps.

In the *first step*, the pre-tax value of the firm at the end of the simulation period is calculated. The pre-tax value of the firm is derived from the estimated cash flows and the value of the net assets at the end of the simulation period. The cash flows are derived from estimates for the cash receipts (sales and other receipts, gains upon the disposal of assets, interest and dividend income) and expenses

(wages and pension payments, expenses for material, energy consumption and other expenses, new investment, interest expenses and distributed profits) covered by the corporate planning model. The cash flow (= liquidity) is calculated in each period. Thereby it is assumed that any given amount of surplus cash flow at the end of a single period can be invested at a given interest rate and any given deficit can be covered by borrowing money at a given debit rate (balancing investment or credit). The interest receipts or expenses plus the amount of the underlying balancing investments or credits are considered for the calculation of the cash flow in the following period. The value of the net assets at the end of the simulation period is computed by deducting the liabilities of the corporation from the assets. Both the assets and the liabilities are valued at calibrated parameters that are the same in each country. For assets we use replacement prices and for liabilities nominal values.

	Pre-tax cash flow at the end of the simulation period
+	Value of the net assets at the end of the simulation period (= assets in the capital stock at replacement prices
–	Liabilities in the capital stock at nominal values)
=	Pre-tax value of the firm at the end of the simulation period

In the *second step*, we calculate the post-tax value of the firm at the end of the simulation period. The determination of the post-tax value of the firm only has cash flow effects and no impact on the value of the net assets. The post-tax cash flow is derived in each period by deducting the tax liabilities from the pre-tax cash flow. In order to calculate the absolute amount of tax liabilities, receipts and expenses are entered into the tax balance sheet and/or into the tax profit and loss account following national taxation rules (e.g. regarding the computation of depreciation allowances). After having applied the national tax rates, we allow for other relevant components such as loss carryovers and tax credits in order to come to the amount of tax liabilities. The reduction of the cash flow due to tax payments (liabilities) also has an impact on the balance of investment and credit and the connected interest receipts or payments. By taking into account these tax-induced effects on the interest income or expense of each period, the deferral of tax payments is integrated into the model. Hidden reserves and liabilities are only relevant for taxation matters at the very end of the simulation.

	Pre-tax cash flow at the end of the simulation period
–	Tax liabilities in each period
=	Post-tax cash flow at the end of the simulation period
+	Value of net assets at the end of the simulation period (= assets in capital stock at replacement prices
–	Liabilities in capital stock at nominal values)
– / +	Tax liabilities on hidden reserves / tax refunds on hidden liabilities
=	Post-tax value of the firm at the end of the simulation period
	Pre-tax value of the firm at the end of the simulation period
–	Post-tax value of the firm at the end of the simulation period
=	Effective average tax burden

In contrast to models which compute tax burdens solely based on pre-tax returns (yields),² calculations based on cash receipts and cash expenses regarding balancing investments allow for the entire computation of all tax bases at any time during the period of simulation (because all relevant income and assets have been entered into the tax base). As a consequence, the model can include complicated tax provisions such as progressive tax rates, tax credits (e.g. for foreign taxes) with upper ceilings, and loss carryovers without any difficulty.

2.3 Tax Parameters Incorporated into the Model

The tax base and the effective average tax burden are calculated for the EU-27 member states. In order to calculate the tax liability in each country, the European Tax Analyzer takes into account all taxes that may be influenced by the investments and financing at the level of the corporation (see [Table 5](#)).

Table 5: Considered Taxes

	Real Estate Tax	Payroll Tax	Trade Tax on Income/ Value Added	Trade Tax on Capital	Net Wealth Tax	Corporate Tax (incl. Surcharges)
AT	√	√				√
BE	√					√
BG	√					√
CY	√	√				√
CZ	√					√
DE	√		√			√
DK	√					√
EE	√					√
ES	√			√		√
FI	√					√
FR	√	√		√		√
GR	√					√
HU	√		√			√
IE	√					√
IT	√		√			√
LT	√					√
LU	√		√		√	√
LV	√					√
MT						√
NL	√					√
PL	√					√
PT	√					√
RO	√					√
SE	√					√
SK	√					√
SL		√				√
UK	√					√

² See Schreiber, Spengel and Lammersen, 2002.

A detailed description of the tax parameters is not given here. They are instead explained in detail in section 3.2, where the tax burdens of different countries are compared with each other.

When calculating the tax bases, the most relevant assets and liabilities and the effects of the corporate planning are considered. Furthermore, the tax module allows the selection of several accounting options (tax electives) by which a company can influence its taxable profits. The following elements are considered for profit computation:

1. Depreciation (methods and tax periods for all considered assets, extraordinary depreciation)
2. Inventory (stock) valuation (production costs, FIFO, LIFO and the average costs method, inflation reserves)
3. Research and development costs (immediate expensing or capitalisation)
4. Taxation of capital gains (roll-over relief, inflation adjustment, special tax rates)
5. Employee pension schemes (deductibility of pension costs, contributions to pension funds, book reserves)
6. Provisions for bad debts
7. Guarantee accruals
8. Elimination and mitigation of double taxation on foreign source income (exemption, foreign tax credit, deduction of foreign taxes)
9. Loss relief

Finally, with regard to tax rates, the calculations consider statutory linear as well as progressive tax rate structures. In the case of progressive rates – relevant for special provisions for SMEs in some countries – the tax rates enter into the model as functions of the relevant income or net assets (non-profit taxes) according to tax laws.

2.4 Measurement of the Impact of Elements of a CCTB on the Size of the Tax Base

The major aim of the study is to measure the impact of a CCTB on the size of the tax bases in the EU member states. In the following section, the measurements used to quantify this impact are introduced. A simplifying example for a change from national tax accounting (GAAP) to a CCTB is considered in a 4-period setting. The national GAAP is represented by accelerated depreciation whereas the CCTB would prescribe straight line depreciation.

The impact on the size of the tax base in per cent can be written as follows:

$$\text{Impact on tax base (in \%)} = \frac{\text{Tax Base (CCTB)} - \text{Tax Base (Nat.GAAP)}}{\text{Tax Base (Nat.GAAP)}}.$$

There are basically two possible measures to account for the *size of the tax base*. First, one could take the accumulated sum of tax bases over the considered 4 periods. Expressed as a formula, it can be written as:

$$\text{Sum of Tax Base} = \sum_{t=1}^4 \text{Tax Base}_t.$$

Second, one could consider the future value of the tax bases over the considered 4 periods. The *future value* is one of the most commonly used financial measures to assess and evaluate economic problems which have time as a dimension. The definition of the future value is derived as follows: The future value of the tax base is the sum of all periodical tax bases in period 4 (the last period) valued with the nominal interest rate i . Expressed as formula it can be written as:

$$\text{Future Value} = \sum_{t=1}^4 \text{Tax Base}_t * (1+i)^{T-t}.$$

To clarify: in contrast to the described future value the so called *present value* would consider the discounted sum of the tax bases at the beginning of period 1. In the following, in accordance with the design of the European Tax Analyzer, the impact of a change in tax accounting rules from national GAAP to a CCTB is measured in the last period and therefore the future value is used.³

The difference between the sum of tax bases and the future value of the tax base is the precise valuation of timing effects. These effects arise, for example, if a tax base in earlier periods is higher than in later periods.

The following example illustrates these findings. For the sake of clarity, the underlying assumptions are simplified here.⁴ An identical investment with the two different depreciation rules mentioned above (national GAAP: accelerated depreciation with first-year allowance; CCTB: straight line depreciation) is considered here. The investment consists of the acquisition of machinery which generates declining income receipts (€1100, €800, €600, €400) over the useful life of 4 periods. The acquisition costs of machinery shall amount to €1000 and are depreciable in total. In this example we assume an interest rate of 10% for cash flow available for investment (liquidity) in order to gain distinct results. The future value of the tax base is obtained by valuating the tax base of each period with an interest rate of 10%.

In the first example, the corporate income tax rate is 0% (i.e. no tax is levied). Thus, to illustrate the influence of the temporal distribution of the tax base, we oppose national GAAP (accelerated depreciation, see [Table 6](#)) to a CCTB option (straight line depreciation, see [Table 7](#)). The visualization of financial implications reveals for the calculus in the absence of tax an unequal distribution of the periodical tax bases, due to the different methods of depreciation. In the absence of taxation, the liquidity is not affected by different depreciation regimes as depreciation itself does not affect cash flows.

³ Present values are provided in Appendix 6.

⁴ The calculations in section III are then based on a 10-period approach using the European Tax Analyzer Model. Moreover, the calculations take into account the existing national tax accounting rules and the CCTB options agreed upon with the Commission.

Table 6: National GAAP, accelerated depreciation (case without tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	110	201	281
Depreciation		1,000	0	0	0
Tax base (corporate income tax)		100	910	801	681
Sum of tax base over time					2,492*
Future value of the tax base					2,796**
Tax payment		0	0	0	0
Cash flow available for investment after taxation		1,100	910	801	681
Future value of the investment		1,100	2,010	2,811	3,492

* $2,492 = 100 + 910 + 801 + 681$ | ** $2,796 = 100 * 1.331 + 910 * 1.21 + 801 * 1.1 + 681$ (with $1.331 = 1.1^3/1.21 = 1.1^2/1.1 = 1.1^1$)

Table 7: CCTB option, straight line depreciation (case without tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	110	201	281
Depreciation		250	250	250	250
Tax base		850	660	551	431
Sum of tax base over time					2,492
Future value of the tax base					2,967
Cash flow available for investment		1,100	910	801	681
Future value of the investment		1,100	2,010	2,811	3,492

Therefore, cash flows available for investment and interest receipts earned on the cumulative income of the previous period are the same in both cases. In addition, when calculating without tax, both depreciation regimes lead to the same sum of tax base over time (= €2,492). The future value of the tax base, in contrast, differs due to the depreciation methods considered (national GAAP: €2,796 vs CCTB: €2,967). This difference only fails to have financial consequences in a case with a tax rate of 0%. As such a case cannot be observed within the EU-27 member states, a corporate tax rate of 25% is introduced in the next example.

If corporate income tax is levied, the amount of depreciation and therefore the size of the tax base in each period affect tax payments and, thus, liquidity. As a first result, the comparison of the case with and without tax (Tables 6–9) indicates that the sum of tax base and the future value of the tax bases change (e.g. national

GAAP, 0% corporate tax rate: €2,492/€2,796 vs 25% corporate tax rate: €2,417/€2,718).

Focusing now on a comparison of Table 8 and Table 9 in period 1, the tax base and the corresponding tax payments are lower under national GAAP than the CCTB option. A lower cash outflow of tax payments under national GAAP is associated with higher liquidity available for investments.

Table 8: National GAAP, accelerated depreciation (case with 25% income tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	108	176	234
Depreciation		1,000	0	0	0
Tax base		100	908	776	634
Sum of tax base over time					2,417
Future value of the tax base					2,718
Tax payment		25	227	194	158
Cash flow available for investment		1,075	681	582	475
Future value of the investment		1,075	1,756	2,337	2,813

Table 9: CCTB option, straight line depreciation (case with 25% income tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	89	162	225
Depreciation		250	250	250	250
Tax base		850	639	512	375
Sum of tax base over time					2,375
Future value of the tax base					2,842
Tax payment		213	160	128	94
Cash flow available for investment		888	729	634	531
Future value of the investment		888	1,617	2,250	2,782

Consequently, the resulting tax deferral gives rise to an increase in interest receipts in consecutive periods. This results in a higher sum of tax base over time (national GAAP: €2,417 vs CCTB option: €2,375). Therefore, one could conclude that the introduction of the CCTB option would reduce the size of the tax base and thus would indicate an advantage for investments. But this conclusion turns out to be misleading: In fact the future value of the tax base is lower under national GAAP (= €2,718 vs €2,842) as the investment is depreciated earlier and the

resulting timing effects are captured in the future value. Therefore, the CCTB option turns out to be disadvantageous from an investment perspective. This clearly shows that the sum of tax base over time is not an appropriate measure for capturing the size of the tax base.

The impact of different CCTB options on the size of the tax base in this study is therefore measured as:

$$\text{Impact on tax base (in \%)} = \frac{\text{FutureValue}_{\text{Tax Base, CCTB}} - \text{FutureValue}_{\text{Tax Base, Nat. GAAP}}}{\text{FutureValue}_{\text{Tax Base, Nat. GAAP}}}.$$

Next, the relation between the future value of the tax base (i.e. impact on the size of the tax base) and the effective average tax burden is considered. The effective average tax burden is based on the future value of an investment instead of the future value of the corporate tax base (for a detailed description, see section 2.2 above). It is defined as the difference between the future value of the investment before (pre-tax) and after tax (post-tax). The effective tax burden is a more comprehensive measure as it also accounts for elements not included in the corporate income tax base, such as non-deductible taxes and other non-deductible elements.

The impact in per cent of different elements of a CCTB on the tax burden can be written as follows:

$$\text{Impact on tax burden (in \%)} = \frac{(\text{FutureValue}_{\text{Invest., Pre tax}} - \text{FutureValue}_{\text{Invest., CCTB}}) - (\text{FutureValue}_{\text{Invest., Pre tax}} - \text{FutureValue}_{\text{Invest., Nat. GAAP}})}{\text{FutureValue}_{\text{Invest., Pre tax}} - \text{FutureValue}_{\text{Invest., Nat. GAAP}}}$$

As the effective tax burden is based on the future value of the investment, tax-induced timing effects through tax payments and resulting liquidity effects through interest income are taken into account.

When the modeled impact on the future value of the tax base is compared to the impact on the effective tax burden, it becomes clear that the direction of change is the same. In the example with a 25% corporate tax, both measures indicate an increase of 4.56% of either the tax base or the effective tax burden (see Table 6). That means, no matter which measurement is used, the impact is generally exactly the same. The respective values in Table 10 are taken from the tables above (period 4).

Since several countries do not only levy corporate income taxes but also non-profit taxes like real estate tax or other taxes on capital, the following example assesses the impact of non-profit taxes on both the future value of the tax base and the effective tax burden.

In this third example, a capital tax on real estate of 5% in addition to a corporate income tax of 25% are considered. Real estate is valued at €2,000 and, thus, the tax amounts to €100. The real estate tax shall be deductible for the purpose of the corporate income tax. All other assumptions are left unchanged.

Table 10: Comparison of impact assessed with effective tax burden and impact assessed with future value of the tax base (case with 25% income tax; post-tax)

Effective Tax Burden					
	Pre-tax value (in €)	Post-tax value (in €)	Effective tax burden (in €)	Delta effective tax burden (in €)	in %
Immediate full depreciation	3,492	2,813	680		
Straight line depreciation	3,492	2,782	711	31	4.56

Future Value of the Tax Base					
	Post-tax value (in €)	Effective deviation of future value (in €)			
Immediate full depreciation	2,718				
Straight line depreciation	2,842	124			4.56

Table 11: National GAAP, accelerated depreciation (case with 25% income tax and 5% real estate tax; post-tax including capital tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	100	160	210
Depreciation		1,000	0	0	0
Capital tax		100	100	100	100
Tax base (corporate income tax)		0	800	660	510
Tax base over time					1,970
Future value of the tax base					2,204
Income tax payment		0	200	165	127
Capital tax payment		100	100	100	100
Cash flow available for investment after taxation		1,000	600	495	382
Future value of the investment		1,000	1,600	2,095	2,477

Table 11 shows the results for national GAAP (accelerated depreciation) and Table 12 shows the results for the CCTB option (straight line depreciation). It is now possible to calculate the indicated impacts based on the respective measures future value of the tax base and effective tax burden (see Table 13). The respective values in Table 13 are taken from the tables above (period 4).

Table 12: CCTB option, straight line depreciation (case with 25% income tax and 5% real estate tax; post-tax including capital tax; in €)

Period	0	1	2	3	4
Capital expenditure on depreciable asset	-1,000				
Receipts		1,100	800	600	400
Interest receipts		0	81	146	201
Depreciation		250	250	250	250
Capital tax		100	100	100	100
Tax base		750	531	396	251
Tax base over time					1,928
Future value of the tax base					2,328
Income tax payment		188	133	99	63
Capital tax payment		100	100	100	100
Cash flow available for investment		813	648	547	438
Future value of the investment		813	1,461	2,008	2,446

Table 13: Comparison of impact assessed with effective tax burden and impact assessed with future value of the tax base (case with 25% income tax and 5% capital tax on real estate; post-tax)

Effective Tax Burden (Case with Capital Tax)					
	Pre-tax value (in €)	Post-tax value (in €)	Effective tax burden (in €)	Delta effective tax burden (in €)	in %
Immediate full depreciation	3,492	2,477	1,015		
Straight line depreciation	3,492	2,446	1,046	31	3.06
Future Value of the Tax Base (Case with Capital Tax)					
	Post-tax value (in €)	Effective deviation of future value (in €)		in %	
Immediate full depreciation	2,204				
Straight line depreciation	2,328	124			5.63

Table 10 (case without capital tax) and **Table 13** (case with 5% capital tax) reveal the following: In a setting without capital tax and a proportional corporate income tax, the impact of different rules for tax accounting on the effective tax burden and the future value of the tax base is the same. Both show an increase of 4.56%. With a capital tax, by contrast, a change from accelerated to straight line depreciation increases the effective tax burden by only 3.06%, whereas the future value of the tax base rises 5.63%. This different indication of the impact is due to a base effect. The absolute change in the effective tax burden (€31) and in the future value of the tax base (€124) is the same in both with and without capital tax

(see Table 10 and Table 13). Yet the bases to calculate the change in per cent are affected differently by the introduction of a capital tax into the analysis. The tax base declines (from €2,718 to €2,204), since the capital tax is deductible as a business expense in each period. The effective tax burden, however, increases (from €680 to €1,015) since the capital tax is part of the tax burden and thus increases the tax due on the investment.

As a result for our analysis, thus, it can be expected that countries which have an important share of non-profit taxes, will show a lower impact of a tax base broadening regulation (like the switch from accelerated to straight line depreciation) when the impact is calculated using the measure effective tax burden; but it will show a stronger impact when the impact is calculated using the measure future value of the tax base, compared to a country which has only corporate income tax. The direction of the impact in both cases is, however, the same (positive in our example).

The above findings are summarised as follows:

First, the sum of tax base over time is not an appropriate measure for analysing the effects of changes in tax accounting rules as it disregards the timing effects of taxation.

Second, measuring in terms of the effective tax burden and future value of the tax base capture comprehensively the effects of the considered CCTB options. Consequently, it is appropriate to use these measures in the analysis. It has to be kept in mind that all elements of a CCTB except loss carry forward and participation exemption for dividends will have timing effects.

Third, both indicators – the impact based on the future value of the tax base and the impact based on the effective tax burden – show a very similar change due to changes in tax accounting rules, if there is only corporate income tax with a proportional tax rate. When non-profit taxes are considered in addition, the indicated impact in per cent, when measured in terms of the effective tax burden, is different than the impact in per cent measured in terms of the future value of the tax base.

Therefore, in addition to the effective tax burden, the study will evaluate the impact of a CCTB on the size of the tax bases by measuring the change in the future value of the tax base as follows:

$$\text{Impact on tax base (in \%)} = \frac{\text{FutureValue}_{\text{Tax Base, CCTB}} - \text{FutureValue}_{\text{Tax Base, Nat. GAAP}}}{\text{FutureValue}_{\text{Tax Base, Nat. GAAP}}} .$$

2.5 Model Firms and Data Base

2.5.1 Structure of the Model Firms and Economic Assumptions

Various assumptions have to be made in order to define and describe the model firms analysed in this report, in addition to the economic conditions which are assumed to prevail. These assumptions are presented in the following section.

In this study two model firms – one large company and one SME – are implemented into the model. These firms represent EU-27 average companies. As such, country and industry-specific effects on pre-tax data are ignored, meaning that balance sheet, profit and loss accounting and corporate planning are not dependent on country-specific taxation rules. The data determining the implemented model firms were mainly taken from the AMADEUS database (see section 2.5.2).

Table 14: Balance sheets of the implemented EU-27 model firms (period 6, in €)

Assets	SME	Large	Liabilities	SME	Large
I. Fixed assets	1,273,098	49,641,583	I. Shareholder funds	1,254,419	43,415,131
1. Intangible fixed assets	74,800	2,875,872	1. Capital	420,924	18,207,742
2. Tangible fixed assets	1,085,961	37,793,443	2. Other shareholder funds	833,495	25,207,389
3. Other fixed assets	112,337	8,972,268	II. Non-current liabilities	747,802	27,433,693
			1. Long-term debt	469,217	21,248,099
			2. Other non-current liabilities	278,585	6,185,594
II. Current assets	2,985,322	76,792,466	III. Current liabilities	2,256,199	55,585,225
1. Stocks	877,820	22,936,037	1. Loans	469,217	21,248,099
2. Debtors	1,433,559	15,945,781	2. Creditors	935,447	10,070,619
3. Other current assets	673,943	37,910,648	3. Other current liabilities	851,535	24,266,507
Total	4,258,420	126,434,049	Total	4,258,420	126,434,049

Table 14 shows the balance sheets of the model firms at the end of year 6 (the mid-point of the 10 year comparison). The balance sheets depict the different types of assets (investments) and their sources of financing. Table 14 also highlights the relative weight of these investments and the sources of finance.

The balance sheets of the model firms and their sales figures as well as the amount and structure of expenses at the end of year 6 give the model firms a unique set of characteristics, as expressed by the common financial ratios in Table 15.

Table 15: Financial ratios of the implemented EU-27 model firms (period 6)

	Average EU-27 SME	Average EU-27 large company
Profit/loss for period (€)	194,624	4,124,827
Total assets (€)	4,258,420	126,434,049
Sales (€)	7,167,799	159,457,817
Share of tangible fixed assets (%)	25.50	29.89
Return on sales (%)	2.72	2.59
Return on equity (%)	15.52	9.50
Equity ratio (%)	29.46	34.34
Return on assets (%)	6.87	6.11
Inventories to capital (%)	20.61	18.14
Costs for personnel to turnover (%)	18.20	20.97

One must keep in mind that the above ratios are only valid for the EU-27 average model firms. The use of country and industry specific company data would produce different financial ratios.

Other important assumptions are as follows:

- Expected economic lifetime for assets: production buildings (50 years); office buildings (50 years); patents and concessions (5 years each); plant (4 years) and machinery (five assets are considered, 5 to 10 years); office furniture and fixtures (9 years); financial assets (all zero); stocks (zero).
- Rates of price increase: consumer price index (2.2%); price index for basic material (4.8%); price index for wages (0.8%); price index for investment goods (2.3%).⁵
- Interest rates for creditors and debtors: short term credit (3%); long term credit (3.9%); short term debt (5.9%); long term debt (5.1%).⁶

Since these assumptions in some cases do not represent the reality that individual companies captured by the AMADEUS database are faced with, it is unavoidable that the structure of the implemented EU model firms slightly differs from the EU-27 average model companies shown in Appendix 4. However, as the structure of the companies is very similar, significant distortions in the results can be ruled out.

2.5.2 Data Base and Applied Aggregation Methods

2.5.2.1 Financial Data Derived from the AMADEUS Database

Pre-tax financial data was extracted from AMADEUS database. The AMADEUS database provides financial and supplementary information for about 6.74 million companies in the European Union. Not all of these companies are included in the

⁵ See ECB, ECB and Eurostat calculations, 2006.

⁶ See ECB, MFI interest rate statistics, December 2006; OECD, Financial indicators MEI, 2006.

study, however. One reason for this is that the AMADEUS database also comprises companies with legal forms (e.g. partnerships) and in industries (e.g. mining) that are not relevant for the study. Furthermore, publicly owned companies are not addressed in the study, but are covered by the AMADEUS database. In addition, some companies have to be excluded because the minimum data set required for the study is not available (for further details see section 2.5.2.2). Altogether this leads to a reduction in the number of companies used in the study, in total 1,147,483 companies make up the relevant data sample (see Table 16).⁷

Table 16: Determination of the companies used in the study

Steps	Number
All companies in the AMADEUS database	6,636,823
Of this number, companies with relevant legal forms	6,192,918
Of this number, companies which are not publicly owned	6,182,972
Of this number, companies in relevant industries	4,539,415
Total companies with relevant data (= companies used in the study)	1,147,483

The determination of EU-average companies is based here on Update 125 of February 2005, comprising financial data for the years 1994-2004. The structure of the financial information in AMADEUS (income statement and balance sheet, with applicable annotations) is presented in Table 17. The study uses EU tax legislation in the 27 member states as of the year 2006. Although it would have been desirable to employ company data from 2006, the existing AMADEUS database version provides data only up to 2004. Furthermore, the data at hand is only adequate for the years up to and including 2003. Table 18 provides an overview of the data. In this pre-sample, no restrictions with regard to relevant industries are included.

Moreover, we have to take into account that data for 2002 and 2003 were negatively impacted by an economic downturn. Therefore, it was decided to base the calculations on financial data for 2001. The years 2002 and 2003 were characterised by weak economic activity (in these years the Ifo Economic Climate Indicator registered average quarterly values for the euro zone of 85.4 and 78.0, respectively).

⁷ The reported numbers cover companies belonging to the manufacturing, construction, commerce, service/trade and transport industries.

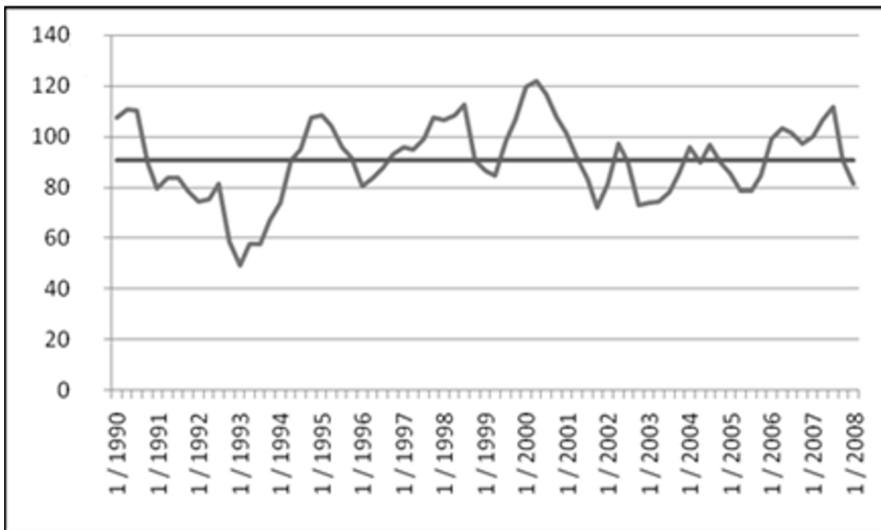
Table 17: Financial information in the AMADEUS database

Number	Items of the financial information according to the AMADEUS format	Annotation
Income Statement		
1	Operating Revenue	Turnover and stock movements as well as other capitalised costs
2	Sales	Turnover resulting from operative activities
3	Costs of goods sold	
4	Gross profit	1 – 3
5	Other operating expenses	
6	Operating profit/loss	4 – 5
7	Financial revenue	
8	Interest paid	
9	Other financial expenses	
10	Financial profit/loss	7 – 8 – 9
11	Profit/loss before tax	6+10
12	Taxation	Income taxes and other taxes
13	Profit/loss after tax	11 – 12
14	Extraordinary revenue	
15	Extraordinary expenses	
16	Extraordinary and other profit/loss	14 – 15
17	Profit/loss for period	13+16
Balance Sheet		
1	Fixed assets	2+3+4
2	Intangible fixed assets	
3	Tangible fixed assets	
4	Other fixed assets (incl. financial fixed assets)	Primarily consisting of shareholdings and other financial fixed assets
5	Current assets	6+7+8
6	Stocks	
7	Debtors	
8	Other current assets	
9	Total assets	1+5
10	Shareholders funds	11+12
11	Capital	
12	Other shareholder funds (incl. reserves)	
13	Non-current liabilities	14+15
14	Long-term debt	
15	Other non-current liabilities (incl. provisions)	Primarily consisting of provisions
16	Current liabilities	17+18+19
17	Loans	
18	Creditors	
19	Other current liabilities	
20	Total shareholders funds and liabilities	10+13+16

Table 18: Number of companies for which relevant data is provided by AMADEUS (all industries)

Year	2004	2003	2002	2001	2000	1999
EU-27	69,127	1,468,194	1,673,139	1,423,813	1,237,262	1,104,774
EU-15	69,008	1,251,712	1,478,333	1,264,052	1,095,151	988,734
EU-12	119	216,482	194,806	159,761	142,111	116,040

However, strong economic activity was experienced in 1999 and 2000 (the Ifo quarterly average in these years was 94.1 and 116.5). The year 2001 (87.1) approximates the long-term average (90.82) and can thus be said to represent balanced economic conditions. The level of economic activity is likely to influence the values of the reported financial data and consequently the EU-average companies.

Figure 2: Ifo Economic Climate Indicator for the euro area (1990-2008)

Source: Ifo Institute, available at www.ifo.de

The computation of EU-average companies is primarily based on balance sheet and income statement data derived from the AMADEUS database. The framework for our computations is in line with the latest CCTB Working Document.⁸ Therefore, the scope of companies included in the sample for the determination of EU-average companies is restricted to legal forms as recorded by the Parent Subsidiary Directive.⁹ With respect to the terms of reference for this report, the

⁸ Common Consolidated Corporate Tax Base Working Group (CCCTB WG), CCCTB: Possible elements of a technical outline, CCCTB/WP057/doc/en, Brussels 2007.

⁹ Council Directive of 23 July 1990 on the common system of taxation applicable in the case of parent companies and subsidiaries of different Member States (90/435/EEC), OJ L 225, 22.9.1990, p. 6.

analysis is based on companies belonging to the following industries: manufacturing, construction, commerce, service/trade and transport. In accordance with the Commission's Steering Group, the energy sector is additionally considered in the sensitivity analysis. The classification of industries is consistent with the NACE codes, as presented in Table 19. As described above, public sector companies are not examined in the study and have thus been excluded. The size determination of large companies as well as of small and medium-sized companies is made in accordance with the Commission's recommendation.¹⁰

Table 19: Classification of industries

Industry	Sub-sections of NACE Rev. 1.1
Manufacturing	15-37
Construction	45
Commerce	50-52
Service Trade	71-74 without 7415, 90-93
Transport	60-63
Energy	40

2.5.2.2 Organisation of Data

Complete and correct data are of course required for an accurate analysis. For this reason, companies which do not provide all the information needed to determine the financial ratios are removed from the calculations. Companies have to report, as a minimum, the following items: tangible fixed assets, stocks, shareholder funds, balance sheet total, sales, interest paid, cost of employees, profit and loss for the period, and number of employees. Moreover, companies for which obviously flawed data has been reported are excluded from the calculations as well. In order to identify such companies it is necessary to check whether the balance sheet totals on the assets side and on the liabilities side correspond. Deviations up to a threshold of 10% are accepted. If the deviation exceeds this threshold, a check is made as to whether the difference can be traced back to mistakes in the summation of the sub-items. If not, the financial statements of the year in question are completely eliminated. Negative values are not accepted within the balance sheet (except for equity items). Any other deviations between overall values (e.g. fixed assets) and the total of the relevant sub-items (e.g. tangible fixed assets, intangible fixed assets, other fixed assets) are eliminated by proportional increase or decrease of these sub-items. The mathematical accuracy of the income statement is also verified. In the case of flaws, certain items are eliminated from the income statement. Alternatively, the financial statement is omitted as a whole. For both the balance sheet and income statement, missing values are calculated if possible without any ambiguity.

In order to provide the broadest possible data sample, however, estimated values for some items are used. The necessity of employing estimated values

¹⁰ Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (2003/361/EC), OJ L 124, 20.5.2003, p. 36.

results from the fact that certain items of the income statement or balance sheet are entirely absent for some countries. Consequently, without some estimates, additional countries would have to be excluded from further analysis. Estimated values are used with regard to the following variables: number of employees/costs of employees, sales/operating revenue and interest paid/financial expenses. While the number of employees is required to determine the size class of a company, interest paid and sales are necessary for the determination of important financial ratios (profit and interest paid to balance sheet total and profit to sales).

For the estimation of these variables, average ratios between variable pairs are used. These ratios are determined in a country-specific as well as in an industry-specific manner on the basis of data from AMADEUS.

Table 20: Number of companies in the sample

Country	Number of large companies	Number of small and medium-sized companies	Total number
Austria	96	188	284
Belgium	893	41,748	42,641
Bulgaria	0	0	0
Cyprus	0	0	0
Czech Republic	405	2,028	2,433
Denmark	473	8,920	9,393
Estonia	108	16,172	16,280
Finland	387	31,093	31,480
France	3,760	405,239	408,999
Germany	677	3,347	4,024
Greece	324	11,086	11,410
Hungary	235	5,377	5,612
Ireland	8	76	84
Italy	2,224	100,335	102,559
Latvia	147	1,959	2,106
Lithuania	22	585	607
Luxembourg	33	144	177
Malta	12	46	58
Netherlands	336	1,942	2,278
Poland	1,480	6,794	8,274
Portugal	431	12,550	12,981
Romania	1,410	98,198	99,608
Slovakia	145	828	973
Slovenia	0	0	0
Spain	423	200,746	201,169
Sweden	717	79,019	79,736
United Kingdom	4,465	99,852	104,317
EU-12	3,964	131,987	135,951
EU-15	15,247	996,285	1,011,532
EU-27	19,211	1,128,272	1,147,483

Where necessary, country or industry differentiation is ruled out. Alternatively, the ratio is determined on the basis of macroeconomic data taken from the EUROSTAT database. A detailed description how missing variables are estimated is given in Appendix 1.

The aforementioned requirements concerning the quality of data as well as the necessary adjustments to the AMADEUS data lead to a sample size of 1,147,483 companies in 24 member states¹¹ of the European Union. Of this number, 19,211 are large and 1,128,272 were small and medium-sized companies. The geographic distribution of these companies is presented in [Table 20](#).

In order to exclude possible outliers which may have a negative impact on average values, company data is removed when the ratios “return to sales” and “return to assets” exceed the 90%-quantile or fall below the 10%-quantile. If the ratios “interest paid to sales” or “costs for personnel to turnover” exceed the 90%-quantile or fall below the 10%-quantile the company is not considered in the calculation of the respective ratio.¹²

2.5.2.3 Determination of the Model Firms

Average Model Firms for EU-27

When preparing data, a key goal is to provide consistent information on the structure of EU-average income statements and EU-average balance sheets in order to accurately represent the companies in the EU member states. On the one hand, it is necessary to consider an appropriate method to ensure that no inconsistencies arise. On the other hand, it is important that the structure of model EU-average companies is not unduly influenced by a small number of member states or companies. If the average balance sheet and income statement is determined as the average of absolute figures for the items, large companies would strongly influence the structure of the EU-average companies. Therefore we decided to determine the items of the financial statements in relation to the “sales” or “total assets” figure for each company and to determine the average for the companies in each country. Consequently, the computation of the EU-average companies is based on country-specific average ratios for the balance sheet items and the income statement items. These country-specific ratios are subsequently aggregated to obtain the EU-average ratios. Finally, these ratios are multiplied with the average values for “sales” and “total assets” averaged out across the EU member states in order to produce the absolute values in euros for the EU-average companies.

The following steps are conducted:

a. Income statement

In order to avoid inconsistencies, two alternative methods are employed: (1) Setting items in direct relation to sales and (2) determining items as residuals or as

¹¹ Bulgaria, Cyprus and Slovenia show no companies in the sample since the data did not meet the requirements.

¹² These ratios are defined as follows: return to sales = profit or loss for period to sales; return to assets = profit or loss for period and interest paid to total assets; costs for personnel to turnover = costs of employees to sales.

a proportion of a residual. To this end the former method is applied to other operating revenue, operating profit/loss, profit/loss before tax, profit/loss after tax, profit/loss for the period and interest paid, whereas all other items (financial revenue, financial profit/loss, taxes and extraordinary income) are determined as residuals. For further division of residuals, we determine the ratios of costs for goods sold to cost of goods sold plus other operating expenses and other financial expenses to interest paid. This procedure leads to consistent income statements. Appendix 2 summarises the determination of the EU-average income statements by showing the relevant formulae.

b. Balance sheet

With regard to the balance sheet, we apply a two step approach. In the first step, the following headline items are set in relation to total assets: fixed assets, current assets, shareholder funds, noncurrent liabilities and current liabilities. In the second step, sub-items (e.g. intangible fixed assets, tangible fixed assets and other fixed assets) are set in relation to the relevant headline items (e.g. fixed assets). In order to avoid inconsistencies in the resulting balance sheets, companies are only considered for the respective step if the values for all required items are available.

This procedure leads to consistent balance sheets. Appendix 3 summarises the determination of the EU-average balance sheets by showing the relevant formulae. The structure, the values in euros and the required financial ratios for the EU-27 companies (large and SME) are presented in Appendix 4. These figures fit well with the data of the implemented model firms (Table 14 and Table 15), which shows that all relevant empirical information was gathered and assembled with great precision.

EU-12, EU-15 and Industry-Specific Model Firms

The approach described for determining the EU-27 companies is applied identically in order to create the EU-12 and EU-15 as well as the industry specific companies. To this end, the data sample is divided by region (EU-12, EU-15) or by industry class according to the NACE industry code. The steps to determine the income statement and the balance sheet are then applied to the relevant sub-samples. The structure, the values in euros and the required financial ratios for these companies (large and SME) are presented in the Appendix 4.

2.5.2.4 Additional Ratios and Figures

The procedure of the European Tax Analyzer computations also requires information on R&D expenses in relation to sales. This information is taken into account in the production plan and is necessary in order to determine the cost of goods. The data in the study is based on EUROSTAT statistics, which identify both R&D expenses as well as the volume of sales in the EU member states. The R&D expenses and sales figures are broken down by country and industry based on the NACE sections D, F, G, I and K. The relation between R&D expenses and

sales is ascertained per country and industry. The information on R&D expenses is taken on the one hand from the Research and Development section under Science and Technology (2001 data) and on the other hand from the Community Innovation Survey (CIS 2004 data). The data used in the European Tax Analyzer is mainly based on the R&D information from CIS. If no CIS data are available, the data based on the information from the Science and Technology sector are applied. If no data are available at all, the value is set to zero.

In order to simulate the growth of wage payments and company pension schemes over time, it is also necessary to supply the European Tax Analyzer with data on employee wages. This data is obtained from EUROSTAT, Unit F2, Labour Market Statistics (Structure of Earnings Survey 2002). The number of employees is broken down by gender, country, industry and educational background.¹³ Hence, it is possible to supply information on the structure of employees with reference to educational level. We are able to calculate the percentage of employees belonging to an educational level for each individual industry as well as across all industries. This information is additionally structured by gender. Moreover, a second data set provides the number of employees broken down by gender, country and company size. Based on this analysis it is also possible to calculate information on the structure of employees in the member states of the European Union (the percentage of male and female employees) depending on the size of companies.¹⁴ Corresponding analyses are carried out as to average annual earnings. This information is broken down by gender, country and size class. Consequently, similar information on the average annual earnings in the member states of the European Union is compiled. Finally, information on the average annual earnings broken down by gender, country, industry and education level is gathered to create data on the structure of average annual earnings depending on education.

The European Tax Analyzer also requires detailed data on property, plant and equipment. Data on fixed assets is important for the production plan. In order to simulate amortisation and depreciation expenses, additional information on the structure of fixed assets is necessary for the computations, i.e. to itemise the components of fixed assets. Hence, the proportion of the items "land and buildings", "plant and machinery" and "fixtures" have to be estimated. Estimates are based on the BACH database for Belgium, Finland, France, Germany, Italy, Portugal and Spain.¹⁵ Alternatively, to the above asset types fall under total assets, total fixed assets and tangible fixed assets. We choose the variation coefficient as the criterion to evaluate which figure leads to the best estimate of asset structure. The analysis is carried out per country, company size and industry. First, the ratios for each industry are averaged over the countries considered (step one). Second, the ratios are averaged out across industries and subsequently across countries

¹³ Educational background is defined according to the International Standard Classification of Education (ISCED-97).

¹⁴ Two classes are reported: companies up to 249 employees and companies with 250 employees or more.

¹⁵ Austria and the Netherlands were ruled out due to questionable data.

(step two). The variation coefficient is identified for each step and alternative, i.e. the relation to tangible fixed assets, fixed assets and total assets. Given that the ratio to tangible fixed assets provides the best estimation results, the asset structure is consequently based on this ratio.

In addition, information on the structure of provisions is generated. The analysis is conducted identically. Regarding provisions, a distinction can be drawn between "provisions for pensions" and "other provisions".¹⁶

The European Tax Analyzer computations require information on the source country of dividend receipts as well. This is important since the tax consequences differ if either the tax exemption method or the tax credit method is applied to avoid double taxation. As a result, the ratio of participations in domestic and foreign companies is required in particular. This information is not included in the balance sheet data. The AMADEUS database, however, provides additional ownership information. Information on direct shareholdings¹⁷ is taken from AMADEUS (see Appendix 5) and aggregated for each country by adding up the shares. Information on shares in domestic and foreign companies in per cent for large as well as for small and medium-sized companies is delivered for each member state. Additionally, the following information is gathered: the average number of shareholdings per company, the average amount of shareholding in per cent, the average equity capital of the affiliated companies, as well as the average financial assets of the shareholders. The two latter items include assessment of the proportion of shareholdings to total financial assets.

Finally, the European Tax Analyzer Model also processes data on warranty claims. This information is not concluded in the AMADEUS database. Moreover, neither statistical institutions¹⁸ nor economic organisation¹⁹ maintain such data. This information, however, is necessary to calculate the provisions for warranty claims. In order to obtain an indication of the approximate level of warranty claims as a percentage of sales, the consolidated accounts of the Dow Jones Stoxx 50 companies²⁰ are examined. The percentage of warranty claims is averaged and taken as an indication of an appropriate estimated value.

¹⁶ In contrast, Austria's data could be included, but Belgium's have to be excluded due to inconsistency.

¹⁷ Ownership information in the AMADEUS database is provided for direct shares and for the shares of the ultimate owner of a company. Indirect shares are not reported.

¹⁸ EUROSTAT as well as the German statistical agency DESTATIS.

¹⁹ For example, the OECD and ICC were contacted.

²⁰ With the exception of the financial and utilities sectors, as these are excluded from the determination of average model companies in the study.

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