



Universität Potsdam

Stefan Bach

**Empirical Studies on Tax Distribution
and Tax Reform in Germany**

Stefan Bach

**Empirical Studies on Tax Distribution and Tax Reform
in Germany**

Professorial Dissertation Thesis

University of Potsdam, Faculty of Economics and Social Sciences

Berlin, July 2012

Published online at the
Institutional Repository of the University of Potsdam:
URL <http://opus.kobv.de/ubp/volltexte/2012/6028/>
URN <urn:nbn:de:kobv:517-opus-60289>
<http://nbn-resolving.de/urn:nbn:de:kobv:517-opus-60289>

Preface

This professorial dissertation was accepted for Habilitation by the Faculty of Economics and Social Sciences, University of Potsdam in 2010. The study encompasses main topics of my research work over the last decade at the Public Economics Department of DIW Berlin. Over the same time period, I was engaged as lecturer at the chair of public finance at the University of Potsdam. I would like to express my gratitude for the inspiration, encouragement and support I received from the colleagues and partners with whom I cooperated in the various research projects and teaching activities.

First and foremost, I am deeply grateful to Hans-Georg Petersen for his permanent encouragement to this work, his long patience with it, and the friendly and inspiring atmosphere with him and his team. I am also much obliged to my further supervisors, Malcolm Dunn and Giacomo Corneo, as well as the dean and the other members of the Faculty for their kind acceptance of my study.

Furthermore, I am very thankful to my friends and colleagues at the Public Economics Department of DIW Berlin. I really enjoyed the extremely friendly, inspiring and productive atmosphere we shared throughout the last decade. Among others, I would especially like to thank Viktor Steiner, Hermann Buslei, Frank Fossen, Nadja Dwenger, Katharina Wrohlich, Peter Haan, Martin Simmler, Florian Walch, Erika Schulz, Michael Broer, Martin Beznoska, and Richard Ochmann for their very constructive cooperation in our research projects and for helpful discussions of my work. I also thank Nicole Scheremet for the support on the research projects and reports.

Most parts of the studies presented here result from joint research projects. I would like to thank my co-authors: Viktor Steiner and Giacomo Corneo (Chapter 2.1), Hermann Buslei (Chapter 2.2), Frank Fossen (Chapter 3.1), Michael Kohlhaas, Bernd Meyer, Heinz Welsch, and other colleagues with whom we cooperated in the various projects on ecological tax reform (Chapter 4).

Finally, I would like to give thanks to Hermann Quinke and his team from the Fraunhofer Institute for Applied Information Technology FIT, Sankt Augustin, for the excellent cooperation in the microsimulation projects on behalf of the Federal Ministry of Finance, and the officials from the Ministry of Finance for the confidence and the support to our research.

Berlin, July 2012

Contents

1 Introduction	5
2 Income Taxation	11
2.1 Effective Taxation of Top Incomes	11
2.1.1 Introduction	11
2.1.2 Institutional Background	13
2.1.3 Data.....	16
2.1.4 Measuring Gross Income.....	19
2.1.5 Effective Income Taxation	22
2.1.5.1 Tax Base Erosion.....	22
2.1.5.2 Effective Tax Progressivity	26
2.1.5.3 Net versus Gross Income Concentration	29
2.1.6 Summary and Conclusions	30
2.2 The Impact of Losses on Income Tax Revenue and Implicit Tax Rates of Different Income Sources	38
2.2.1 Introduction	38
2.2.2 Alternative Apportionment Schemes for the Personal Income Tax	40
2.2.3 Modeling the Apportionment Schemes	43
2.2.4 Empirical Strategy for Germany.....	49
2.2.4.1 Apportionment Schemes for the Personal Income Tax.....	49
2.2.4.2 Data Demands for the Calculation of Implicit Tax Rates	52
2.2.5 Results	55
2.2.5.1 Personal Income Tax Shares	55
2.2.5.2 Implicit Tax Rates	58
2.2.6 Summary and Conclusions	65
3 Business Taxation	71
3.1 Local Business Taxation – Lessons from an International Comparison and a Microsimulation Analysis.....	71
3.1.1 Introduction	71
3.1.2 Options for Local Business Taxation	73
3.1.2.1 Local Business Taxation in Public Finance Theory.....	73
3.1.2.2 International Comparison.....	75
3.1.2.3 Local Business Tax in Germany	78
3.1.2.4 Reform Options for Germany.....	80
3.1.3 Microsimulation Model for the Business Sector.....	81
3.1.4 Empirical Results.....	84
3.1.5 Summary and Conclusions	90
3.2 Revenue Trends, Implicit Tax Rates, and Tax Base Erosion of Business Income Taxation	93

3.2.1	Introduction	93
3.2.2	Business Income Taxation in Germany	95
3.2.3	Tax Revenue, Macroeconomic Implicit Tax Rates, and Tax Base Erosion	103
3.2.3.1	Effective Business Taxation Revenue	104
3.2.3.2	Macroeconomic Corporate Income and Implicit Tax Rates	108
3.2.3.3	Corporate Tax Base Erosion.....	113
3.2.3.4	How Reliable Are the Entrepreneurial Income Aggregates of German National Accounts?	117
3.2.4	Economic Backgrounds	120
3.2.4.1	Corporate Tax Losses by Industries	120
3.2.4.2	Insufficient Data from Financial Accounting.....	123
3.2.4.3	Tax Avoidance Strategies of Multinational Firms	125
3.2.4.4	Tax Avoidance of SMEs and Impact of Tax Enforcement	129
3.2.4.5	Decreasing Effective Tax Rates Due to the Decline in Inflation	131
3.2.5	Summary and Conclusions	132
4	Ecological Tax Reform.....	135
4.1	Introduction: Topics and Studies	135
4.2	Ecological Tax Reform in Germany 1999-2003: Concept, Macroeconomic Impact and Incentives for Structural Change.....	138
4.2.1	Tax Provisions, Fiscal Impact and Revenue Recycling	138
4.2.2	Macroeconomic Impact and Incentives for Structural Change	143
4.2.3	Summary and Conclusions	150
4.3	Impact on the Business Sector	153
4.3.1	Introduction	153
4.3.2	The 2003 Reform of Special Provisions.....	154
4.3.3	Modeling Effective Tax Rates.....	155
4.3.4	Results on Tax Burden and Effective Tax Rates in 2003.....	157
4.3.5	Effects of the Reform of Special Provisions in 2003	166
4.3.6	Summary and Conclusions	169
4.4	Impact on the Household Sector	171
4.4.1	Introduction	171
4.4.2	Microsimulation Model	173
4.4.3	Regressive Distribution of Eco Taxes	176
4.4.4	Use of Eco Tax Funds Moderate the Tax Regression	179
4.4.5	Eco Bonus Would Make the Reform Progressive.....	181
4.4.6	Summary and Conclusions	183
5	Summary and Conclusions	185
	Bibliography	190

1 Introduction

Background: Research work over the last 10 years

This professorial dissertation thesis collects several empirical studies on tax distribution and tax reform in Germany. The studies reflect the main topics of my research work over the last 10 years at the Public Economics Department of DIW Berlin. The department's research program focuses on empirically based analysis and policy evaluation in the field of public finance, using microeconomic analysis and microsimulation models. Since 2002, I managed the project "Microsimulation Studies on Business and Income Taxation" on behalf of the Federal Ministry of Finance. In this project, we develop and operate microsimulation models for the German business and income taxation, based on representative samples of tax files drawn from the official tax statistics. The models and the data bases are used for research projects and evaluation requests on behalf of the ministry, as well as for scientific research.¹

Up to the mid-nineties, Germany has rather been a developing country with respect to the systematic and regular usage of microsimulation models for fiscal policy evaluation, notably, by or on behalf of governmental bodies. This is particular true in the field of taxation. The main reason was the lack of administrative micro data from tax assessment. Such data sets became available at the national level not before the end of the nineties (Zwick, 2001). Until this time, academic impact analysis and evaluation research in this field mainly relied on household survey data, such as the Income- and Consumption Survey or the German Socio-Economic Panel (SOEP), see, e.g., Kassella and Hochmuth (1989), Spahn et al. (1992), Wagenhals (1997), Buslei and Steiner (1999). At Potsdam University, Bork (2000) built up a comprehensive microsimulation model for the main direct and indirect taxes of the household sector, based on an integrated data set, which mainly relied on the Income- and Consumption Survey 1993, augmented by information from the SOEP and even by tax file information collected from particular regional fiscal authorities. For firms, neither micro data from tax files nor adequate accounting data from business surveys were available. Data from financial accounting is accessible to this day only insofar as the firms are obliged to disclose their financial statements, which only applies to larger incorporated firms and to summarized items

¹ For an overview, see http://www.diw.de/de/diw_02.c.101874.de/ueber_uns/forschungsabteilungen/staat/forschungsprojekte/forschungsprojekte.html?id=diw_02.c.298564.de.

of the balance sheet and the income statement. Thus, no microsimulation tools existed for the fiscal and distributional effects of German business taxation before we started to develop our microsimulation model BizTax.

We first started with personal income taxation. Based on highly representative samples of the personal income tax statistics, we constructed a full-fledged micro simulation model that captures all the different items of the tax base and the tax code (Bach et al., 2004). As a first study, we carried out a comprehensive evaluation of the fiscal and distributional impact of the controversial income splitting procedure, which is used in Germany for the income taxation of married couples (Bach and Buslei, 2003, Bach, Buslei et al., 2003). When the discussion on a fundamental income tax reform emerged in Germany as of 2003, we published a study on the then main reform proposals (Bach et al., 2004, Bach and Steiner, 2007), in which we also estimated second round effects on labor supply. The main results noticed by the public were that the fundamental reform proposals, which mostly include a considerable cut in tax rate, would imply high revenue shortfalls of 1 percent of GDP and more, even if broadening the tax base and long-run effects from rising employment and stronger growth were taken into account. In particular, a separate study on the tax reform concept proposed by Paul Kirchhof, the notorious “professor from Heidelberg”, gains considerable attention in the public during the poll campaign for the federal elections of 2005 (Bach, 2005a). We showed that, against the huge cuts in income tax rates proposed, it seems rather unlikely that broadening the tax base and positive effects on employment and growth would make the reform revenue-neutral, as alleged by Kirchhof.

The extensive up-to-date keeping of the personal income tax microsimulation model was not continued when we turned our focus in applied microsimulation to business taxation. However, we used our deepened experience and knowledge on personal income taxation and the data sets for academic oriented studies on income distribution and effective income taxation. Due to the comprehensive income tax base and assessment procedures, the personal income tax statistics collect most of the income components (including public pensions and wage replacement benefits from social security) and several socio-economic characteristics of the taxpayers (age, household and family type, occupational status, etc.). Notably, the personal income tax statistics fully includes the population with high and very high income. Therefore, the utilization of this data suggests itself for scrutinizing the size and structure of the very top earners’ income. Household surveys do not well portray the top percentiles, if only due to the low number of observations. Yet they fully cover the bottom part of the population, including the numerous persons that do not file a tax return, so we merged information from the Socio-

Economic Panel (SOEP) to the income tax statistics. Analyzing the entire income distribution in Germany in the period 1992 to 2003, we find a remarkable growth of the income share accruing to the very top fractiles of the population, while the average income remains constant in terms of real income (Bach, Corneo and Steiner, 2007, 2009).

In a companion study, we analyzed the effective income taxation at the individual level by income groups, in particular with respect to the top incomes (Bach, Corneo and Steiner, 2008). This study is presented in Chapter 2.1 of this volume. In another study, we examined the effective income taxation falling on functional income sources, such as labor income, business and capital income, etc. (Bach and Buslei, 2009a). For that purpose we allocate the individual income tax liability to the respective income sources, according to different apportionment schemes accounting for losses. Including the business taxes falling on corporate income, we calculate implicit tax rates based on the corresponding macroeconomic income aggregates from the national accounts statistics. Chapter 2.2 of this volume deals with this study.

Since 2006, we turned our activities in applied microsimulation on behalf of the Federal Ministry of Finance to business taxation. As already mentioned, there were no microsimulation tools for the German business taxation up to this time. Based on representative micro data from the local business tax statistics as well as from the corporate and personal income tax statistics, we built up the microsimulation model BizTax (Bach et al., 2008a). Currently, the model relies on the 2004 wave of the tax statistics. The tax statistics micro data is thoroughly edited. The model data set is updated to 2015 with respect to changes in business structure by industries and legal forms, to the macroeconomic income aggregates such as entrepreneurial income or interest expenses, and to the current revenue of business taxes. The Federal Government's medium term projections on macroeconomic performance and tax revenue are used for the extrapolation over the forecasting horizon after the current year. Basically, the model estimates the first-round fiscal and distributional effects of the current business taxation and of reform scenarios. Second-round effects, for instance on location decisions, financing, choices of legal form, and portfolio allocation, are not established yet.

We first applied the BizTax model for the evaluation of the business tax reform of 2008 (Bach et al, 2007a,b). In a first academic oriented study, we analyzed the fiscal, distributional, and regional effects of the German local business tax and its reform (Fossen and Bach, 2008). Based on theory and an international comparison, we identified generalized reform options for the local business taxation. Using the BizTax model, we quantified the effects of the tax reform options compared to the status quo. This study is presented in Chapter 3.1 of this vol-

ume. Another study discusses the extension of the German local business tax to professionals and farmers, which are exempted from taxation as yet (Bach, Broer and Fossen, 2010). Moreover, the business taxation micro data and the microsimulation model have been used for estimations of the elasticity of the corporate income tax base and of the financial leverage to corporate income taxation (Dwenger and Steiner, 2008, 2009). Since the tax statistics data sets drawn from the tax assessment do not include many relevant items from the firms' tax statement, we started to utilize published financial statements that are, at least, available for larger incorporated firms. A study on the impact of the new "interest limitation" ("Zins-schranke") introduced by the business tax reform of 2008 has been carried out using the financial statements data base DAFNE, provided by the Bureau van Dijk (Bach and Buslei, 2009b). In another study the impact of corporate taxation on investment was analyzed based on firm-level panel data from the Hoppenstedt data base (Dwenger, 2009).

A further strand of our research on the German business taxation deals with the macroeconomic performance of business taxation against the background of macroeconomic corporate income. Based on the business tax statistics and our microsimulation model, we derive comprehensive measures of the entire business taxation revenue and the tax base accrued in a tax year. A comparison of the tax base reported in tax statistics with the macroeconomic corporate income from national accounts indicates considerable tax base erosion. When we published a first study on these issues in January 2007 (Bach and Dwenger, 2007), the results attracted some attention in the public debates on the business tax reform of 2008. An updated and extended version of this study is given in Chapter 3.2 of this volume.

Applied environmental economics, in particular the scopes and limitations of the ecological tax reform, were a main topic of my research work since I joined DIW Berlin in 1992. From its breakup in the early nineties we attended the discussion on the ecological tax reform in Germany with several studies and comments.² A first comprehensive concept and assessment study published in 1994 was highly influential to the public debate (Bach et al., 1995). In a further study we discussed the scope of tax allowances addressing the dangers for the competitiveness of energy-intensive industries (Bach et al., 1998). In a rather extensive study on behalf of the Federal Environment Agency (Umweltbundesamt) and together with FiFo Köln,

² For an overview, see http://www.diw.de/de/diw_02.c.101874.de/ueber_uns/forschungsabteilungen/staat/forschungsprojekte/forschungsprojekte.html?id=diw_02.c.299151.de

we analyzed in depth the requirements for tax reform in Germany under both traditional tax and environmental policy goals (DIW Berlin and FiFo Köln, 1999).

After the implementation of the ecological tax reform in Germany since 1999, we carried out several assessment studies. The main results from these studies are presented in Chapter 4 of this volume. Together with other researchers, we ran a first systematic impact analysis on behalf of the German Federal Ministry of Finance, applying two macroeconomic models and a microsimulation model (Bach et al., 2001, 2002, 2003). Update studies carried out in 2005 took into account the increased energy prices and examined in depth the 2003 reform of special provisions for the goods and materials sectors (Kohlhaas, 2005a, Bach, 2005b, 2007, Kohlhaas and Bach, 2007). In a recent study unpublished yet we analyzed the distributional effects of the reform using micro data on income and consumption of households.

Structure of this volume

Chapter 2 deals with two studies on effective income taxation, based on representative micro data sets from tax statistics. Chapter 2.1 presents a study on the effective income taxation at the individual level, in particular with respect to the top incomes (Bach, Corneo and Steiner, 2008). The analysis is based on an integrated micro data file of the income tax statistics and the Socio-Economic Panel (SOEP), which captures the entire income distribution, from the bottom to the very top. The study of Chapter 2.2 discusses the effective income taxation of functional income sources, such as labor income, business and capital income, etc. (Bach and Buslei, 2009a). Using income tax micro data and microsimulation models, we allocate the individual income tax liability to the respective income sources, according to different apportionment schemes accounting for losses. Including the business taxes falling on corporate income, we calculate implicit tax rates based on the corresponding macroeconomic income aggregates from the national accounts statistics.

Chapter 3 presents two studies on business taxation, based on representative micro data sets from tax statistics and the microsimulation model BizTax. Chapter 3.1 provides a microsimulation study on fundamental reform options for the German local business tax (Fossen and Bach, 2008). Based on theory and an international comparison, we derive general concepts of local business taxation. Using the BizTax model, we quantify several tax reform options with respect to the first round effects on revenue and its distribution across firms and regions. The study presented in Chapter 3.2 discusses the macroeconomic performance of business taxation against the background of corporate income. We calculate comprehensive measures of the entire business taxation revenue and the tax base accrued in a tax year. A comparison of the

tax base reported in tax statistics with the macroeconomic corporate income from national accounts gives hints to considerable tax base erosion. The average implicit tax rates on corporate income falling considerably short of statutory tax rates and effective tax rates reported in the literature.

Chapter 4 deals with several assessment studies on the ecological tax reform implemented in Germany as of 1999. Chapter 4.1 describes the scientific, ideological, and political background of the ecological tax reform. Chapter 4.2 presents the main findings of this study on macroeconomic performance and structural change. We employed two macroeconomic models, an econometric input-output model and a recursive-dynamic computable general equilibrium (CGE) model. In Chapter 4.3, the reform's impact on the business sector and the effects of special provisions granted to agriculture and the goods and materials sectors are outlined (Bach, 2005b, 2007, Kohlhaas and Bach, 2007). Findings on the distributional effects for the household sector are presented in Chapter 4.4. Based on the Income and Consumption Survey of 2003, we carried out a comprehensive micro simulation analysis of the ecological tax reform.

2 Income Taxation

This Chapter presents two studies on effective income taxation, based on representative micro data sets from tax statistics. Chapter 2.1 deals with the effective income taxation at the individual level, in particular with respect to the top incomes. Chapter 2.2 discusses the effective income taxation falling on functional income sources, such as labor income, business and capital income, etc.

2.1 Effective Taxation of Top Incomes

Abstract: We analyze the taxation of top personal incomes in Germany on the basis of an integrated data file of individual tax returns and a general household survey for the years 1992-2002. The unique feature of this integrated data set is that it includes all taxpayers in the top percentile of the gross income distribution. We show that despite substantial tax base erosion and significant reductions of top statutory marginal tax rates, German personal income taxation has remained effectively progressive. The distribution of the tax burden is highly concentrated, and the effective average income tax rate of the German economic elite, the top 0.001 quantile of the gross income distribution, is about 34 percent, which is well below the legislated tax rate.

2.1.1 Introduction

Despite partial retrenchment of the welfare state in many countries, progressive personal income taxation is still widely regarded as an essential tool to reduce income disparities. In order to evaluate the rationale for abolishing, reforming, or retaining the personal income tax as it is, one has to empirically assess the contribution of that instrument to reduce income inequality. The equalizing effect of the income tax does not only depend on the shape of the tax schedule but also on the pattern and the size of tax base erosion triggered off by tax exemptions, deductions, and various loopholes in the tax code. In this paper we undertake such an empirical investigation for the case of Germany. We assess the true progressivity of the German income tax by estimating effective tax rates for various income fractiles. Special attention is devoted to the taxation of top incomes and to the contribution of the personal income tax (PIT) in reducing the concentration of income in the hands of a tiny group of super-rich people.

On the basis of administrative tax records, OECD (1990) found that redistributive effects of the PIT vary a lot between countries, and that there seems to be no positive correlation between pre-tax inequality and the extent of redistribution. Similar results are reported for the late 1980's and early 1990's by Wagstaff et al. (1999) on the basis of survey data for 12

OECD countries and by Wagstaff and van Doorslaer (2001) using administrative tax data for 17 OECD countries, as well as by Verbist (2004) on the basis of survey data for the EU-15 countries. For Germany, there has hitherto been little empirical research on the effective progressivity of the PIT. Using survey data for 1983, Lang et al. (1997) found that the effective marginal tax rate for high incomes was 16 percentage points below the legislated one and that much of that difference was due to tax avoidance by interest income and income from real assets. They also documented that the effective tax rate increases with income, although the increase of the tax rate was shown to be negligible at high income levels. However, the dataset used by those authors did not include households within the 2 percent richest group of the population, a group contributing a relatively large share to the income tax revenue. Using income tax returns data for the 1990's, Bach et al. (2005) showed that the German income tax was effectively progressive and contributed to reduce income concentration in that period.

Recent literature has analyzed the evolution of top incomes and its impact on overall income inequality, while progressivity of the PIT and its impact on the distribution of net incomes has, with a few exceptions, not been the focus of this literature.³ For Germany, Bach et al. (2009) showed that inequality in gross *market* income increased in Germany in the period 1992-2001, and that this increase was mainly driven by the increasing income concentration at the very top of the distribution. In particular, the economic elite, defined as the top 0.001 percentile of the gross income distribution, obtained a much higher increase in real gross market income than the average person or even the average member of the top decile of the income distribution. This finding is in line with the development observed in other OECD-countries (see Atkinson and Piketty, 2007).

In this paper, we present effective average tax rates for various fractiles of the income distribution as well as measures of inequality reduction achieved by means of the income tax. We focus on the taxation of top incomes in Germany in the period 1992-2002, the year with the most recent available data from the tax statistics, and provide detailed information on the taxation of the German economic elite. Our investigation is based on an integrated data file of individual tax returns data and a general household survey for the years 1992 to 2002. The tax returns data include stratified 10 percent samples of the total taxpayer population in Germany. Noticeably, *all* German taxpayers that belong to the top percentile of the income distribution

are included in our data set. This trait, which distinguishes our study from previous ones, enables us to characterize the taxation of top incomes in a very precise fashion.

The next Section 2.1.2 provides the reader with some information on the institutional background relevant for the subsequent empirical analysis, especially regarding changes in the taxation of personal incomes that took place in Germany since the early 1990's. Section 2.1.3 describes our tax return data and the method we apply to account for non-filers. Section 2.1.4 describes our measurement of (economic) gross income from tax returns data. Section 2.1.5 contains our main results on the effective income taxation of top incomes. First, we show that tax base erosion, i.e., the gap between taxable and gross income, is substantial and varies significantly by level and source of income. Second, we document that despite substantial tax base erosion and significant reductions of top statutory marginal tax rates in recent years, until 2002 the German PIT has remained effectively progressive. The distribution of the tax burden is highly concentrated, and the German economic elite is still taxed relatively heavily, even though the effective tax rate for this group has significantly declined in recent years. Finally, we show that the PIT substantially contributes to reduce the concentration of income in Germany, where the lion's share of this redistributive effect is contributed by the top 1 percent of taxpayers. Section 2.1.6 summarizes our main results and concludes.

2.1.2 Institutional Background

In Germany, a taxpayer's PIT is computed as a function of her or his nominal taxable income (*'zu versteuerndes Einkommen'*) in that year. Assessed income tax liability (*'Festgesetzte Einkommensteuer'*) is computed as the tax burden on the entire taxable income assessed for the tax year (which is the calendar year), on which the tax schedule is applied. Paid withholding taxes, such as the monthly wage tax (*'Lohnsteuer'*) or taxes on interest and dividends, are offset against the PIT liability. The tax schedule includes a basic allowance (*'Grundfreibetrag'*), which means that households with low income pay no income tax. The marginal tax rate linearly increases with income until income reaches a certain threshold. For incomes larger than that threshold, the marginal tax rate stays constant. Hence, the average tax rate converges towards the top marginal tax rate with increasing taxable income. Since the average tax rate increases with income, the tax schedule is progressive.

³ Recent contributions include the studies in Atkinson and Piketty (2007) and Burkhauser et al. (2007). The taxation of top incomes has been the object of several studies devoted to the US case, see, e.g., Slemrod

Single taxpayers are taxed according to the tax schedule for individuals (*Grundtabelle*). Nearly all married couples are taxed jointly with full income splitting. In the case of joint filing, the couple's tax liability equals twice the tax liability of a single taxpayer whose income is half of the couple's income. In nearly all cases, joint taxation with full income splitting is less onerous than individual taxation, therefore the former procedure is used by default in tax assessment of married couples.

In nominal terms, the German PIT has historically been strongly progressive, as can be seen from the difference in marginal and average tax rates in Figure 2.1-1. There have been various tax reforms in the observation period.⁴ Top statutory marginal tax rates in the period 1992 to 2002 were reduced from 53 percent to 48.5 percent.⁵ The lowest marginal tax rate was increased from 19 percent in 1992 to 25.9 percent in 1998 and subsequently reduced to 19.9 percent in 2001. This was accompanied by successive increases in the basic allowance, in particular a doubling of the basic allowance in 1996. In 1992 a *'solidarity surcharge'* tax amounting to 3.75 percent of the PIT amount was introduced, briefly suspended in 1993, subsequently re-invented at the rate of 7.5 percent in 1995, and reduced in 1998 to the current level of 5.5 percent of the PIT.

Other changes in tax regulations are also likely to have affected the effective taxation of top incomes in our observation period. Owners of unincorporated companies, e.g., sole proprietors and partnerships, are subject to the PIT, in contrast to corporations, which are subject to the flat corporate income tax in Germany. To level the playing field, the legislator decided to reduce the tax burden of unincorporated companies at the same time as lowering the corporate income tax rate by introducing tax rate limitations for income from business enterprise (*"Tarifbegrenzung für gewerbliche Einkünfte"*). The Location Preservation Act (*"Standortsicherungsgesetz"*), which became effective on January 1st, 1994, reduced the corporate income tax rate for retained profits from 50 percent to 45 percent. By the same Act, the general

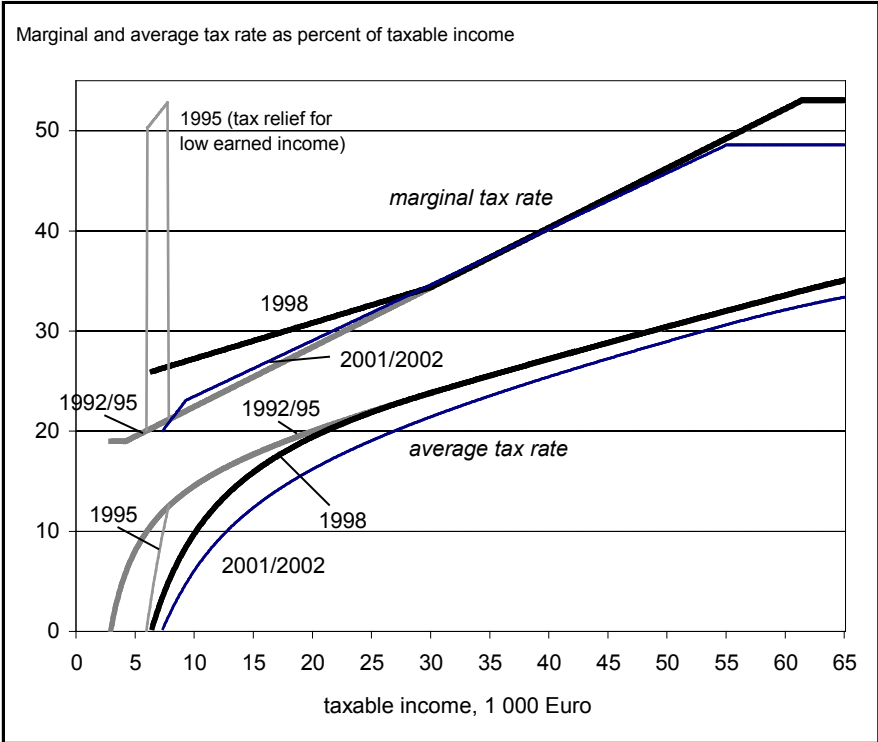
(1994) and Feenberg and Poterba (2000).

⁴ Corneo (2005) discusses the evolution of the PIT in Germany in historical perspective. Since the tax schedule is applied to nominal taxable income with no indexation of the basic allowance and other tax expenditures, there is 'bracket creep' implying a relatively high elasticity of the personal income tax to changes in nominal income of about 2, on average (see, e.g., Haan and Steiner, 2005). For this reason, the tax code (including the basic allowance) has to be adjusted from time to time in order to avoid purely nominal income gains to lead to ever higher taxation in real terms. In Germany, this is usually accomplished in connection with periodic tax reforms.

⁵ The major 2000 reform of the PIT was implemented in three steps: the first step became effective on January 1st, 2001, the second step in 2004, and the third step in 2005. In the second (third) step, the top marginal tax rate was reduced to 45 percent (42 percent).

top marginal PIT rate of 53 percent was reduced to 47 percent for earnings from business enterprise above about Euro 50,000.

Figure 2.1-1 Statutory marginal and average tax rates as percent of taxable income, 1992-2002



The Tax Relief Act (“*Steuerentlastungsgesetz 1999/2000/2002*”), which was put into effect retroactively on January 1st, 1999, further reduced the corporate income tax rate for retained profits to 40 percent and limited the top marginal personal income tax rate for earnings above certain thresholds from business enterprise to 45 percent in 1999 and to 43 percent in 2000. The general top marginal tax rate for all other personal incomes was left unchanged at 53 percent in 1999. The top marginal income tax rate (not including the solidarity surcharge tax) was reduced to 51 percent in 2000 and to 48.5 percent in 2001.⁶ The reform also replaced the limitation of the top marginal PIT rate for tradesmen referred to above with a lump-sum credit against the local business tax deductible from the PIT.

⁶ The Tax Relief Act included some complementary measures with the intention to compensate parts of the reduction of tax rates. The most important changes were: Restrictions for high loss offsets between incomes from different sources, more restrictive rules for the assessment of certain provisions, especially in the insurance and nuclear energy industries, restrictions for current-value depreciations. Furthermore, the so-called co-entrepreneurship decree was temporarily abolished, which facilitated tax-neutral transfers of individual assets between partners and their partnerships.

The Corporation Tax Reform Act (“*Steuersenkungsgesetz 2000*”) reduced the corporate tax rate on both retained and distributed profits to 25 percent. By the same Act, the previous full imputation system⁷ was demised in favour of the classical system with a half-income shareholder relief. Since then, distributed and retained profits are taxed at the same rate of 25 percent, with the former being taxed at the personal level at half the shareholder’s personal income tax rate in order to mitigate ‘double-taxation’ of dividends. The half-income system was also applied to the taxation of capital gains.

In Germany, effective taxation of top incomes is also influenced by various tax expenditures. Investments in real estate as well as capital equipment have been vast loopholes for tax-saving activities during the first couple of years after German re-unification. Special depreciation allowances, tax reliefs and generous accounting rules for investments in real estate and business capital formation in East Germany, in combination with tax-free capital gains that could be offset against income from other sources, led to massive tax savings for people at the top of the income distribution. Between 1992 and 1998, most of the capital gains from business income were taxed at half the rate of the then prevailing PIT rate. Other capital gains from capital investment were taxable only if realized within certain time periods defined by the tax law. Reducing these massive tax expenditures and ‘broadening the tax base’ has been advertised as one aim of the subsequent tax reforms introduced since the late 1990’s. We will see below how effective these intentions have been in practice.

2.1.3 Data

Our empirical investigation is based on official income tax returns (ITR) data for re-unified Germany in the years 1992, 1995, 1998, 2001, and 2002, the last year for which individual tax returns was available in 2008. This delay is due to long-lasting assessment procedures, the triennial interval between subsequent income tax statistics (up to 2001), and the way the data are transmitted from the fiscal authorities to the Federal Statistical Office, and finally to the Federal Ministry of Finance. For each of these cross sections, the ITR data include a representative sample of about 3 million tax returns, i.e., roughly 10 percent of the entire taxpayer population. Samples for each of the first four of these cross-sections are drawn by the German Federal Statistical Office from the set of all tax files of each year so as to build a stratified

⁷ Under this system distributed corporate profits in the form of dividends are taxed at the same rate as retained profits and dividends are taxed at the shareholder’s PIT rate with an allowance for the tax paid at the corporate rate.

random sample. The sampling fraction for pre-defined cells according to gross taxable income and other tax-relevant characteristics is determined by minimizing the standard error with respect to taxable income (Zwick, 2001). In particular, tax return samples include *all* taxpayers with high incomes or high income losses. The 2002 cross section is similar, in principle, but provided by the fiscal authorities directly to the Federal Statistical Office. Our matching procedure will adjust for differences in the sampling scheme, especially the substantially larger number of non-filers in the 2002 data due to the change in data collection (see below).

The original data set includes all assessed taxpayers, i.e., single persons or married couples who file a tax return in a given year. Slightly more than 50 percent of all tax returns are joint files of married couples, where this share has been decreasing over time. Assuming that one taxpayer corresponds to one household, about three quarters of all German households pay income tax. Whilst very good in representing the upper range of the income distribution, as nearly all domestic residents in this range file a tax return, the ITR data do not portray well the lower tail of the income distribution and also miss a non-negligible share of taxpayers in its middle part. In particular, households living on social assistance or income replacement benefits (e.g., from private insurance or social security) usually do not file, unless they have other taxable income. Furthermore, households with wage earnings only file a tax return if they want to claim itemized deductions that are not already taken into account by their wage tax, which is withheld at source by the employer. These taxpayers were only partly recorded by the tax statistics up to 2001, and completely disregarded since 2002.

There are various ways to account for these omissions in tax return data. As suggested by Picketty and Saez (2003), one possibility is to identify the fractiles of the income distribution on the basis of the total number of *potential* tax units. This approach was also applied by Dell (2005) and Bach et al. (2005) using German tax return data. However, it assumes that all non-filers can be placed at the lower tail of the gross income distribution. As mentioned above, this assumption is not valid in the German case due to the relatively large number of non-filers with labor income only. Furthermore, the regulations concerning the provisions for filing tax returns were changed by the tax reform of 1996, which did not only affect people at the bottom of the income distribution.

Therefore, we follow a different approach, namely merge ITR data with data from the German Socio-Economic Panel (SOEP) for the same years to account for non-filers. The SOEP is

an annual survey of households living in Germany with detailed information on incomes, both at the individual and household level.⁸ Information on individual and household gross incomes as well as income components is collected retrospectively in each wave for the previous year. The sample size is much smaller than that of the ITR, for example, in the year 2001 about 12,000 households were interviewed. Nevertheless, the SOEP represents a larger share of the population than the ITR since it also includes people who do not file tax returns. As previous research has shown (see Bach et al., 2009), the SOEP represents the German income distribution very accurately except for the top 1 percent of the population.⁹ This group, on which we focus below, is completely represented in the ITR data.

Our matching approach selects for each person in the SOEP a number of persons in the ITR data base, the number being determined by the relation of the respective weighting factors in the two data sets (for the details, see Bach et al., 2009, Appendix 1). Since the ITR data contain a smaller subset of the population than the SOEP, not all individuals contained in the SOEP can be matched to the appropriate number of their ‘statistical twins’ in the ITR. After all observations in the ITR data are exhausted by this matching algorithm, we are left with a certain number of unmatched individuals in the SOEP, which we add to the ITR data set and sort into the respective income percentile to get the integrated ITR-SOEP data set. Thereby, not only individuals who have no or little income, and therefore do not pay income tax, are added, but also those who, due to specific regulations in the German tax system, do not file tax returns.¹⁰ Detailed income information about these individuals is available in the SOEP, from which the individual PIT is calculated using a microsimulation model (see Schwarze, 1995).

The upper part of Table A2.1-1 in the Appendix 2.1-1 shows the estimated number of taxpayers and non-filers obtained from our integrated data base. Between 1992 and 2001, the num-

⁸ A description of the SOEP can be downloaded from www.diw.de/soep, see also Haisken-DeNew and Frick (2005).

⁹ Starting in 2002 (S-wave), the SOEP includes a disproportionately large sample of “high-income” households. This so-called *high-income sample* consists of over 1,200 households with monthly net incomes of at least 3,750 Euro. Although the implied level of gross income would put all members of this sample in the top 20 percent of the gross income distribution, only very few would make it to the top 1 percent. Thus, even taking advantage of the high-income sample, the SOEP is not representative for the population of individuals at the top 1 percent of the income distribution.

¹⁰ Single or couple taxpayers who only have wage income which is taxed at the source in Germany are not obliged to file tax returns independently of their level of taxable income. Since the SOEP does not provide information on the filing status of individuals or households, we match conditionally on a number of variables, such as main income source, occupational status, marital status, age group, family type and the number of children.

ber of assessed taxpayers remained fairly constant at about 29 millions, even though the income tax reform of 1996 relaxed some provisions for filing tax returns. The markedly lower number of taxpayers observed in the ITR data in 2002 is due to the mentioned exclusion of additional non-filers in this data set. This corresponds to the high number of non-filers in that year, which exceeds the level reached in 2001 by about 2 million. As shown in the table, the number of non-filers has been increasing over time reaching about 17 million in 2001, and 19 million in 2002. Our matching approach adjusts for both the increasing number of non-filers in the period 1992-2001 and the exclusion of additional non-filers in 2002.

2.1.4 Measuring Gross Income

In principle, German tax law employs a comprehensive notion of income, which includes all earned income and capital income. However, exemptions and various types of tax relief create a substantial gap between taxable income and gross income. In order to cope with this problem and to derive a measure of economic income, we adjust taxable income by adding all tax-exempted incomes and tax relief as well as by accounting for various tax avoidance strategies that can be identified in our data.

In the subsequent analysis, we distinguish between the following income components:

- (i) *wage income* consists of wages and salaries, including employers' social security contributions, calculated before deduction of allowable expenses;
- (ii) *income from business activity* includes taxable income from agriculture and forestry, from unincorporated business enterprise, and from self-employed activities, including professional services;
- (iii) *capital income* includes interest and dividends as well as incomes from renting and leasing;
- (iv) *capital gains* as realized from sale of an enterprise, parts of an enterprise, or shares of investors with substantial shareholdings, or if classified as '*speculation gains*';
- (v) *transfer income* includes unemployment compensation, social assistance, housing benefits, the child benefit, pensions derived from former employment, the taxable share of life annuity funds (pure interest portion of the annuity payment), and alimonies between separated or divorced spouses.

German tax returns data record ‘*adjusted gross income*’ (*Summe der Einkünfte*) by adding positive incomes from all mentioned sources and deducting losses.¹¹ Income from business activity and capital income are defined net of various related expenses. From this income measure, we derive (economic) gross income by adding all tax-exempted incomes as well as tax relief that can be identified in our integrated data base, as described in more detail in Appendix 2.1-2. Of special importance is the adjustment of incomes from dividends required by the change from the full-imputation to the classical corporate income tax with half-income taxation of dividends at the shareholder level in 2002. Until 2001, distributed gross dividends are recorded in our data, whereas dividends for the year 2002 are recorded net of the corporate income tax of 25 percent. Hence, we adjust dividend income in that year by multiplying recorded net dividends by the factor 4/3.¹² Moreover, we disregard losses from renting and leasing exceeding some thresholds since most of these losses are likely to arise from tax avoidance.

As a result of our adjustments, we obtain a gross income measure, which is fairly close to ‘*pre tax, post transfer*’ household income. As shown in Table A2.1-1 in the Appendix 2.1-1, total overall income recorded in the integrated data base was about Euro 1.7 trillion in 2002, excluding capital gains and transfer income it was Euro 1.3 trillion in that year. This represents 82 percent of total primary income of households as documented by the national accounts statistics. There is very little difference in total wage income between our integrated data base and the national accounts. As revealed by Table A2.1-1, the discrepancy between gross income and income from national accounts is mainly due to incomes from business and capital. Unfortunately, German national accounts do not provide differentiated information on business and capital income according to the categories used for the income tax assessment, or recorded by the SOEP. It should also be kept in mind that in the national accounts business income is calculated as a residual. Furthermore, non-profit organizations, which often have substantial capital income, which regularly remains tax-free, are classified as part of house-

¹¹ As of 1999, the offsetting of losses between separate income sources is restricted to 51,500 Euro (103,000 Euro in the case of jointly assessed married couples) plus half of the remaining total of positive income (see Federal Ministry of Finance, 2002).

¹² There is another complication concerning dividend income related to the corporate tax reform of 2001: Distributed retained earnings from previous years which were taxed at the then prevailing higher corporate rate could claim tax returns amounting to the difference to the new 25 percent rate over a transition period of 15 years. Although this effect may bias upward our calculation of gross income, since we only measure an increase in dividend income but not the corresponding decrease in shareholders’ wealth, it should not affect our calculation of the effective tax rate, the main focus of the present study.

holds in national accounts. To some extent, the discrepancy between our estimates and those from the national accounts may be due to the fact that some fraction of corporate income is received by households in form of capital gains rather than dividends. Furthermore, we may underestimate capital income because of unmeasured tax evasion.

Information on the evaluation of top incomes in comparison to mean and median income during the observation period is contained in Table A2.1-2 in the Appendix 2.1-2. There, we break down the top decile into smaller groups starting with the top 1 percent percentile down to the 0.0001 percentile of the gross income distribution. This breakdown reveals remarkable differences at the top of the distribution. In 2002, real average gross income received by the top 1 percent amounted to about Euro 317,000, i.e., almost three times the average amount received by the top decile. To make it to the top 0.001 percent fractile, which we take as representing the German *economic elite*,¹³ your gross income needed to exceed Euro 9 million in 2002. A member of this small group of taxpayers received, on average, some Euro 22 million in that year. The tiny group of about 40 taxpayers making up the top 0.0001 percentile received an average amount of Euro 70 million.

Between 1992 and 2002, average real gross income of the economic elite increased by almost 38 percent, thus substantially outpacing the increase of 5.4 percent realized on average by the top decile. The super-rich did even better, though: On average, their gross income increased by more than 70 percent in the period 1992-2002. However, incomes at the very top are rather volatile since they are mainly derived from business income and capital gains.

In the Appendix 2.1-2 we also report the distribution of gross income by income component (see Table A2.1-3). As expected, transfer income and wage income are the key income sources for the lowest nine deciles of the income distribution. Income from business activity and from capital becomes the main income source only for the top fractiles of the distribution. Thus, the economic elite receives only 4 percent of its total income in form of wage income, while more than half of it stems from business activity and the rest comes from capital. Interestingly, in Germany, income from business activity makes up a much larger share and wage

¹³ This definition derives from previous analysis of the composition of market incomes within the top 1 percent percentile of the distribution which indicates that about 70 percent of total gross market income of this group is derived from business activity, and that more than 50 percent in this group almost exclusively derive their incomes from business activity, see Bach et al. (2009). Note, however, their analysis refers to a different definition of gross income (i.e., market income excluding capital gains) and to the personal rather than the taxpayer level.

income a much smaller share of top incomes than in the US or other large European countries.¹⁴

2.1.5 Effective Income Taxation

An income tax reduces income inequality if the tax schedule is progressive and the tax base closely approximates the economic income of taxpayers. Effective tax progressivity depends both on the statutory income tax schedule and the degree of tax base erosion. The latter, in turn, depends on the share of taxed income by income source (wage income, business income, capital income), which may vary due to special tax regulations, and the distribution of these various income components across the gross income distribution. As shown in the previous section, the composition of gross income varies greatly across the gross income distribution, and this may have a strong impact on effective income taxation if tax base erosion varies by source of income. In the following, we first look at tax base erosion and then derive the degree of effective tax progressivity.

2.1.5.1 Tax Base Erosion

Several provisions in the tax code contribute to tax base erosion, i.e., ‘*taxable income*’ (‘*zu versteuerndes Einkommen*’) falling short of gross income. Taxable income, as measured in German tax returns data, is derived by deducting income-specific expenses, income-specific allowances, special personal expenses, and extraordinary financial burdens from adjusted gross income, which was defined in Section 2.1.4. Special personal expenses are those not related to a specific income source, such as the allowances for contributions to public or private health or pension insurance funds, educational expenses for own children, alimonies, the church tax and charitable contributions up to certain amounts. Extraordinary financial burdens include high expenses for health care, disability, and child care (see Federal Ministry of Finance, 2002). Furthermore, we deduct child allowances from taxable income as the basis for the assessment of the PIT according to the basic tax schedule.¹⁵

¹⁴ For a comparison between Germany, the US and France, focusing on developments in the 1990s in terms of market incomes, see Bach et al. (2009).

¹⁵ For taxpayers receiving the child benefit this is only an approximation. For them, the correct measure would be the difference between the child allowance and the pure transfer component of the child benefit. Since this difference would have to be simulated for part of the population, and we focus on top incomes for whom this differentiation is irrelevant, we decided to simplify matters slightly here.

Table 2.1-1 reports the evolution of the share of, respectively, adjusted gross income and of taxable income, in each case measured relative to our measure of (economic) gross income, during the observation period. In 2002, adjusted gross income amounted to about 67 percent of total gross income, on average. This share has remained fairly constant during the observation period. Basically the same can be said about the share of taxable income, if at a significantly lower level. In 2002, for example, this share was just 52 percent, i.e., 15 percentage points below the share of adjusted gross income.

Table 2.1-1 Share of adjusted gross income and of taxable income as percentage of gross income, 1992-2002

Gross income ¹⁾ fractiles	Adjusted gross income as percentage of gross income ¹⁾					Taxable income ²⁾ as percentage of gross income ¹⁾				
	1992	1995	1998	2001	2002	1992	1995	1998	2001	2002
1 st - 5 th decile	47.7	43.9	42.6	40.9	39.2	33.9	29.1	25.9	25.9	22.4
6 th - 9 th decile	72.3	70.6	69.6	69.1	69.4	57.3	54.5	53.2	52.6	52.7
10 th decile	81.0	76.7	77.1	79.3	79.2	70.3	65.0	66.0	68.5	68.0
Top 1%	87.7	79.5	82.8	86.6	86.0	79.9	70.4	75.4	80.0	78.4
Top 0.1%	90.7	82.3	87.9	90.2	87.9	84.5	74.0	81.9	85.3	81.9
Top 0.01%	93.7	85.6	91.4	91.1	87.2	88.3	77.7	85.9	86.6	80.6
Top 0.001%	93.8	84.9	92.3	88.6	84.7	89.4	77.3	85.4	85.2	77.5
Top 0.0001%	92.9	71.3	95.3	81.6	79.1	85.6	62.5	87.5	81.1	73.7
Total	70.1	67.2	66.8	67.0	66.9	56.7	52.7	52.1	52.7	51.9

1) For the definition of gross income, see Section 4. - 2) Less child allowance.
Source: ITR-SOEP data base.

Both the share of adjusted gross income and of taxable income is much smaller in the bottom half of the income distribution. The latter declined from 33.9 percent in 1992 to 22.4 percent in 2002, which reflects the rise of untaxed transfer income and the strong increase of the basic allowance and the child allowance during the observation period. In contrast, the share of taxable in gross income amounts to more than 70 percent in the top decile of the gross income distribution, and this share has decreased only slightly in the observation period. Within the top 1 percent of the income distribution, this share is even higher, amounting to 78.4 percent in 2002, with little change since the early 1990's. However, this share significantly varies within the top percentile for a given year and also over time. In particular, for this group the year 1995 stands out with a relatively low ratio of taxable to gross income recorded. The same is true for the share of adjusted gross income in gross income. Although this ratio has subsequently increased, it did not attain its previous value by the end of the observation period. The decline in the share of taxable income in gross income within the top 1 percent is especially

pronounced for the economic elite and the super-rich.¹⁶ One reason for this is may be the impact of tax expenditures on investments in real estate, as described below.

For the year 2002, Table 2.1-2 shows that the degree of tax base erosion, as measured by the ratio between adjusted gross income and gross income, differs greatly between the various income components (calculations for the other years are reported in Table A2.1-4 in the Appendix 2.1-2).¹⁷ In that year, the share of taxed wage income amounted to 77.2 percent, compared to 97.4 percent for income from business activity, and less than 30 percent for transfer income. The case of capital income is special due to the taxation of incomes from renting and leasing. Erosion is so extreme that, on average, positive economic incomes from renting and leasing and tax expenditures on this income source just balanced in 2002. As Table A2.1-4 shows, taxed income from renting and leasing has even been strongly negative in the 1990's amounting to more than *minus* 100 percent in the mid and late 1990's, implying that, on average, each Euro earned from renting and leasing was associated with losses of one Euro. This was made possible by generous tax regulations introduced especially for investments in East Germany after re-unification. This resulted in substantial negative tax revenues on average from this income source, the more so as taxpayers with high tax rates had strong financial incentives to invest in such funds. As regard to income from interest and dividends, the fraction of it that effectively is taxed increased since the early 1990's, reaching about two thirds in 2002. This diminishing tax erosion can mainly be explained by various reductions of the savers allowance for interest and dividend income.

Table 2.1-2 also reveals that the share of taxed income by component greatly varies across the income distribution. Whereas the variation is small in case of business income, the share of taxed wage income is much lower in the lower part of the gross income distribution than at the top. One important factor contributing to this difference is the inclusion of employers' social security contributions, which remain untaxed, into our measure of gross income. Due to the existence of an upper social security threshold, this has only a small effect at the top of the income distribution where wages tend to be relatively high. Differences in the taxed shares of

¹⁶ In their study of income tax avoidance in Germany in 1983, Lang et al. (1997) found that the portion of taxed to gross income tends to increase in the income deciles. Their data came from the Income and Consumption Survey (EVS), which does not include households with top incomes.

¹⁷ The calculation of the share of taxable income in gross income by source of income would require assumptions about the division of the second type of tax expenditures mentioned above between the various income components which cannot be tested.

wage and business income across the gross income distribution have changed little since the early 1990's (see Table A2.1-4 in the Appendix 2.1-2).

Table 2.1-2 Share of adjusted gross income as percentage of gross income by income component, 2002

Gross income ¹⁾ fractiles	Gross income ¹⁾	Wage income ²⁾	Income from business activity ³⁾	Capital gains ⁴⁾	Capital income			Transfer income
					Total	Interest, dividends ⁵⁾	Renting and leasing ⁶⁾	
1 st - 5 th decile	39.2	68.5	97.6	127.9	32.7	35.3	27.3	23.8
6 th - 9 th decile	69.4	76.1	99.7	52.9	47.8	58.7	20.8	32.1
10 th decile	79.2	81.4	96.1	92.9	50.9	78.2	- 21.9	34.1
Top 1%	86.0	89.0	93.8	96.7	60.7	87.0	- 17.0	41.7
Top 0.1%	87.9	92.9	88.1	99.6	78.1	92.7	6.7	51.7
Top 0.01%	87.2	90.5	82.3	99.9	86.6	94.8	7.7	61.1
Top 0.001%	84.7	91.8	75.3	100.0	90.8	96.2	10.0	62.2
Top 0.0001%	79.1	84.7	67.9	100.0	93.0	98.6	- 922.4	86.7
Total	66.9	77.2	97.4	90.6	47.1	65.6	1.1	27.8

1) For the definition of gross income, see Section 4.- 2) Including employers' social security contributions and imputed social security contributions for civil servants, minus taxable pensions from former employments, plus tax-exempted foreign income and income from tax-exempted "minijobs".- 3) Taxable income from agriculture and forestry, from business enterprise, from self-employed activities (professional services), plus tax reliefs, less capital gains from business activity, plus tax-exempted foreign income.- 4) From business activity and from private investments (solely speculation gains).- 5) Taxable income from investments (exclusive income from business activities), inclusive receipts below the savers allowance, less capital gains from private investments.- 6) Taxable income from renting and leasing, plus higher losses from renting and leasing.
Source: ITR-SOEP data base.

The share of taxed capital gains varies a great deal both across the income distribution and over the observation period, which is probably related to the type of capital gains included in our data set and the way they are realized. In contrast, about two thirds of all interest and dividends recorded in our data base get taxed, on average, and this share seems to be strongly increasing in the level of gross income: Whereas in the lower half of the gross income distribution less than a third of income from interest and dividends is taxed, this share is almost 80 percent in the top decile and increasing towards 100 percent at the very top. The small share of taxed capital income in the lower part of the income distribution can be explained by the savers allowance for interest income as well as by tax evasion.

Whereas about a quarter of income from renting and leasing is taxed in the lower part of the income distribution, taxation of this income source becomes strongly negative for the top decile and the top 1 percent of all taxpayers, due to the mentioned special regulations in the tax code. The tiny group of super-rich took extreme advantage of those tax regulations, transforming their positive incomes from renting and leasing into an overall loss of more than 900 percent in 2002. Table A2.1-4 in the Appendix 2.1-2 reveals that net tax receipts on renting and leasing were, on average, even negative during the 1990's, and that tax expenditures

related to this income source were extremely high especially at the top of the income distribution. For example, in 1995 the top percentile of the income distribution could transform each Euro of positive income from renting and leasing into 2.5 Euros of income losses for tax purposes. In that year, this form of tax avoidance was even higher at the very top of the gross income distribution reaching staggering values of almost 6 Euros losses per one Euro positive income from renting and leasing for the economic elite, and even some 22 Euros for the super-rich. This was not magic, but just a careful exploitation of loopholes in the tax code. This extreme form of tax avoidance was substantially reduced since the mid-1990's but, on average, it still leaves income from renting and leasing effectively untaxed and provides huge tax savings for some very rich people.

As shown in the last column of Table 2.1-2, less than one third of transfer income gets taxed, on average, and this share is strongly increasing in the level of income. The small share in the lower part of the distribution can be explained by the fact that most of these transfers relates to public pensions, taxed only by the interest portion of the annuity payment ('*Ertragsanteil*', approximately 30 percent on average), and tax-exempted social security contributions. There has been little change in the taxed share of transfer income across the income distribution over time.

Taxable income in 2002 was about the same fraction of gross income as it was in 1992. However, the share of taxable income substantially varied both across the gross income distribution and also over time. The share of taxed income also varied greatly by income component, with relatively little variation, both across the distribution and over time, for business income and substantial variation for other income components. At the very top of the income distribution the share of taxed capital income, not including capital gains, has been strongly increasing since the mid-1990's due to changes in the tax treatment of income from renting and leasing, whereas the share of taxed capital gains declined over time.

2.1.5.2 Effective Tax Progressivity

Having derived gross income as described in Section 2.1.4, for each taxpayer the effective average tax rate, as measured in terms of gross income, can be calculated by applying the tax schedule of the respective year, see Section 2.1.2. We account for both the PIT and the solidarity surcharge tax. Social security contributions are not taken into account when calculating individual tax liabilities because the German social security system is of the Bismarckian variety, strongly relying on the equivalence principle. Thus, social security contributions can be viewed as outlays for insurance against individual risks that the individual would have

incurred in the absence of mandatory social insurance, as it is the case for most self-employed people in Germany. We adjust for the change in the taxation of dividend income in 2002 (see Section 2.1.4) by adding taxes paid on dividend income at the personal as well as the corporate level, where the latter can directly be calculated from the information on the amount of dividend taxes paid by the private shareholder coded in the ITR data.

Starting with the distribution of the assessed income tax, Table 2.1-3 shows that taxpayers in the top decile contributed more than half of the total tax revenue in all years. Their share increased from 52.7 percent in 1992 to 54.7 percent in 2002, whereas the share in the bottom half declined and the one paid by taxpayers in the 6th-9th decile of the gross income distribution remained more or less constant. On average, in 2002 households making up the top decile paid Euro 25,300 income tax, measured in 2000 prices. In real terms, this means an increase of almost Euro 2,000 during the observation period. By comparison, the average income tax paid by the 10 percent poorest taxpayers was about Euro 500 in 2002, and that of those making up the 6th to 9th decile Euro 4,600, almost the same as in 1992. At the other end of the distribution, the economic elite paid about Euro 7.7 million as income tax in 2002, on average, an increase of almost Euro 1 million in real terms compared to 1992. For the super-rich, the average amount of income tax was more than Euro 22 million in 2002, an increase of more than Euro 5 million since 1992. As a summary measure of inequality in the distribution of the tax burden, the Gini coefficient was about 0.765 in 2002, compared to 0.728 in 1992. This indicates that the high concentration of the tax burden already prevailing in the early nineties has markedly increased since then.

Table 2.1-3 Assessed income tax liability 1992-2002 - structure and average tax burden

Gross income ¹⁾ fractiles	Assessed income tax liability (including solidarity surcharge)									
	structure in percent					average tax burden in 1 000 Euro at 2000 prices ²⁾				
	1992	1995	1998	2001	2002	1992	1995	1998	2001	2002
1 st - 5 th decile	7.0	7.6	5.8	4.3	5.1	0.6	0.7	0.5	0.4	0.5
6 th - 9 th decile	40.3	42.1	39.6	38.9	40.2	4.5	4.5	4.6	4.4	4.6
10 th decile	52.7	50.2	54.5	56.7	54.7	23.4	21.6	25.5	25.6	25.3
Top 1%	24.4	20.7	24.3	24.4	22.2	108.5	88.8	113.6	109.9	102.8
Top 0.1%	11.3	9.1	12.0	10.7	9.5	502.1	390.9	558.0	484.1	440.0
Top 0.01%	4.6	3.9	5.6	4.5	4.1	2 062.1	1 672.2	2 622.9	2 041.5	1 891.8
Top 0.001%	1.5	1.4	2.3	1.7	1.7	6 779.0	6 075.2	10 645.3	7 582.7	7 680.0
Top 0.0001%	0.4	0.4	0.7	0.5	0.5	17 333.3	15 897.4	33 538.8	21 088.6	22 468.3
Total	100.0	100.0	100.0	100.0	100.0	4.4	4.3	4.7	4.5	4.6
Gini coefficient	0.7284	0.7206	0.7553	0.7770	0.7649					

1) For the definition of gross income, see Section 4.- 2) Deflated by consumer price index.
Source: ITR-SOEP data base.

Average tax rates for the various income groups are presented in Table 2.1-4. In 2002, the effective average tax rate for the entire taxpayer population was 12.9 percent as measured relative to gross income, and 24.8 percent if measured in terms of taxable income. Thus, on average, tax allowances cut the level of the effective tax rate almost by half. In the top decile of the gross income distribution, average tax rates increase to 21.9 percent and 32.3 percent, respectively. Between the top decile and the top percentile of the income distribution, effective average tax rates increase by more than 10 percentage points. In 2002, the average effective tax rate at the top 1 percent of the gross income distribution amounted to 32.4 percent, and to 41.4 percent if measured in terms of taxable income. Thus, in relative terms the difference in average tax rates when measured, respectively, relative to taxable income and gross income is strongly declining in the level of the latter reflecting the much larger share of taxable income in gross income at the top of the distribution.

As shown by Table 2.1-4, up to the top 0.1 percent of the income distribution the German PIT effectively is progressive, i.e., the effective average tax rate increases with gross income. Tax progression disappears at the top of the income distribution, however. For instance, in 2002 the effective tax rate monotonically decreases with income over the four top fractiles of the distribution. Given that the top nominal marginal PIT rate was still 48.5 percent in 2002, and more than 51 percent including the solidarity surcharge tax, our results indicate that the effective burden of the PIT is much lower than the German tax schedule would imply. Still, at the top of the income distribution the tax burden is substantial, whereas it seems quite modest in the lower half of the distribution amounting, on average, to less than 4 percent of gross income and 16 percent of taxable income.¹⁸

Table 2.1-4 also shows that tax rates have, on average, remained fairly stable over time, and this holds true irrespective of whether they are measured relative to gross income or taxable income. Only at the very top do we observe a marked decline in effective tax rates. In particular, average effective tax rates paid by the economic elite declined from 41.6 percent in 1992 to 34.3 percent in 2002, and an even stronger decline can be observed for the super-rich. This substantial reduction in top effective tax rates, which mainly occurred after 1998, outpaced the decline in assessed tax liabilities in relation to taxable income. This finding mirrors the decline in the share of taxed income at the very top, as documented in Section 2.1.5.1. Re-

¹⁸ Recall, however, that our definition of individual tax liability does not include social security contributions which weigh relatively heavily on taxpayers with low earnings and little other income.

markably, between 1998 and 2002 average effective tax rates in the top decile and even top 1 percent of the gross income distribution even slightly increased, whilst they stayed more or less constant if measured relative to taxable income. Thus, the 2000 tax reform described in Section 2.1.2 seems to have substantially reduced the effective tax burden at the very top, with little effect on other taxpayers.¹⁹

Table 2.1-4 Average income tax rates, 1992-2002

Gross income ¹⁾ fractiles	Assessed income tax liability (including solidarity surcharge)									
	in percent of gross income ¹⁾					in percent of taxable income ²⁾				
	1992	1995	1998	2001	2002	1992	1995	1998	2001	2002
1 st - 5 th decile	4.4	4.7	3.9	2.9	3.5	13.0	16.2	15.0	11.0	15.7
6 th - 9 th decile	10.5	10.6	10.8	10.1	10.5	18.3	19.5	20.3	19.2	20.0
10 th decile	21.4	19.9	21.6	21.9	21.9	30.4	30.6	32.8	32.0	32.3
Top 1%	34.2	30.1	31.5	33.4	32.4	42.8	42.7	41.7	41.8	41.4
Top 0.1%	41.0	35.7	35.6	38.2	36.1	48.6	48.2	43.5	44.8	44.1
Top 0.01%	42.3	36.6	36.4	38.7	35.3	47.9	47.1	42.4	44.6	43.8
Top 0.001%	41.6	35.3	41.0	38.1	34.3	46.6	45.7	48.1	44.7	44.2
Top 0.0001%	42.3	31.0	45.0	36.0	32.0	49.4	49.6	51.5	44.4	43.4
Total	12.7	12.3	13.0	12.6	12.9	22.4	23.4	25.0	23.9	24.8

1) For the definition of gross income, see Section 4.- 2) Less child allowance.
Source: ITR-SOEP data base.

2.1.5.3 Net versus Gross Income Concentration

As the comparison of the Gini coefficient for the pre-tax and after-tax distribution of income in Table 2.1-5 shows, personal taxation of incomes does reduce income inequality in Germany. For example, in 2002 the Gini coefficient of 0.462 for gross income was reduced to 0.428 if inequality is measured in terms of net income, which means a reduction in the Gini coefficient by about 7 percent. The PIT has also reduced income inequality in each of the other years and its impact in reducing inequality seems to have changed little during the observation period.

Looking in Table 2.1-5 at the distribution of gross and net incomes across percentiles of the gross income distribution reveals some additional insights. In 2002, taxpayers in the lower half of the gross income distribution received 18.7 percent of gross income and 20.7 percent

¹⁹ This result is not driven by the change in the taxation of dividends brought about by the Corporation Tax Reform Act 2000, since we have properly adjusted dividends and taxes reported in the ITR data base, as explained above.

of net income. The share of gross income received by taxpayers placed in the 6th-9th decile of the gross income distribution was 49.1 percent, against 50.3 percent share in net income. Thus, only the top decile contributed to the redistribution of income to people in the lower deciles. While taxpayers in the top decile received 32.2 percent of gross income in 2002, they only obtained 29 percent of total net income in that year. Much of this difference is due to the relatively heavy taxation of very high incomes. While 8.9 percent of total gross income accrued to taxpayers in the top percentile, they only received 6.9 percent of total net income. Although effective taxation is even higher for the economic elite and the super-rich, as documented in the previous Section, in absolute terms these tiny groups of taxpayers have a modest impact on the reduction of overall income inequality. Looking at the shares of net income accruing to those groups over time generates an insight into the evolution of income concentration in Germany. Strikingly, the share received by the economic elite increased by 50 percent between 1992 and 2002, the super-rich almost doubled their share.

Table 2.1-5 Distribution of gross income and net income, 1992-2002

Gross income ¹⁾ / net income ²⁾ fractiles	Gross income ¹⁾					Net income ²⁾				
	structure by income fractiles in percent					structure by income fractiles in percent				
	1992	1995	1998	2001	2002	1992	1995	1998	2001	2002
1 st - 5 th decile	20.00	20.04	19.41	19.10	18.73	21.80	21.70	21.32	21.15	20.70
6 th - 9 th decile	48.72	48.86	47.74	48.42	49.10	49.95	49.74	48.96	49.73	50.29
10 th decile	31.28	31.11	32.85	32.49	32.17	28.25	28.56	29.72	29.12	29.01
Top 1%	9.06	8.47	10.06	9.17	8.85	6.87	6.81	7.99	7.04	6.91
Top 0.1%	3.50	3.14	4.37	3.53	3.40	2.39	2.34	3.27	2.52	2.51
Top 0.01%	1.39	1.31	2.01	1.47	1.49	0.94	0.97	1.49	1.04	1.12
Top 0.001%	0.46	0.49	0.72	0.56	0.62	0.32	0.37	0.50	0.40	0.48
Top 0.0001%	0.11	0.14	0.21	0.16	0.19	0.08	0.12	0.14	0.12	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Gini coefficient	0.4444	0.4440	0.4593	0.4597	0.4615	0.4118	0.4162	0.4255	0.4234	0.4281

1) For the definition of gross income, see Section 4.- 2) Gross income less assessed income tax liability, disregarding other direct taxes on household income or wealth, social security contributions and other charges levied by public authorities.
Source: ITR-SOEP data base.

2.1.6 Summary and Conclusions

Whilst the evolution and concentration of top incomes have recently been analyzed for a number of countries, their taxation has received relatively scant attention. In this paper, we have analyzed the progressivity and redistributive effects of the PIT focusing on top incomes on the basis of individual tax returns data for the period 1992-2002. The great advantage of our data source is that it allows us to investigate the upper tail of the income distribution on the basis of complete and reliable data. Since *all* taxpayers within the 1 percent percentile are represented in our integrated data set, we can provide a fine breakdown of the top percentile

of the income distribution in Germany that does not entail any sampling error. Thus, for the first time the German *economic elite*, which we defined as representing the 0.001 percent quantile of the gross income distribution, and even the super-rich, the 0.0001 percent quantile, could be investigated.

We have measured (economic) gross income by adding to adjusted gross income reported in tax returns data all tax-exempted incomes as well as tax reliefs that can be identified in our integrated data base. Although there are some shortcomings in comparison to a theoretically well-defined economic income concept in terms of the Schanz-Haig-Simons net accrual principle, our empirical measure of income seems to be a reasonably effective tool to investigate the actual income situation and composition of gross incomes and to calculate the degree of effective tax progressivity.

On the basis of our integrated data set, we have shown that gross income in Germany is strongly concentrated at the very top of the distribution and that in the period 1992-2002 the increase of inequality in gross income was mainly driven by a rapid increase in gross income received by the German economic elite. Given the progressive German statutory tax schedule, this strong income concentration implies that the PIT could potentially play an important redistributive role and reduce income inequality. However, since the composition of income systematically varies with the level of income, effective progression differs from statutory progression. Tax base erosion, i.e., the gap between taxable and gross income, amounts to almost 50 percent, on average, with relatively little variation over time but substantial variation by level and source of income. The observed pattern of tax base erosion can be explained by differences in both specific tax regulations for the various income sources and the ability to exploit loopholes in the tax code. For top incomes, the share of taxed income has significantly declined in recent years.

Despite this decline and the recent tax reforms, which reduced top marginal tax rates significantly, the PIT effectively remains progressive in Germany. The distribution of the tax burden is highly concentrated: the top decile contributes more than half of the entire tax revenue and the share of taxes paid by the top 1 percent exceeded 20 percent in 2002. The average PIT liability of the German economic elite was almost Euro 8 million in that year, and its average effective tax rate measured in terms of gross income (including the solidarity surcharge and dividend taxation occurring at the corporate level) was about 34 percent. This is substantially less than the top statutory rate and substantially more than the overall average effective PIT rate of about 13 percent. However, effective tax progression stops at income levels within the top percentile, i.e., the effective tax rate is not monotonically increasing in gross income with-

in the top percentile of the income distribution. Furthermore, we have found that, whilst the average effective tax rate has remained fairly constant in the observation period, it has significantly declined at the very top. In particular, for the economic elite the average effective tax rate dropped by almost 18 percent in that decade.

As shown by our comparison of the distribution of gross and net income, the PIT substantially contributes to reduce economic disparities in Germany. In 2002, the PIT led to a reduction in the *Gini* coefficient from about 0.462 to 0.428, and this redistributive effect of the PIT has hardly changed since the early 1990's in Germany. We have also shown that in each year only the top decile of the gross income distribution contributed to the redistribution of income to people in the lower part of the distribution, where the lion's share of this redistributive effect is contributed by the top 1 percent of taxpayers.

We may have overestimated the degree of effective tax progressivity in Germany because our measure of gross income does not fully account for tax avoidance, and taxpayers with very high incomes might be in a better position to exploit those unobserved avoidance strategies. Hints of this come from comparing the business and capital incomes reported by the tax statistics to roughly comparable items in national accounts. Still, the magnitude of gross tax progressivity revealed by our analysis seems sufficiently large that our conclusions would remain valid even if the margins of error of our estimates were considerable.

Finally, it should be recalled that the present paper is restricted to the analysis of the progressivity of the PIT and its impact on the distribution of incomes at the level of taxpayers. To draw out the implications of this analysis for economic welfare and analyze the vertical redistribution and horizontal inequity effects of the PIT would require one to move from the taxpayer level to the individual level - taking household composition into account -, which seems an interesting topic for future research.

Appendix 2.1-1

Table A2.1-1 Structure of the ITR-SOEP data base compared to the national accounts, 1992-2002

	unit	1992	1995	1998	2001	2002
Income taxpayers (assessment)	1 000	29 479	29 676	28 673	29 104	27 557
Single assessment (singles)	1 000	13 961	14 299	13 789	14 595	13 798
Joint assessment (married couples) ¹⁾	1 000	15 518	15 377	14 884	14 509	13 760
Potential tax units total ²⁾	1 000	44 502	44 619	45 173	46 260	46 662
Estimated non-filers	1 000	15 023	14 943	16 500	17 156	19 105
Private households total ³⁾	1 000	35 700	36 938	37 532	38 456	38 720
Taxpayers as percentage of potential tax units	%	66.2	66.5	63.5	62.9	59.1
Taxpayers as percentage of private households	%	82.6	80.3	76.4	75.7	71.2
Gross income ⁴⁾ (integrated data base)	mill. Euro	1 295 340	1 428 540	1 565 068	1 651 233	1 690 463
Gross income less capital gains and transfers	mill. Euro	1 071 999	1 156 930	1 227 134	1 293 999	1 310 840
Gross domestic product ⁵⁾	mill. Euro	1 646 620	1 848 450	1 965 380	2 113 160	2 143 180
Primary income of private households ⁵⁾	mill. Euro	1 270 240	1 402 200	1 466 590	1 599 320	1 597 550
Gross income less capital gains and transfers as percentage of primary income private households	%	84.4	82.5	83.7	80.9	82.1
Wage income ⁶⁾ (integrated data base)	mill. Euro	902 253	984 404	1 019 664	1 069 102	1 082 666
Compensation of employees ⁵⁾ (national accounts)	mill. Euro	917 170	997 020	1 032 250	1 120 610	1 128 320
Wage income from tax statistics as percentage of compensation of employees from national accounts	%	98.4	98.7	98.8	95.4	96.0
Income from business activities and capital income ⁴⁾ (integrated data base, less capital gains)	mill. Euro	169 938	167 141	208 211	224 261	228 160
Entrepreneurial and property income of private households ⁵⁾ (national accounts)	mill. Euro	353 070	405 180	434 340	478 710	469 230
Entrepreneurial income	mill. Euro	124 990	143 280	142 120	132 970	143 000
Property income (net) ⁷⁾	mill. Euro	228 080	261 900	292 220	345 740	326 230
Business and capital income from tax statistics as percentage of entrepreneurial and property income from national accounts	%	48.1	41.3	47.9	46.8	48.6
<p>1) Married couples living together are assessed as one tax payer. - 2) Derived from population census statistics: Entire population of 20 years and older, married couples counted as one tax unit. - 3) Current population survey, may of resp. years. - 4) For the definition of gross income, see Section 4. - 5) At current prices, national accounts. - 6) Including employers' social security contributions and imputed social security contributions for civil servants, minus taxable pensions from former employments, plus tax-exempted foreign income and income from tax-exempted "minijobs". - 7) Received less payed property income (interest, distributed income of corporations, property income attributed to insurance policy holders, rents).</p> <p>Source: Income tax statistics 1992-2002; ITR-SOEP data base; national accounts.</p>						

Appendix 2.1-2

From Taxable Income to Gross Income

We obtain (economic) gross income by adding all tax-exempted incomes as well as tax reliefs that can be identified in our integrated data base. Specifically, the various income categories are computed as follows:

- Our measure of *wage income* includes employers' social security contributions and is calculated before deduction of allowable expenses. Since civil servants are not covered by the social security system but are also entitled to pensions and health insurance, we have imputed social security contributions to them, following the approach applied in national accounts. Taxable pensions from former employment, which are part of the statutory income from employment, are accounted as transfer income (see below). Tax-exempted foreign wage income is added.
- Income from *business activity* includes taxable income from agriculture and forestry, from unincorporated business enterprise and from self-employed activities (professional services). Tax reliefs are taken into account as far as they are identifiable in our data, e.g., tax-exempted profits from outbound business investments or tax subsidies explicitly surveyed in tax assessment. Since German income tax statistics do not provide information from financial accounting of firms (tax balance sheet, profit and loss statement), we cannot account for certain tax expenditures, such as depreciations according to the declining balance method or provisions for impending losses or pension reserves. We also cannot quantify the extent to which businessmen avoid taxation by disguising private expenses as operating expenditures or transferring part of their profits abroad via manipulations of transfer price.
- *Capital gains* from financial investments are taxable solely if they are classified as "speculation gains", i.e., if sale of the asset closely follows acquisition of that asset. In 2002, for example, this meant that the time lapse between buying and selling had to be less than 10 years in the case of real estate and less than a in the case of other assets (e.g., securities) for the capital gain to be legally counted as taxable income. Thus, capital gains included here are predominantly capital gains that were realized from transfer of an enterprise, parts of an enterprise, or shareholdings.
- Taxable income from *interest and dividends* includes all capital income from private investments, except income from business activities. Especially in this field we face difficult measurement issues. First, interest and dividend income was granted in the 1990s a rather high savers allowance of DM 6,000 / Euro 3,070 per year (double this amount for married

couples). We compute those allowances as part of gross income whenever tax units claim them. However, many taxpayers with financial income did not claim them since their financial income was lower. Second, bank secrecy law might have encouraged tax evasion of financial income to some extent. By definition, evaded income is not recorded by tax returns, but can be partially imputed from information contained in the SOEP.

- Taxable income from *renting and leasing* has been a vast loophole for tax-saving activities in Germany for decades, especially in the 1990s. Depreciation allowances, tax reliefs and generous accounting rules in combination with tax-free capital gains led to massive budgetary losses that could be set off against income from other sources to a large extent. Since most of these activities are likely to be motivated by tax avoidance, we ignore losses exceeding some thresholds. In particular, losses of more than Euro 5,000 from direct investments in real estate and of more than Euro 2,500 from shareholdings (closed property funds, property developer partnerships etc.) are disregarded in calculating gross income. As a sensitivity check, we have alternatively included up to 50 percent of reported losses in gross income, which had very little effect on our calculations of tax erosion by income quantile and effective tax rates.
- Taxable *transfer income* includes taxable pensions derived from former employments, the taxable share of life annuity funds (pure interest portion of the annuity payment), and alimonies between separated and/or divorced spouses. We correct for the allowance for taxable pensions from former employment. Furthermore, we add the non-taxable share of life annuity funds, which is estimated as 70 percent of the whole pension. The ITR data set also provides the non-taxable replacement amounts from insurances for loss of earned income (e.g., benefits from unemployment or health insurance), as they are relevant for taxation with progression (*'Progressionsvorbehalt'*). Social assistance, housing benefits, and other public transfers not captured by the ITR data are taken from the information contained in the SOEP.

Table A2.1-2 Average and top average real gross incomes in Germany, 1992-2002

Gross income ¹⁾	1992	1995	1998	2001	2002	1995	1998	2001	2002
	1 000 Euro at 2000 prices ²⁾					1992 = 100			
Mean income	35.0	34.9	35.9	35.8	35.9	99.6	102.5	102.4	102.5
Median income	27.6	27.0	26.8	26.6	26.2	98.1	97.3	96.4	95.0
Average income									
Top 10%	109.5	108.4	117.8	116.5	115.4	99.0	107.6	106.4	105.4
Top 1%	317.1	295.1	361.0	328.9	317.3	93.1	113.8	103.7	100.1
Top 0.1%	1 223.2	1 095.0	1 566.8	1 266.2	1 218.1	89.5	128.1	103.5	99.6
Top 0.01%	4 875.6	4 569.4	7 207.2	5 280.5	5 357.0	93.7	147.8	108.3	109.9
Top 0.001%	16 280.5	17 198.3	25 936.2	19 917.8	22 393.3	105.6	159.3	122.3	137.5
Top 0.0001%	40 947.6	51 226.3	74 478.6	58 540.7	70 247.1	125.1	181.9	143.0	171.6
Lowest income									
Top 10%	66.7	68.1	69.3	70.8	72.3	102.1	104.0	106.2	108.4
Top 1%	143.5	142.9	151.4	153.7	151.2	99.6	105.5	107.1	105.4
Top 0.1%	475.8	428.1	512.0	481.7	450.6	90.0	107.6	101.2	94.7
Top 0.01%	2 093.4	1 772.1	2 714.5	2 085.7	1 905.9	84.6	129.7	99.6	91.0
Top 0.001%	8 627.7	8 197.8	12 068.7	9 396.3	9 421.9	95.0	139.9	108.9	109.2
Top 0.0001%	26 112.2	27 589.2	47 732.8	33 046.7	37 092.7	105.7	182.8	126.6	142.1

1) For the definition of gross income, see Section 4.- 2) Deflated by consumer price index.
Source: ITR-SOEP data base.

Table A2.1-3 Distribution of gross income by income component, 2002

Gross income ¹⁾ fractiles	Gross income ¹⁾	Wage income ²⁾	Income from business activity ³⁾			Capital gains ⁴⁾	Capital income less capital gains			Transfer income
			Total	Thereof: income from			Total	Interest, dividends ⁵⁾	Renting and leasing ⁶⁾	
				business enterprise	profess. services					
by income fractiles, in percent										
1 st - 5 th decile	18.7	9.6	1.3	- 1.1	3.7	- 0.9	15.3	14.3	17.7	53.8
6 th - 9 th decile	49.1	56.6	34.6	42.5	24.2	5.0	33.3	33.2	33.4	37.4
10 th decile	32.2	33.8	64.1	58.7	72.1	95.9	51.5	52.5	48.9	8.7
Top 1%	8.8	5.4	38.1	34.8	41.3	86.7	27.9	29.2	24.6	1.1
Top 0.1%	3.4	1.0	18.0	21.9	9.5	69.6	15.5	18.0	9.1	0.2
Top 0.01%	1.5	0.2	8.6	12.1	1.0	49.4	6.9	8.7	2.2	0.0
Top 0.001%	0.6	0.0	3.8	5.0	0.1	26.7	2.3	3.0	0.5	0.0
Top 0.0001%	0.2	0.0	1.3	1.6	0.0	8.2	0.5	0.7	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
by income components, in percent										
1 st - 5 th decile	100.0	32.9	0.6	- 0.3	0.7	0.0	3.7	2.5	1.2	62.9
6 th - 9 th decile	100.0	73.9	6.3	4.1	1.8	0.1	3.1	2.2	0.9	16.7
10 th decile	100.0	67.2	17.9	8.6	8.0	1.7	7.2	5.3	2.0	5.9
Top 1%	100.0	38.8	38.6	18.6	16.7	5.7	14.3	10.7	3.6	2.7
Top 0.1%	100.0	18.9	47.5	30.6	10.1	11.9	20.6	17.1	3.5	1.1
Top 0.01%	100.0	8.3	51.4	38.2	2.4	19.2	20.8	18.8	2.0	0.3
Top 0.001%	100.0	4.1	54.5	38.3	0.6	24.9	16.3	15.3	1.0	0.1
Top 0.0001%	100.0	1.8	61.6	38.1	0.0	24.6	11.8	11.8	0.1	0.1
Total	100.0	64.0	9.0	4.7	3.6	0.6	4.5	3.2	1.3	21.9

1) For the definition of gross income, see Section 4.- 2) Including employers' social security contributions and imputed social security contributions for civil servants, minus taxable pensions from former employments, plus tax-exempted foreign income and income from tax-exempted "minijobs".- 3) Taxable income from agriculture and forestry, from business enterprise, from self-employed activities (professional services), plus tax reliefs, less capital gains from business activity, plus tax-exempted foreign income.- 4) From business activity and from private investments (solely speculation gains).- 5) Taxable income from investments (exclusive income from business activities), inclusive receipts below the savers allowance, less capital gains from private investments.- 6) Taxable income from renting and leasing, plus higher losses from renting and leasing.
Source: ITR-SOEP data base.

Table A2.1-4 Adjusted gross income as percentage of gross income by income component, 1992-2001

Gross income fractiles ¹⁾	Gross income ¹⁾	Wage income ²⁾	Income from business activity ³⁾	Capital gains ⁴⁾	Capital income			Transfer income
					Total	Interest, dividends ⁵⁾	Renting and leasing ⁶⁾	
2001								
1 st - 5 th decile	40.9	69.6	92.5	107.1	28.5	30.3	24.7	24.4
6 th - 9 th decile	69.1	76.2	98.3	29.3	33.5	40.4	14.9	32.1
10 th decile	79.3	81.6	95.8	89.1	50.1	77.1	- 47.1	33.0
Top 1%	86.6	89.6	95.1	93.8	65.2	88.7	- 32.1	42.0
Top 0.1%	90.2	93.3	93.6	96.9	80.7	93.6	- 9.9	53.2
Top 0.01%	91.1	94.2	91.4	96.1	87.4	94.7	- 16.6	61.4
Top 0.001%	88.6	91.8	86.6	91.9	91.7	96.7	- 61.5	50.0
Top 0.0001%	81.6	93.8	77.5	77.9	95.6	98.2	- 68.3	75.1
Total	67.0	77.3	96.6	84.4	42.0	60.4	- 13.4	28.0
1998								
1 st - 5 th decile	42.6	70.2	97.7	83.6	10.0	9.0	11.9	25.4
6 th - 9 th decile	69.6	76.2	98.6	61.4	- 1.9	18.3	- 44.0	32.6
10 th decile	77.1	80.9	96.4	96.0	4.8	64.9	- 196.6	38.7
Top 1%	82.8	89.5	96.0	98.4	20.6	82.6	- 207.7	39.9
Top 0.1%	87.9	94.2	95.1	99.8	44.7	90.4	- 230.8	44.3
Top 0.01%	91.4	95.7	93.0	100.0	58.7	91.6	- 327.7	38.6
Top 0.001%	92.3	96.9	92.8	100.0	68.8	92.7	- 270.4	35.6
Top 0.0001%	95.3	97.0	95.5	100.0	73.5	83.5	- 129.4	40.9
Total	66.8	77.1	97.2	95.0	3.7	45.2	- 105.9	29.0
1995								
1 st - 5 th decile	43.9	71.4	91.7	65.4	14.4	7.4	25.5	24.1
6 th - 9 th decile	70.6	77.0	98.7	32.9	4.3	20.7	- 34.6	32.0
10 th decile	76.7	81.2	97.0	87.9	- 5.2	67.5	- 224.3	44.2
Top 1%	79.5	88.6	96.7	95.0	1.2	87.4	- 254.5	43.6
Top 0.1%	82.3	93.3	96.0	99.6	24.8	96.8	- 293.3	52.2
Top 0.01%	85.6	94.5	93.9	99.8	41.5	99.3	- 394.3	58.7
Top 0.001%	84.9	96.1	88.9	99.7	43.9	99.8	- 589.0	50.4
Top 0.0001%	71.3	92.5	75.2	100.0	14.9	99.9	- 2 247.1	73.7
Total	67.2	77.6	97.5	84.4	1.2	44.4	- 105.2	28.3
1992								
1 st - 5 th decile	47.7	72.5	99.0	79.8	15.1	11.9	21.2	25.9
6 th - 9 th decile	72.3	78.0	99.7	65.3	2.4	20.0	- 47.9	32.7
10 th decile	81.0	82.2	99.0	94.4	33.2	82.0	- 131.8	40.0
Top 1%	87.7	89.7	98.7	97.3	49.1	99.8	- 146.9	44.2
Top 0.1%	90.7	94.0	98.3	99.7	63.3	100.0	- 165.5	51.2
Top 0.01%	93.7	93.8	97.8	100.0	75.8	100.0	- 193.6	59.3
Top 0.001%	93.8	95.0	96.8	100.0	73.1	100.0	- 496.9	60.3
Top 0.0001%	92.9	92.4	96.7	100.0	75.5	100.0	- 439.6	76.3
Total	70.1	78.6	99.2	92.6	21.6	54.2	- 72.2	29.2

1) For the definition of gross income, see Section 4.- 2) Including employers' social security contributions and imputed social security contributions for civil servants, minus taxable pensions from former employments, plus tax-exempted foreign income and income from tax-exempted "minijobs".- 3) Taxable income from agriculture and forestry, from business enterprise, from self-employed activities (professional services), plus tax reliefs, less capital gains from business activity, plus tax-exempted foreign income.- 4) From business activity and from private investments (solely speculation gains).- 5) Taxable income from investments (exclusive income from business activities), inclusive receipts below the savers allowance, less capital gains from private investments.- 6) Taxable income from renting and leasing, plus higher losses from renting and leasing.
Source: ITR-SOEP data base.

2.2 The Impact of Losses on Income Tax Revenue and Implicit Tax Rates of Different Income Sources

Abstract: In order to calculate the burden of a comprehensive and progressive income tax falling on a certain income source, an apportionment scheme for the entire tax burden has to be chosen. This raises the question of how to deal with losses, which is relevant for Germany in view of the heavy losses from renting. Using micro data from tax statistics we analyze the income tax shares of functional income sources for three apportionment schemes. The choice of the apportionment scheme markedly affects the tax shares of income sources and the implicit tax rates, in particular those of capital income.

2.2.1 Introduction

The effective tax burden on economic activities plays an important role for many issues of fiscal policy. Business and capital income taxation both affect investment, location decisions, financing, choices of legal form, and portfolio allocation. Taxes on wages have an impact on employment, both as part of the income tax or as payroll taxes financing social security. Due to the complexity of real-world taxation systems there is a need for summary measures on the tax burden of functional income sources and their share in total tax revenue (Sørensen, 2004: 1). Such summary measures are of particular interest for the description of tax burden over time or across countries.

Macroeconomic summary measures are constructed for income types by economic functions such as labor income, business and capital income, etc.). The European Commission (2009) estimates macroeconomic implicit tax rates in the tradition of Mendoza, Razin, and Tesar (1994) and enhancements of these methods (see OECD, 2001). The calculations are based on national accounts data and revenue statistics. They give an impression of the effective tax burden in a certain period in the past (“backward-looking”). Besides, the tax burden is modeled for “representative” companies, employees, or households, in order to demonstrate potential impacts on different tax rules (“forward-looking”) (see, among others, Devereux et al., 2002, Spengel, 2003, OECD, 2007, Devereux et al., 2008, for the differences between the approaches see Becker and Fuest, 2006). In this paper, we only discuss a backward-looking approach, which is based on micro data from tax statistics.

As a starting point for an empirical analysis on the effective tax burden of functional income sources one has to allocate total tax revenue across the income sources involved. For instance, business and capital income taxes should be assigned to business and capital income, payroll and social security taxes to labor income, unless incidence analysis suggests a different distributional impact. This is not straightforward, however, in the case of the personal income tax

(PIT), which is the highest-yielding revenue source of direct taxation in most OECD countries. Actual PIT systems aggregate several income categories to a “comprehensive” tax base, allowing for loss-offset across income types within the assessment year and over time, deducting several personal allowances and taxing the residuum at progressive tax rates. The tax share falling on one income type hence depends on the amount of other taxable income types. Therefore, an apportionment scheme has to be chosen in order to calculate the tax burden of an income type. This raises the question of how far the estimated tax burden on one income source depends on the choice of the apportionment system. Using representative micro data we precisely model different apportionment rules and analyze their impact on tax shares.

A simple apportionment scheme allocates the total PIT liability across the positive income sources according to their share in total positive income. Losses from particular income sources are neglected in this case. Many countries use this procedure for limiting tax credits against the PIT, e.g., tax credits for taxes from abroad, or for local and regional taxes.²⁰ The European Commission (2009) uses a second apportionment scheme. The individual tax liability is allocated according to the share of an income source in total income, both positive and negative. As long as the tax liability is positive, a negative income tax share is assigned to those income types that are running losses.

We suggest a third apportionment scheme, which comprehensively accounts for loss offset. If some income sources run losses but others realize positive income we assign the fictitious tax liability to the positive income types that would have resulted in taxing them alone. The difference between the fictitious tax liability on positive incomes and the actual tax liability on total income is allocated to the losses as a negative revenue share. If there are losses but total income is still positive, due to tax progression the tax shares assigned to both positive and negative incomes are higher compared to the apportionment scheme used by the European Commission (2009). If the taxpayer’s total income is negative, all the incomes are neglected by the second apportionment scheme since there is no tax to pay. In case of the third scheme these incomes are taken into account if there is at least one positive income source.

Thus, the third apportionment scheme puts more weight on losses compared to the second. This is a matter of particular interest if some income sources often run losses, which is the case for business income and especially for income from renting and leasing. In Germany, the

²⁰ In Germany, the local business tax, which plays an important role in business taxation, is credited against PIT liability in the case of non incorporated firms.

latter income source was negative even in aggregate terms for decades. In order to analyze the third apportionment scheme we run a separate assessment for total positive income and assign the difference between the fictitious PIT liability for the positive incomes and the actual PIT liability to the loss income types as a negative revenue share. In analyzing the tax liability over time, we also take into account losses carried forward or carried back.

We analyze the impact of the alternative schemes on the tax share of functional income sources using representative micro data from tax statistics for all years available over the period from 1992 to 2003. Moreover, in order to point out the impact on macroeconomic implicit tax rates we calculate them following the approach of the European Commission (2009). The use of micro data from tax statistics instead of macro data from revenue statistics or national accounts allows for an apportionment of profit taxation to sole proprietors and partnerships. Therefore, for the first time for Germany we are able to allocate the overall tax burden on business income to households (including the sole proprietors) and corporations (including partnerships) according to the concept of national accounts.

As a main result, we find that the choice of the apportionment scheme markedly affects the tax share attributed to the income sources. Income types without significant losses such as labor income or transfer incomes show higher tax shares and implicit tax rates if we account for losses. The opposite is true for capital income, in particular for income from renting and leasing, since losses from these incomes have been dominating during the last decades in Germany.

The following Section 2.2.2 portrays the three alternative apportionment schemes and illustrates their effects by an example close to reality. Section 2.2.3 further specifies the alternatives. Section 2.2.4 describes the empirical analysis based on micro data from tax statistics as well as national account data. Section 2.2.5 presents the results with respect to the income tax shares and implicit tax rates by functional income sources. Section 2.2.6 concludes.

2.2.2 Alternative Apportionment Schemes for the Personal Income Tax

In order to allocate the tax revenue raised by a comprehensive and progressive personal income tax (PIT) including loss offset across the income sources involved, an apportionment scheme for the entire tax burden has to be chosen. The selected formula should be convenient for the analysis intended, and the assumptions should be made clear. This study scrutinizes the impact of different apportionment schemes on the income tax shares and implicit tax rates of functional income sources and points out the consequences of the underlying assumptions.

A simple approach is to allocate the total PIT liability across the positive income sources according to their share in total positive income. The German income tax law applies this procedure in crediting foreign taxes (Sec. 34c German Income Tax Code) or parts of the local business tax (Sec. 35 German Income Tax Code) against PIT.²¹ Losses from particular income sources are neglected in this case although they reduce taxable income and thus the PIT liability. The latter is allocated to positive incomes only.

An alternative is splitting up PIT by both positive and negative income sources according to their share in total income, aggregated over all incomes and allowing for loss offset. The European Commission employs this apportionment scheme for the calculation of implicit tax rates for functional income sources (European Commission, 2009, De Laet and Wöhlbier, 2008).²² From an economic point of view, taking into account losses in allocating PIT burden across income sources could be motivated by fundamental characteristics of income streams. Investment choices and many other economic decisions often have an impact over many years. Therefore the resulting income streams should be appraised for longer time periods. This is particular the case for business income, for which losses often have to be balanced by profits in later years. Another issue of German income taxation is that taxable income from renting and leasing is negative even in aggregate (see Table A2.2-1 in the Appendix 2.2). Tax policy obviously aims to promote housing and real estate investments by hidden tax subsidies in the guise of income determination rules. An allocation rule that only refers to positive income sources raised in the particular assessment year neglects the dampening effect of loss offset allowances, both within the assessment year and over time. Thus, income tax shares of stronger loss-making income sources such as business and rental income are overestimated, the shares of labor or transfer income are underestimated respectively. The apportionment scheme based on yearly positive and negative income sources can not fully account for long-term impacts of taxation over the life-cycle, in particular with respect to individuals that are only running losses over a long time. However, accounting for current losses and also considering losses carried forward or carried back might capture the essential elements of intertemporal income allocation.

²¹ In a similar way, the means testing of social transfers in Germany such as the housing allowance or public student loans only refers to positive income sources.

²² For Germany, these calculations were realized using comprehensive microsimulation models commissioned by the Federal Ministry of Finance. Presumably, current losses of single income sources were taken into account for the apportionment (see European Commission, 2009: 371). It remains unclear, however, if, and in which way, intertemporal loss carry-forward or carry-back have also been taken into account.

The following example points out these impacts for a taxpayer over three assessment years, whereas the time value of money is ignored and a simple tax schedule is assumed. In every year the taxpayer earns wages of Euro 70,000. In the first and second year he is running losses from a real estate investment, in the third year he sells this investment with a considerable capital gain, which is liable to PIT. To sum up, the total income over the three years amounts to Euro 210,000 from wages, and 20,000 from renting.

Example **Income sources, taxable income and personal income tax liability over three years**
in Euro

	Year			Total	Total in percent
	1	2	3		

Assumptions on tax base and tax rate

Income from						
wages and salaries	70 000	70 000	70 000	210 000	↑	91.3
renting and leasing	- 100 000	- 20 000	140 000	20 000	↓	8.7
Total income	- 30 000	50 000	210 000	230 000		100.0
Total positive income sources	70 000	70 000	210 000	350 000	↓	152.2
Deduction of loss carry-forward	0	- 30 000	0	- 30 000		
Adjusted gross income	- 30 000	20 000	210 000	200 000		
Personal allowances	15 000	15 000	15 000	45 000		
Taxable income	0	5 000	195 000	200 000		
PIT liability, 25% flat rate	0	1 250	48 750	50 000		

(1) Allocation of PIT liability across positive income sources

Income from						
wages and salaries	0	1 250	16 250	17 500	↑	35.0
renting and leasing	0	0	32 500	32 500	↓	65.0
Total	0	1 250	48 750	50 000	↓	100.0

(2) Allocation of PIT liability across all income sources including deducted losses

Income from						
wages and salaries	0	4 375	16 250	20 625	↑	41.3
renting and leasing	0	- 3 125	32 500	29 375	↓	58.8
Total	0	1 250	48 750	50 000	↓	100.0

(3) Allocation of PIT liability with separate assessment of positive and negative income sources

Income from						
wages and salaries	13 750	13 750	16 250	43 750	↑	87.5
renting and leasing	- 13 750	- 12 500	32 500	6 250	↓	12.5
Total	0	1 250	48 750	50 000	↓	100.0

For information: Effective tax rate
of income from

wages and salaries	19.6	19.6	23.2	20.8
renting and leasing	13.8	25.0	23.2	31.3

In order to determine the tax liability we assume a simple tax law. There is a loss carry-forward rule, no loss carry-back, personal allowances of Euro 15,000 per year are deducted from taxable income, there is a flat-rate tax of 25 percent, and there are no specific arrangements for family taxation or capital gains taxation. According to the example, no tax liability

is due in the first year. Non-deducted losses could be carried forward to the following year. The total income tax liability over the period sums to Euro 50,000.

If we allocate the yearly income tax liability only across positive income types (alternative 1 in the example) we ignore the losses from renting set off against labor income in splitting up PIT. In contrast, the considerable capital gain from renting in the third year is fully included in the apportionment. Therefore, the first allocation rule results in a 35 percent tax share of renting income. In contrast, the share for income from renting in total income over the three years amounts to only 8.7 percent.

The example's second alternative allocates the PIT liability according to both positive and negative income sources, thereby allowing for loss offset. Since the losses carried forward from the first year result from renting, the corresponding loss deduction in the second year is assigned to this income source. Thus, the share of renting income in total PIT liability over the three years declines to 59 percent. Yet this share is still much too high since the second apportionment scheme does not account for the positive labor income in the first year which is completely offset against losses from renting.

We suggest a third apportionment scheme, which fully accounts for loss offset, even in the case if there is no positive taxable income, like in the first year of our example. This alternative shows how much PIT revenue would have been raised if positive income sources were taxed alone without loss offset as well as the negative revenue impact of losses. For that purpose we run an additional assessment for each year that only accounts for positive income sources. The higher fictitious tax liability is allocated to positive income sources only. Afterwards, the difference between this fictitious tax liability on positive incomes and the actual tax liability on total income is allocated to the loss-making income sources as a negative revenue share. Over the three years, the tax share of the income sources nearly equals the income share. The remaining overestimation of the tax share falling on renting income results from the indirect tax progression that is caused by the personal allowances. These allowances are not included in the intertemporal loss offset. This impact would be enhanced by direct tax progression from increasing tax rates, which is still applied in most OECD countries.

2.2.3 Modeling the Apportionment Schemes

The empirical assessment of the PIT apportionment across different income types requires an adequate data base. In principle, macro data, semi-aggregated data or micro data could be used. As the advantages of micro data the European Commission emphasizes a precise esti-

mation of the share of each income type in total taxes and of the average tax rate (European Commission, 2009: 367, 375, see also Sørensen, 2004: 21, Clark, 2002).

In order to capture the impact of specific tax regulations for certain income types, the calculation of the PIT shares should be based on representative micro data from tax files. This allows a realistic allocation of taxes across income types for each taxpayer. In comparison, estimates based on statistics of cash revenue of the tax authorities do not necessarily provide a proper assignment of the income tax burden to the accrual period (BMF, 2004). Due to current interim payments, which are based on previous tax assessments, supplementary payments, or repayments for previous tax years, these estimates may differ substantially from the assessed tax liability in a certain year. Moreover, the reported aggregate tax revenue data may not be allocated properly by income sources since the underlying prepayment or repayment procedures encompass several income types. However, revenue statistics in Germany are available up to the present while micro data from income tax statistics are published with a considerable delay. At present, the latest complete wave is for the year 2004.

For couples, which are assessed jointly in Germany or in case of further household members included in the assessment, the income sources should be treated separately by individuals, provided that the information is available. For the apportionment scheme proposed in this study (alternative 3), an additional tax assessment has to be made taking into account only positive incomes. This requires a microsimulation model, which provides an estimate of the tax liability for each taxpayer close to reality. The PIT shares of the different income types on the individual level may then be added up in order to determine the respective shares on the aggregate level.

Naturally, the regulations of the German income tax system are more complex than the rules described in the example above. For instance, there are specific tax allowances and tax deductions for some income types. Moreover, as in many other countries, the tax rate is directly progressive, which means that the marginal tax liability increases with taxable income.

The characteristics of the German income tax function PIT , which are relevant for this study can be described for taxpayer j with income types i as follows (see also European Commission, 2009: 375, Clark, 2002):

$$PIT_j = t \left(\sum_i (Y_{i,j} - A_{i,j}) - L_j - A_j^p \right) - \sum_i C_{i,j} - C_j^p, \quad (1)$$

where the following notation applies:

- $t(\cdot)$ denotes the tax rate function with taxable income as argument. This function is “linear-progressive” in Germany, which means that the marginal tax rate increases with taxable income until the maximum income tax rate is reached (2009: 42 percent starting from a taxable income of Euro 52,552, and 45 percent from Euro 250,401 onwards).
- Y_i represents the single income type i , such as business income and its sub-categories (in Germany: agriculture and forestry, unincorporated business enterprise, and other self-employed activities), labor income, capital income (from capital investments and from renting and leasing), transfer income. Each type of income is included after the deduction of operating expenses or other income-related expenses.
- A_i measures income type specific allowances like the saver’s allowance for income from capital investments, or the allowance for income from agriculture and forestry.
- L denotes deducted losses that are carried forward from previous tax years or carried back from following tax years.
- A^p represents personal deductions and allowances like the tax allowance for elderly persons, the allowance for itemized special expenses and extraordinary expenses, or the child- or household allowances.
- C_i measures income type specific credits that are deducted from the tax liability as, for instance, the foreign tax credit, the credit for local business tax (since 2001) or the tax credit for domestic corporate income tax (until 2001).
- C^p denotes credits from the tax liability, which are not related to specific income types, for example donations for political parties, or expenses for household-related services (among others: expenses for house-cleaning).

Alternative 1

In the first PIT apportionment scheme considered, the total PIT liability is distributed by the share of positive income for each income type in total positive income. The income tax burden of person j assigned to income type i is formally defined as

$$PIT_{i,j} = \frac{\max(Y_{i,j} - A_{i,j}, 0)}{\sum_i \max(Y_{i,j} - A_{i,j}, 0)} \left(PIT_j + \sum_i C_{i,j} \right) - C_{i,j}. \quad (2)$$

Thus, the PIT liability is allocated according to the level of the positive incomes for each income source, as far as the earnings exceed the income-specific tax deductions. First, all income-specific tax credits are added on top of the tax liability that should be allocated among the income types. In a second step, the PIT share attributed to an income type will be reduced by the tax credits granted for this specific income type. Tax credits from the tax liability that do not refer to specific income types (C^p) will not be considered in the apportionment. Thus, they reduce the tax burden of all income types proportionally to their share in total positive income.

Alternative 2

The second alternative of an apportionment scheme takes into account both positive and negative income types. For that purpose, one should not only consider current positive and negative income sources but also deducted losses in the tax year (L), which are carried forward from previous tax years or carried back from following tax years. If adequate panel data were available, one could assign the impact of the losses from other periods to each income type, as it is the case for income from renting in the example above (Section 2.2.2). However, the only data available for Germany for the past are the cross-section surveys of the income tax statistics, which were drawn every three years. The waves are not connected and do not provide panel information. Panel information might be available in the future and will be based on the yearly survey of the assessment data that starts with the year 2001. At present, the available cross-section data only allow to take into account the aggregate of losses deducted. We define an additional negative income type L , which comprises deducted losses from other periods and will be considered in the allocation of the income tax across income types.

Thus, the income tax liability on income type i for person j ($PIT_{i,j}$) is formally defined as:

$$PIT_{i,j} = \frac{Y_{i,j} - A_{i,j}}{\sum_i (Y_{i,j} - A_{i,j}) - L_j} \left(PIT_j + \sum_i C_{i,j} \right) - C_{i,j}. \quad (3a)$$

The negative income tax liability $PIT_{L,j}$ falling on deducted losses (L_j) is defined as:

$$PIT_{L,j} = \frac{-L_j}{\sum_i (Y_{i,j} - A_{i,j}) - L_j} \left(PIT_j + \sum_i C_{i,j} \right). \quad (3b)$$

While the information from the cross-section micro data of the income tax statistic does not allow a precise allocation of deducted losses across income types, it can be used as a basis for a rough estimate. For the past the cross section data show the amount of current unclaimed losses, i.e., losses, which cannot be set off against current positive income in the tax year. The latest available wave of the income tax statistics 2004 reports a share of unclaimed losses in total losses for income from renting of 24 percent and a share for business income of 64 percent, the other income types are not important. Note, however, that the share of unclaimed losses for income from renting was somewhat higher in the years before 2004, and it was considerably higher in the nineties (1995: 39 percent, 1998: 37 percent). We use rough estimates based on this information in the calculations presented below in order to allocate the

tax share of unclaimed losses PIT_L across the income types i for the calculation of implicit tax rates (Section 2.2.5.2).

Alternative 3

Alternative 3 differs from alternative 2 if a person has positive income for some income types and losses for at least one other income type. For persons with positive income types only, the share of each income type is identical to the result in alternative 2. Thus, differences emerge only for persons with positive *and* negative income types. As demonstrated in the example in Section 2.2.2, an additional tax assessment of positive incomes only and assigning the negative PIT share to losses might lead to results for the PIT shares, which are close to those based on a proper analysis over time.

At fist, the additional tax assessment takes into account only positive income types. The fictitious tax liability on positive income types of person j , PIT_j^+ is formally defined as:

$$PIT_j^+ = t \left(\sum_i \max(Y_{i,j} - A_{i,j}, 0) - A_j^p \right) - \sum_i C_{i,j} - C_j^p. \quad (4)$$

This higher tax liability is distributed among the positive income types as:

$$PIT_{i,j}^+ = \frac{\max(Y_{i,j} - A_{i,j}, 0)}{\sum_i \max(Y_{i,j} - A_{i,j}, 0)} \left(PIT_j^+ + \sum_i C_{i,j} \right) - C_{i,j}. \quad (5)$$

Then, the difference between the actual income tax PIT_j and the fictitious higher tax on positive income PIT_j^+ is distributed among the negative income types. The tax burden for a negative income type i is then given as:

$$PIT_{i,j}^- = \frac{\min(Y_{i,j} - A_{i,j}, 0)}{\sum_i \min(Y_{i,j} - A_{i,j}, 0) - L} \left(PIT_j - PIT_j^+ + \sum_i C_{i,j} \right) - C_{i,j}. \quad (6a)$$

Analogous to equation 3b, the negative income tax burden $PIT_{L,j}^-$, which falls on loss carry-forward or loss carry-backward (L_j) is given by:

$$PIT_{L,j}^- = \frac{-L_j}{\sum_i \min(Y_{i,j} - A_{i,j}, 0) - L_j} \left(PIT_j - PIT_j^+ + \sum_i C_{i,j} \right). \quad (6b)$$

If the tax credits C_i and C^p themselves depend on the level of taxable income or on the level of the income tax liability, the effects of these dependencies could in principle be captured in the

equations (5), (6a), and (6b). For example, the old-age allowance depends on the level of labor income and other incomes except specific old-age incomes (pensions or annuities). The credit of foreign taxes or of the local business tax depends on the share of these income types in total taxable income and on the level of the PIT liability.

In case of a progressive tax, there are two main differences between alternative 2 and alternative 3 (see the example in the Appendix 2.2). First, the distributed tax liability is equal to zero both for positive and negative income types under alternative 2 if total income (adjusted gross income) is below zero and, thus, no taxes are paid in the current tax year. This differs from alternative 3 and this difference can be most easily described for the simple case of one positive and one negative income type. In this case, under alternative 3 the positive income type is assigned a tax amount, which depends on the level of the positive income type alone. If the sum of both incomes is below zero, the negative income type is assigned the level of the (fictitious) tax on the positive income type, with the opposite sign.

The second difference occurs if total income is positive and a PIT liability exists but at least one income type is negative. In alternative 2, the amount of losses is valued with the average tax rate and this rate is taken at the level of total income (adjusted gross income). Under alternative 3, taxes assigned to the loss income type are equal to the difference between the tax liability considering only the positive income types and the tax, which falls on total income (adjusted gross income). Approximately, this is equal to a valuation of the losses with the marginal tax rate (for the interval between total income and total positive income). As for a progressive tax scheme the marginal tax rate is higher than the average tax rate, losses are valued higher under alternative 3.

It can be shown that alternative 2 and 3 lead to equal results for a pure flat tax with tax rate α if no allowances are granted and taxes are refunded in case of negative taxable income:

$$PIT_j^{flat} = \alpha \sum_i (Y_{i,j} - A_{i,j}). \quad (7)$$

This is, for instance, the case with the European value-added tax (VAT). However, income tax systems in Germany and other OECD countries are far from fulfilling these conditions. The income tax is assessed on an annual basis. Unclaimed losses may only be carried back or carried forward in other tax years and offset against positive income, without any consideration of personal allowances. Approaches aiming to equalize the average tax rate over a longer time-period (Vickrey, 1939, Hackmann, 1979) cannot be found in real tax rules. This disadvantages persons with highly volatile income compared to those with a steady income stream.

Thus, alternative 3, or the differences in the results of alternatives 2 and 3 respectively, provide important additional information on the income tax share and implicit tax rates of income sources when losses play an important role for some income types. This was the case in Germany in the eighties and the nineties of the last century, especially for rental income (see Table A2.2-1 in the Appendix 2.2). The share of the income tax burden as well as the implicit tax rate for these income types are considerably lower under alternative 3 while the opposite applies for the other income types (see the results presented in Section 2.2.5).

2.2.4 Empirical Strategy for Germany

2.2.4.1 Apportionment Schemes for the Personal Income Tax

The effects of alternatives 1 and 2 can be analyzed empirically by using representative micro data of the German income tax statistics. Until 2001, the income tax statistics were collected in triennial intervals, including additional data from the wage withholding taxation. Since 2001, a yearly survey of the assessment data is also available. Our analysis is based on highly representative 10 percent stratified random samples from the personal income tax statistics of the particular years.²³ The data sets include nearly all items of the tax return forms, which are stored electronically by the fiscal authorities. Due to the long-lasting assessment procedures, the latest available wave of the income tax statistics is for the year 2004. Based on this detailed information we consider all income-specific allowances and tax credits in allocating the PIT liability across income types. The analysis of alternative 3, however, requires an additional PIT assessment that only accounts for positive income sources. We are using comprehensive microsimulation models to determine the higher fictitious PIT liability.

As income-specific allowances (A_i) we take into account the allowance for income from agriculture and forestry (Sec. 13 sub. 3 German Income Tax Code) and the saver's allowance (Sec. 20 sub. 4 German Income Tax Code). As income-specific tax credits (C_i) we consider the former top tax rate limitation for income from unincorporated business enterprise (Sec. 32c, until 2000), the credit for local business tax (Sec. 35, since 2001), and the credit for income from agriculture and forestry (Sec. 34e, until 2000). For income from capital investment, we account for the domestic corporate income tax that could be credited against PIT

²³ A higher sampling fraction is provided for taxpayers with higher income and other tax-relevant characteristics in order to minimize the standard error with respect to taxable income.

under the full imputation system in Germany until 2001. Due to lack of information and their minor quantitative importance, we neglect foreign tax credits in the apportionment analysis.²⁴

We also neglect the reduced tax rates for capital gains from sale of an enterprise, or parts of an enterprise (which apply if the entrepreneur retires or becomes disabled, Sec. 34 sub. 3 German Income Tax Code), that could be regarded as a type of tax credit. One should assign this tax reduction to business income. However, this would require extensive calculations in order to isolate the dampening impact on the tax liability. With respect to the minor impact on PIT revenue we neglect this provision for the split-up across income types.

For the PIT apportionment, the taxation with progression procedure (“Progressionsvorbehalt”) could be treated in different ways. According to this peculiar tradition of the German income taxation system, certain tax-exempted incomes (in particular exempted foreign income and wage replacement benefits from social security) are taken into account in calculating the average tax rate, which is then applied to taxable income only. We simply allocate this tax enhancing effect to the sources of taxable income according the respective apportionment scheme under consideration. Alternatively, one could regard this tax increase as a burden on the exempted income sources.

For joint-filing married couples we implement the PIT apportionment using the income information for each spouse, which is separately reported in the data set. If, for instance, the husband is running losses from renting of Euro 20,000, and his wife earns Euro 10,000 from renting, the wife’s positive income would account for the split-up according to alternative 1. If we regarded the couple as a single taxpayer, however, there would be losses from renting of Euro 10,000. In the case of alternative 3, the wife’s positive income from renting were considered in allocating the higher fictitious tax liability allocated to positive income sources only, and the husband’s losses were included in the apportionment of the negative revenue shares of loss income sources.

In addition to the analysis based on the tax return data from the income tax statistics of the respective years, we have to estimate the missing revenue from the numerous non-filing tax-

²⁴ The income tax files include only summarized information on foreign taxes that are allowed to credit against German PIT liability. There is no information available from which particular income types the foreign tax credit stems. Presumably, capital investments dominate the underlying incomes, and these incomes are usually taxed in the investor’s country of residence including foreign tax credit according to the double taxation provisions. In some cases business or labor income might also be affected, but usually these foreign incomes are exempted from domestic PIT in Germany.

payers only paying wage tax at the source. Until 2004, these tax returns are only partially included in the German income tax statistics since there was no reliable system to collect the wage tax cards that are not returned to the fiscal authorities. Results for 2004, the first year in which the electronic data transfer of the employers' wage-tax returns has been utilized by the tax statistics, reveal about 6 million non-filing wage taxpayers and an extra wage tax revenue of Euro 14.5 billion including solidarity surcharge tax. For the previous years, we estimate this missing revenue in comparing the entire wage tax revenue from the current revenue statistics with the aggregated wage tax of the filing taxpayers credited against income tax liability and thus reported in the income tax statistics. We assign the missing wage tax revenue to labor income.

The empirical analysis of alternative 3 is more intricate compared to the other apportionment alternatives. For an additional PIT assessment of the positive income sources we use comprehensive microsimulation models that fully account for nearly all of the relevant items of applicable tax law in the respective years. For the years 1995 and 1998 we use our own microsimulation model (Bach et al., 2004). For the years 2002 onwards we use the personal income tax microsimulation model of the Fraunhofer Institute for Applied Information Technology FIT, Sankt Augustin, which is operated on behalf of the German Federal Ministry of Finance in order to evaluate the fiscal and distributional impact of tax reforms.

The models are based on income tax samples for the corresponding years. The FIT personal income tax model is based on the 2003 wave of the assessed income tax statistics. Taxpayers, taxable and non-taxable income sources, and the other tax-relevant items are extrapolated to 2007 (for a description of the methods used see Quinke, 2001, Bach et al., 2004). Changes in tax law including the recent reforms are captured in the simulation code. Based on this model we are running simulations on the PIT liability for 2007.

The simulation models allow us realistic assessments of the additional PIT liability for the positive income sources according to alternative 3. For the calculation of total income and the subsequent determination of the PIT liability we nullify all of the negative income sources as well as the deduction of losses carried forward and back. In the case of joint-filing married couples, the apportionment scheme is performed with the detailed income information for each spouse, including the allocation of positive and negative PIT revenue shares according to alternative 3. Behavioral responses of the taxpayers to the higher tax burden are not considered.

2.2.4.2 Data Demands for the Calculation of Implicit Tax Rates

In order to highlight the impact of the different apportionment schemes on macroeconomic implicit tax rates we calculate these figures following the approach of the European Commission (2009). Implicit tax rates are defined as the ratio of the tax burden assigned to the respective income types and the corresponding income aggregates that are derived from the national accounts statistics. The implicit tax rates are calculated for labor income and for capital and business income, the latter differentiated by corporations and households including the self-employed. The European Commission (2009) reports such implicit tax rates for every year since 1995.²⁵

In line with the concept of the European Commission (2009), we adopt the “usual” assumptions regarding tax incidence, in particular, that the employers’ share of social contributions is borne by labor income, and that the corporate income tax and other business taxes fall on business and capital income. This means that these taxes are not shifted forward to consumers or backwards to employees or suppliers.²⁶ The main task of studies such as European Commission (2009) and our contribution presented here is to provide empirical information on tax revenue and macroeconomic tax bases. Based on this approach, different incidence assumptions across income sources could also be analyzed.

For calculating the implicit tax rate on labor income the European Commission includes the social contributions levied on labor income (European Commission, 2009: 354), in addition to the wage share in PIT liability. The revenue of social contributions is taken from the national accounts statistics (compulsory actual social contributions paid by employers and employees on employed labor income). The total tax burden on labor is put in relation to the compensa-

²⁵ The yearly calculation of macroeconomic implicit tax rates according to the approach of the European Commission (2009) raises a problem with respect to the timely accounting of losses carried forward or back (Clark, 2002: 15, see also Jacob et al., 2008: 11, 19). Current unclaimed losses actually reduce the income aggregate of the year when they arise. In contrast, the tax liability is reduced in the following or previous tax years when the losses are deducted from the tax base. In single years, this timing problem might have a significant impact on the implicit tax rates, in particular if there is a trend in losses, or gains and losses systematically vary over the business cycle. This problem might be of some importance for Germany because unclaimed losses carried forward strongly increased over the last decades (Dwenger, 2008). We abstain from adjusting for these unclaimed losses, and thus remain in line with the modelling of the European Commission (2009).

²⁶ These assumptions have been questioned for several decades. With respect to the first, this might not be true in the short run since the employer has to pay the contribution from his payroll in accordance with the applicable tax law. Adjustments in wage setting etc. take some time. In the case of the latter, recent studies indicate that labor might bear a substantial burden from the corporate income tax (Gentry, 2007). This seems plausible against the background of globalization, market income polarization, as well as the European tax reduction competition.

tion of employees according to national accounts. This is the broadest macroeconomic labor income aggregate, comprising all salaries and wages from dependent employment, including the remuneration of civil servants, wages from short-time employment taxed in a lump sum (the so called “minijobs” in Germany), other compensations from dependent employment exempted from PIT or social contributions, and the employers’ social contributions.

Our calculations on the implicit tax rates on capital and business income differ in some respects from the approach of the European Commission (2009). For the yearly tax burden of the local business tax and the corporate income tax, the Commission uses data from the current revenue statistics. In contrast, we are using the actual annual tax liability for these taxes, as it is reported in the corresponding tax statistics (see also Bach und Dwenger, 2007). This gives a more reliable picture of the yearly implicit tax rate, since the cash revenue disclosed in the revenue statistics for a given year might considerably differ from the actual tax liability for that year. These business taxes heavily rely on business profits, which is also true for the local business tax. Thus, current interim payments, which are based on previous tax assessments as well as supplementary payments or repayments after the assessment for previous tax years might considerably abandon the year’s actual tax liability according to the tax assessment, and these timing differences might heavily fluctuate with the business cycle or after major tax reforms.

As measure of the corporate income tax burden we use the assessed tax liability including solidarity surcharge and after deduction of domestic corporate income tax (until 2001 Germany applied the full imputation system to avoid double taxation of distributed profits). For 2007, we use the estimates of our microsimulation model for business taxation BizTax (Bach et al., 2008a). This model is based on representative micro data from the last available waves of the German business tax statistics, the model data set is updated to the present using the pertinent macro data and forecasts. Recent tax reforms are implemented in the tax assessment program code. Moreover, we estimate the withholding taxes on capital investments, which are not credited against domestic personal or corporate income tax, thus paid by foreigners or tax exempted residents. For that purpose, we compare the cash revenue from these taxes with the credits for these taxes reported in the personal and corporate income tax statistics for the particular years.

The European Commission assigns the social contributions levied on the income of the self-employed to capital and business income. In Germany, some self-employed members of professional guilds such as craftsmen, farmers, artists, or writers are compulsorily insured in the public pension system. Moreover, other self-employed persons are voluntarily insured in the

public pension system or in the public health insurance. We take these figures from the national accounts, according to the method of the European Commission (2009: 348).

The European Commission proposes a specific income concept for the denominator of the implicit tax rate on capital and business income (European Commission, 2009: 360) that is derived from the income accounts of the national accounts statistics. The idea is to approximate the actual tax base as close as possible. We modify this approach with respect to three items. First, we take into account the specific treatment of the local business tax revenue in the German national accounts. Although the German local business tax nowadays is largely levied on business profits, its revenue is not booked into the category “taxes on income” of the secondary distribution of income account (ESA 95 Code: d51). Instead, it is factored into the position “other taxes on production” in the generation of income account (ESA 95 Code: d29). This comes from the historical tradition of the local business tax, which was formerly levied on a broader base of the firm’s value added and equity. German statistical authorities are currently reconsidering this assignment. The revenue of “other taxes on production” is deducted in calculating primary incomes in national accounts. Since local business tax revenue should be included in the numerator of the implicit tax rate, it should not reduce the denominator, as it is the case in the Commission’s calculations. Therefore, we increase the denominator as defined by the European Commission by the local business tax revenue. Second, we reduce capital and business income by the non-taxable subsidies, which are roughly estimated by 20 percent of the category “production subsidies other than on products” (ESA 95 Code: d39rec) (see Bach und Dwenger, 2007: 62), and the profit income of the central reserve bank. The Tables 2.2-3 to 2.2-5 in the following Section 2.2.5 both include the capital and business income aggregates according to our concept and of the European Commission.

The comprehensive utilization of tax statistics data allows us, for the first time for Germany, to differentiate the implicit tax rate on capital and business income in those of corporations and households including the self-employed according to the concept of the European Commission. The reports of the European Commission (2009) do not provide these figures for Germany since the revenue statistics used in that study do not allow an apportionment to these subgroups of taxpayers. The problem is to isolate the share of non-incorporated partnerships in tax revenue. Partnerships play an important role in Germany as many medium-sized businesses and even some bigger firms use this legal form. The income of partnerships is taxed “transparently”, which means that the entire business income is passed to the shareholders who have to enter it into their PIT return. In national accounts, however, partnerships are assigned to the corporate sector, and German national accounts statistics follow this approach

according to European and international standards. The revenue statistics do not distinguish between those company sectors, but the tax statistics do. The local business tax statistics include the legal form of the firms, which we use. The income tax statistics differentiate business income (from agriculture and forestry, from business enterprise, and from professional services) into income from sole proprietorship and from partnerships. Based on this information, we further allocate the PIT share on business income across sole proprietors and partnerships using the alternative 2 as apportionment scheme. The share of sole proprietors is assigned to the household sector, the share of partnerships is assigned to corporations. The social contributions of the self-employed are allocated to the household sector.

For the denominator of the implicit tax rate we calculate the two sectors' macroeconomic income aggregates according to the concept of the European Commission (2009: 362), using the sectoral income accounts of the national accounts data.²⁷ The addition of the local business tax revenue as well as the deductions for non-taxable subsidies and profit income of the central reserve bank (see above) follow the respective information of the sectoral accounts.

2.2.5 Results

2.2.5.1 Personal Income Tax Shares

The results of the three PIT apportionment alternatives considered in this study are presented in Table 2.2-1 for the years 1992, 1995, 1998, 2003, and 2007. For 1992, the alternative 3 of the PIT split-up has not been analyzed because we do not have a microsimulation model for this year. The starting point of the apportionment procedure is the entire PIT liability per year including the non-assessed wage tax revenue and the solidarity surcharge. Until 2001, we deduct the domestic corporate income tax credited against PIT, according to the full imputation system applied until then in Germany. The PIT is the tax with the highest revenue in Germany. For instance, in 2003 the entire revenue of PIT including non-assessed wage tax and solidarity surcharge amounts to Euro 198 billion, or 9.2 percent of the gross domestic product (GDP). This revenue rises to 9.4 percent of GDP in 2007 according to our estimations based FIT personal income tax model. The model's data base for 2007 is aligned to the per-

²⁷ According to the concept of the European Commission (2009: 363) the capital and business income aggregates assigned to the two sectors do not sum up to the overall aggregate. Due to the double taxation of dividends at the company level and at the shareholder level, the Commission includes the dividend income received by households (ESA 95 Code: d42_S14-15rec) in both the corporations' and the households' denominator.

formance of the macroeconomic income aggregates and the cash revenue of the PIT components.

The categories of the income types considered in Table 2.2-1 follow the concept of the European Commission (2009). While most of the definitions of income types are obvious, some deserve a comment. Labor income only includes compensations for active dependent employment. Pensions and related benefits from former employment, in particular the remuneration of retired civil servants, are assigned to transfer income. Self-employed income comprises the income from all unincorporated business, inclusive agriculture and forestry and from professional services. These income sources comprehend the entire profit from business enterprise. There is no fictitious allocation across imputed entrepreneurial wage, return on business capital, and extra profits. Income from renting and leasing, from capital investment, and capital gains are consolidated to capital income. The remaining income types liable to PIT such as the taxable share of public pensions or alimonies between separated or divorced spouses are assigned to transfer income. For the apportionment alternatives 2 and 3 we consider deducted losses that were carried forward or carried back from previous or following tax years as a specific negative income type, as described above (see above, Section 2.2.4.2). Further analysis of the available waves of the income tax statistics shows that more than two thirds of the unclaimed losses generated in 2002 to 2004 stem from self-employed income, the rest refers to losses from renting. In the nineties, the share of renting income was somewhat higher. For the calculation of implicit tax rates (see the following Section 2.2.5.2) we assign the negative revenue impact of deducted losses from previous or following tax years to capital and business income, since labor income or other income types have practically no impact on unclaimed losses carried forward or back.

As expected, the PIT apportionment according to positive income types only (alternative 1) yields relatively low shares for income types that do not have significant losses such as labor income or transfer income (Table 2.2-1). Their share in the PIT is higher in alternatives 2 and 3. Taxable income from renting and leasing was heavily generating losses during the nineties. This causes lower PIT shares of capital income and especially of renting income for alternatives 2 and 3 compared to alternative 1.

Table 2.2-1 Allocation of PIT revenue by income sources according to different apportionment schemes, 1992–2007

	1992	1995	1998	2003	2007 ¹⁾
	Annual revenue, mill. Euro				
Personal income tax, wage tax ²⁾	147 927	154 177	180 688	189 144	216 154
Solidarity surcharge	5 659	10 675	8 974	9 064	10 506
Total	153 586	164 852	189 661	198 208	226 660
	as % of GDP				
Total	9.3	8.9	9.7	9.2	9.4
	Structure in % by income types				
Alternative 1					
Allocation across positive income sources ³⁾ from					
Labor income ⁴⁾	72.9	76.6	73.6	76.2	69.2
Self-employed income	20.7	17.6	21.0	16.7	23.5
Sole proprietors	13.5	10.5	11.9	10.8	15.3
Partnerships	7.2	7.1	9.1	5.9	8.2
Capital income	3.7	2.7	2.7	4.1	4.0
Capital investment ⁵⁾	1.9	0.7	0.8	2.0	2.1
Renting and leasing	1.8	2.0	1.9	2.1	1.9
Transfer income ⁶⁾	2.7	3.1	2.7	3.0	3.3
Deducted losses from other tax years	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0
Alternative 2					
Allocation across all income sources including deducted losses from					
Labor income ⁴⁾	74.5	78.8	75.7	77.9	70.3
Self-employed income	21.4	18.7	21.9	16.9	24.2
Sole proprietors	14.0	11.2	12.4	10.8	15.5
Partnerships	7.4	7.6	9.5	6.1	8.7
Capital income	1.5	-0.4	-0.1	2.4	2.7
Capital investment ⁵⁾	2.2	1.1	1.2	2.2	2.2
Renting and leasing	-0.7	-1.4	-1.2	0.2	0.5
Transfer income ⁶⁾	2.8	3.1	2.7	3.0	3.4
Deducted losses from other tax years	-0.2	-0.3	-0.2	-0.3	-0.6
Total	100.0	100.0	100.0	100.0	100.0
Alternative 3					
Allocation with separate assessment of positive and negative income sources ³⁾ from					
Labor income ⁴⁾		81.6	78.4	79.8	71.5
Self-employed income		20.1	22.9	17.0	24.3
Sole proprietors		12.0	13.0	10.9	15.5
Partnerships		8.1	9.9	6.1	8.7
Capital income		-3.7	-3.1	1.2	1.9
Capital investment ⁵⁾		1.7	1.7	2.4	2.3
Renting and leasing		-5.4	-4.8	-1.2	-0.5
Transfer income ⁶⁾		3.4	3.0	3.3	3.5
Deducted losses from other tax years		-1.3	-1.2	-1.3	-1.1
Total		100.0	100.0	100.0	100.0

1) Estimation.- 2) Assessed personal income tax, non-assessed wage tax, less credited domestic corporate income tax.- 3) For joint-filing married couples the income sources of each spouse are counted separately.- 4) Compensations for active dependent employment, excluding pensions and related benefits from former employment.- 5) Including capital gains.- 6) Other income liable to PIT less capital gains, including pensions and related benefits from former employment.

Sources: Personal income tax statistics, 10 % or 1 % stratified random samples of the respective years; PIT microsimulation models of DIW Berlin and FIT Sankt Augustin; Federal Statistical Office Germany (Destatis).

We find some variation over time for all income types. The share of self-employed income decreases from 1992 to 1995 as well as from 1998 to 2003. Besides business cycle fluctuations, the introduction of the top tax rate limitation for income from business enterprise in 1993 and the credit for local business tax as of 2001 might have had an impact on this development. According to the estimation for 2007 the self-employed income's share rises markedly. This reflects the profit boost in the years before, which is taken into account for the projection of the model's data base. Correspondingly, labor's share in PIT revenue varies in the opposite direction.

If we compare the results for alternative 2, which is used by the European Commission with those for alternative 3 suggested by us, we find that the labor income share in PIT for alternative 3 is higher by various percentage points. In 1995 the difference is 2.8 percentage points, it declines to 1.2 percentage points by 2007. For transfer income the revenue share increases by 0.3 percentage points. In contrast, the revenue shares of both capital income and loss deduction decrease considerably from alternative 2 to alternative 3. For capital income this effect is dominated by the heavy losses from renting and leasing during the last decades. Even for alternative 2 the PIT shares of total capital income are negative in the years 1995 and 1998. The decline of losses from renting and leasing leads to a positive share of this income type in the following years under alternative 2 but remains slightly negative under alternative 3. The PIT share of total capital income is positive in 2003 and 2007 for both alternatives 2 and 3.

2.2.5.2 Implicit Tax Rates

Our Tables 2.2-2 to 2.2-5 highlight the impact of the PIT apportionment scheme for the macroeconomic implicit tax rates on income sources, which are regarded as summary measures for the income tax burdens by economic functions. We adopt the approach developed by the European Commission (2009), as outlined above (Section 2.2.4.2). For that purpose, the tax revenue assigned to the respective income types is divided by the corresponding income aggregates, derived from the national accounts statistics. According to the approach of the European Commission, implicit tax rates are calculated for labor income (Table 2.2-2), and for capital and business income (Table 2.2-3), the latter differentiated by corporations (Table 2.2-4) and households including self-employed (Table 2.2-5).

The upper panel of the Tables 2.2-2 to 2.2-5 shows the results for the implicit income tax rates by the three apportionment schemes. The next panel displays the entire implicit tax rates where other relevant taxes such as social contributions or other taxes on business income are

also taken into account. These results could be best compared with the Commission's results on implicit tax rates for Germany. Deviations from our results stem from the differing data bases (assessment data from the tax statistics versus revenue statistics) and from some adjustments in the denominator of the implicit tax rate on capital and business income (see Section 2.2.4.2). The underlying aggregates on income sources and tax burden are reported in the lower panel of the Tables 2.2-2 to 2.2-5.

Implicit tax rates on labor income

In calculating the implicit tax rate on labor income, the European Commission puts the tax revenue in relation to the compensation of resident employees according to national accounts (for the precise definition see above, Section 2.2.4.2). The tax revenue from labor income includes both the wage share in PIT liability and the actual social contributions on labor income. According to our results the implicit tax rate rises until 1998 and declines afterwards (Table 2.2-2). The latter should reflect the reform agenda of the first red-green federal government after 1998, which markedly reduced social contribution rates. These reliefs were financed by spending cuts in social security and indirect tax hikes (VAT, eco taxes). In the following years the step-by-step income tax reform reduced income tax rates until the year 2005. Our results with respect to level and trend of the implicit tax rates on labor income are very close to those obtained by the European Commission (2009: 325) in most years, the remaining differences are due to the fact that the Commission's calculations are based on cash revenue of PIT.

What is interesting here is the share of PIT including solidarity surcharge that is affected by the apportionment scheme. Compared with alternative 1, which allocates the income tax only by positive income sources, alternative 2 yields an increase in implicit tax rates by 0.4 percentage points in 1995. Alternative 3 involves a rise of 0.8 percentage points in that year. The downturn of losses from renting and leasing lowers these differences until 2007 to 0.2 percentage points for alternative 2, and 0.4 percentage points for alternative 3 respectively. These differences seem not to be too substantial at first glance. In view of the huge aggregate of labor income amounting to Euro 1,200 billion, however, these differences deal with a tax revenue of Euro 3 to 5 billion in 2007. This equates to the revenue of the German inheritance and gift tax, which has been under heavy discussion for many years.

Table 2.2-2 Implicit tax rates on labor income according to different apportionment schemes for PIT revenue, 1992–2007

	1992	1995	1998	2003	2007 ¹⁾
Implicit tax rates on labor income ²⁾	%				
Personal income tax and solidarity surcharge on labor income, allocated by					
Alternative 1: Allocation across positive income sources	12.2	12.7	13.5	13.3	13.2
Alternative 2: Allocation across all income sources	12.5	13.0	13.9	13.6	13.5
Alternative 3: Allocation with separate assessment		13.5	14.4	14.0	13.7
Actual social contributions on labor income ³⁾	24.8	26.4	27.6	26.9	26.0
Total, allocated by					
Alternative 1: Allocation across positive income sources	37.1	39.1	41.1	40.2	39.2
Alternative 2: Allocation across all income sources	37.3	39.4	41.5	40.5	39.5
Alternative 3: Allocation with separate assessment		39.9	42.0	40.8	39.7
For information:					
Tax revenue and income aggregates	bill. Euro				
Personal income tax and solidarity surcharge on labor income, allocated by					
Alternative 1: Allocation across positive income sources	112.0	126.3	139.5	151.0	156.8
Alternative 2: Allocation across all income sources	114.4	129.9	143.6	154.5	159.4
Alternative 3: Allocation with separate assessment		134.4	148.7	158.2	162.1
Actual social contributions on labor income ³⁾	227.9	263.1	284.8	304.0	307.7
Compensation of employees (resident), national accounts	917.2	997.0	1032.3	1132.1	1183.6
1) Estimation.- 2) Based on the compensation of employees (resident), national accounts. This includes the employers' social contributions.- 3) Paid by employers and employees. Sources: Personal income tax statistics, 10 % or 1 % stratified random samples of the respective years; microsimulation models of DIW Berlin and FIT Sankt Augustin; Federal Statistical Office Germany (Destatis).					

Implicit tax rates on capital and business income

Moreover, the European Commission calculates implicit tax rates on capital and business income. Table 2.2-3 assembles all taxes on business and capital income, which are divided by the corresponding income aggregates. For the denominator we basically rely on the income concept of the Commission based on national accounts, but adjust for the local business tax, which is deducted from business income and correct for tax-exempted subsidies and central reserve bank profit (see above, Section 2.2.4.2). For the numerator we include the PIT share and the other taxes on business and capital income, such as the local business tax, the corporate income tax, the capital returns tax non-credited to domestic personal or corporate income tax, and the social contributions levied on the income of the self-employed.

Table 2.2-3 Implicit tax rates on capital and business income according to different apportionment schemes for PIT revenue, 1992–2007

	1992	1995	1998	2003	2007 ¹⁾
Implicit tax rates on capital and business income ²⁾	%				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	9.1	7.1	8.7	7.4	8.3
Alternative 2: Allocation across all income sources	8.5	6.3	7.9	6.7	7.9
Alternative 3: Allocation with separate assessment		5.3	6.8	6.0	7.5
Social contributions of the self-employed, local business tax, corporate income tax, non-credited capital returns tax, solidarity surcharge ³⁾	12.8	11.6	13.1	11.4	11.6
Total, allocated by					
Alternative 1: Allocation across positive income sources	21.9	18.7	21.8	18.7	19.8
Alternative 2: Allocation across all income sources	21.3	17.9	21.0	18.1	19.5
Alternative 3: Allocation with separate assessment		16.8	19.9	17.3	19.1
For information:					
Tax revenue and income aggregates	bill. Euro				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	37.4	33.4	45.1	41.3	62.3
Alternative 2: Allocation across all income sources	34.9	29.8	40.9	37.7	59.6
Alternative 3: Allocation with separate assessment		24.8	35.3	33.4	56.7
Other taxes on capital and business income, and social contributions of the self-employed ³⁾					
Local business tax	22.5	20.7	24.5	24.5	40.7
Corporate income tax ⁴⁾	18.3	17.9	26.4	23.3	28.3
Non-credited capital returns tax ⁵⁾	1.8	3.8	4.0	4.3	6.4
Solidarity surcharge	0.8	1.6	1.7	1.5	1.9
Social contributions of the self-employed	8.9	10.5	10.9	10.2	9.8
Total	52.3	54.5	67.6	63.8	87.1
Capital and business income, national accounts concept of the European Commission	398.9	460.5	503.3	545.5	721.6
own concept ⁶⁾	409.4	470.7	517.6	560.4	753.0
<p>1) Estimation.- 2) Based on business and capital income derived from national accounts, own concept.- 3) Data from tax statistics, estimations for 2003 and 2007; social contributions according to national accounts.- 4) Assessed corporate income tax less credited corporate income tax (full imputation scheme until 2001).- 5) Estimation.- 6) Business and capital income derived from national accounts according to the concept of the European Commission, plus deducted local business tax, less profit of the central reserve bank, less 20 percent of received subsidies. Sources: Personal income tax statistics, 10 % or 1 % stratified random samples of the respective years; corporate income tax statistics; local business tax statistics; microsimulation models of DIW Berlin and FIT Sankt Augustin; Federal Statistical Office Germany (Destatis).</p>					

For the PIT share on business and capital income we sum up the shares falling on the self-employed income, on income from capital investment, on renting and leasing, and on deducted losses from other tax years (see the respective items in Table 2.2-1). The latter are almost completely caused by unclaimed losses from self-employed and capital income, since losses do not play any significant role in labor and transfer income (see the discussion in Section 2.2.4.2). Table 2.2-4 and Table 2.2-5 present the breakdown of the implicit tax rate on capital and business income to corporations and households including self-employed.

Generally, the results presented here show relatively low implicit tax rates on capital and business income, compared to statutory tax rates or even effective tax rates estimated from „forward-looking“ simulation models for Germany (see Spengel, 2003, Becker and Fuest, 2006, Devereux et al., 2008). This reflects the remarkable shortfall of taxable business income reported in the tax statistics, compared to the corresponding income aggregates of national accounts (see Bach and Dwenger, 2007, Heckemeyer and Spengel, 2008). The same is true for capital income of households, which is also caused by the saver’s allowance for income from capital investments, and, presumably, considerable tax evasion.²⁸

The implicit tax rates on capital and business income markedly declined since 1992. In 1995, the massive investment incentives for East Germany provided by generous tax allowances might have impaired the tax burden, besides small tax cuts in the previous years. In 1998, the implicit tax rate turns out somewhat higher, which might be explained by the upturn of the business cycle. By 2003, the tax cuts from the preceding business tax reform came into effect. The years until 2007 show considerably rising implicit tax rates due to the boost in business income.

Because of the much smaller share of capital and business income in comparison with labor income, the impact of the PIT apportionment scheme on the implicit tax rates is significantly stronger than for labor income. The 1995 implicit tax rate using alternative 2 decreases by 0.8 percentage points compared to alternative 1, for alternative 3 the impact of the PIT allocation makes up 1.8 percentage points. Until 2007, these differences fall to 0.4 percentage points for alternative 2, and to 0.7 percentage points for alternative 3 respectively.

The comprehensive utilization of tax statistics data allows us, for the first time for Germany, to differentiate the implicit tax rate on capital and business income into those of corporations and households including the self-employed according to national accounts sectors. The report of the European Commission (2009) does not provide these figures for Germany since

²⁸ In order to illustrate the possible effect of an overestimation of capital and business income in national accounts on our results for the respective implicit tax rate, we calculated the implicit tax rates for alternative 2 assuming a capital and business income aggregate decreased by an amount equal to 1 percent of GDP. In this case, the level of the implicit tax rate shown in Table 2.2-3 for alternative 2 increases by less than 1 percentage point in all years observed.

the revenue statistics used in that study do not allow an apportionment to these subgroups of taxpayers with respect to non-incorporated partnerships (see above, Section 2.2.4.2).²⁹

Table 2.2-4 presents the results for the implicit tax rates for corporate business income, including the business and income tax share of partnerships. There is a considerable decrease in implicit tax rates over the period observed, in particular since the business tax reform of 2001. Until 2007, the implicit tax rates might have decreased further according to our estimated tax revenue. Although the tax revenue of both PIT and the other business income taxes rises considerably again, the macroeconomic tax base increases even stronger. In 1995, the implicit tax rate for alternative 2 increases by 0.4 percentage points compared to alternative 1, for alternative 3 by 0.7 percentage points. These differences reduce to 0.2 percentage points both for alternative 2 and 3 until 2007.

The implicit tax rates on capital and business income for the household sector including the self-employed are dominated by the PIT burden (Table 2.2-5) since the social contributions of the self-employed and the other taxes on business and capital income are low. The apportionment schemes have a strong impact on implicit tax rates, in particular when losses from renting and leasing peaked around the years 1995 and 1998. For these years the results report a reduction of the implicit tax rate for alternative 2 by 1.1 percentage points in comparison to alternative 1, and by 2.5 percentage points for alternative 3 (2.6 percentage points in 1998). In particular due to the decline of losses from renting and leasing the implicit tax rates almost recapture the 1992 level by 2007. The differences in the implicit tax rates decrease to 0.7 percentage points (alternative 2 versus 1) and 1.2 percentage points (alternative 3 versus 1).

²⁹ It should be noted that the capital and business income aggregates assigned to the two sectors do not sum up to the overall aggregate, as explained in footnote 27. Thus, the overall implicit tax rate on capital and business income is not equal to the weighted average of the sectors' implicit tax rates.

Table 2.2-4 Implicit tax rates on capital and business income of corporations including partnerships according to different apportionment schemes for PIT revenue, 1992–2007

	1992	1995	1998	2003	2007 ¹⁾
Implicit tax rates on capital and business income ²⁾	%				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	6.1	5.3	6.4	3.8	3.9
Alternative 2: Allocation across all income sources	6.3	5.7	6.7	3.9	4.2
Alternative 3: Allocation with separate assessment		6.0	7.0	3.9	4.2
Local business tax, corporate income tax, non-credited capital returns tax, solidarity surcharge ³⁾	21.4	17.6	18.9	15.2	14.5
Total, allocated by					
Alternative 1: Allocation across positive income sources	27.5	22.9	25.3	18.9	18.4
Alternative 2: Allocation across all income sources	27.7	23.2	25.6	19.0	18.7
Alternative 3: Allocation with separate assessment		23.6	25.8	19.0	18.7
For information:					
Tax revenue and income aggregates	bill. Euro				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	11.0	11.7	17.4	11.7	18.6
Alternative 2: Allocation across all income sources	11.4	12.5	18.0	12.0	19.7
Alternative 3: Allocation with separate assessment		13.3	18.8	12.0	19.8
Other taxes on capital and business income ³⁾					
Local business tax	19.1	18.6	22.4	21.7	37.2
Corporate income tax ⁴⁾	18.3	17.9	26.4	23.3	28.3
Non-credited capital returns tax ⁵⁾	0.4	0.8	0.8	0.9	1.3
Solidarity surcharge	0.7	1.4	1.5	1.3	1.6
Total	38.5	38.6	51.1	47.1	68.5
Capital and business income, national accounts					
concept of the European Commission	170.0	210.2	256.7	296.7	443.2
own concept ⁶⁾	180.3	220.2	270.4	310.8	472.9
<p>1) Estimation.- 2) Based on business and capital income derived from national accounts, own concept.- 3) Data from tax statistics, estimations for 2003 and 2007.- 4) Assessed corporate income tax less credited corporate income tax (full imputation scheme until 2001).- 5) Estimation.- 6) Business and capital income of corporations derived from national accounts according to the concept of the European Commission, plus deducted local business tax, less profit of the central reserve bank, less 20 percent of received subsidies. Sources: Personal income tax statistics, 10 % or 1 % stratified random samples of the respective years; corporate income tax statistics; local business tax statistics; microsimulation models of DIW Berlin and FIT Sankt Augustin; Federal Statistical Office Germany (Destatis).</p>					

Table 2.2-5 Implicit tax rates on capital and business income of households and self-employed according to different apportionment schemes for PIT revenue, 1992–2007

	1992	1995	1998	2003	2007 ¹⁾
Implicit tax rates on capital and business income ²⁾	%				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	7.5	5.4	6.4	6.1	7.5
Alternative 2: Allocation across all income sources	6.6	4.3	5.3	5.3	6.9
Alternative 3: Allocation with separate assessment		2.8	3.8	4.4	6.4
Social contributions of the self-employed, local business tax, non-credited capital returns tax, solidarity surcharge ³⁾	3.9	3.9	3.8	3.4	3.2
Total, allocated by					
Alternative 1: Allocation across positive income sources	11.4	9.3	10.2	9.6	10.8
Alternative 2: Allocation across all income sources	10.6	8.2	9.0	8.7	10.1
Alternative 3: Allocation with separate assessment		6.7	7.6	7.9	9.6
For information:					
Tax revenue and income aggregates	bill. Euro				
Personal income tax and solidarity surcharge on capital and business income, allocated by					
Alternative 1: Allocation across positive income sources	26.4	21.8	27.7	29.6	43.7
Alternative 2: Allocation across all income sources	23.5	17.3	22.9	25.7	39.8
Alternative 3: Allocation with separate assessment		11.5	16.5	21.4	36.9
Other taxes on capital and business income, and social contributions of the self-employed ³⁾					
Local business tax	3.4	2.1	2.2	2.8	3.4
Non-credited capital returns tax ⁴⁾	1.5	3.1	3.2	3.5	5.2
Solidarity surcharge	0.1	0.2	0.2	0.2	0.3
Social contributions of the self-employed	8.9	10.5	10.9	10.2	9.8
Total	13.8	15.9	16.5	16.6	18.7
Capital and business income, national accounts concept of the European Commission	353.1	405.2	434.3	482.9	577.7
own concept ⁵⁾	353.3	405.4	434.9	483.7	579.3
1) Estimation.- 2) Based on business and capital income derived from national accounts, own concept.- 3) Data from tax statistics, estimations for 2003 and 2007; social contributions according to national accounts.- 4) Estimation.- 5) Business and capital income of households and self-employed derived from national accounts according to the concept of the European Commission, plus deducted local business tax, less 20 percent of received subsidies. Sources: Personal income tax statistics, 10 % or 1 % stratified random samples of the respective years; local business tax statistics; microsimulation models of DIW Berlin and FIT Sankt Augustin; Federal Statistical Office Germany (Destatis).					

2.2.6 Summary and Conclusions

Summary measures on the tax burden by economic functions have a considerable influence on tax policy debates. They comprehend essential characteristics of the tax system and allow for comparisons over time or across countries. However, summarizing the vast complexity of the tax system to one or a few parameters always implies a loss of information. The effectiveness and significance of such parameters depends on their construction, and on the data base from which they are derived.

Macroeconomic implicit tax rates are important parameters for the description and evaluation of the tax burden by economic functions. This is particular true for the taxation of main income sources such as labor income, capital and business income, or transfer income. For that purpose, the tax revenue assigned to these income types is divided by the corresponding income aggregates, usually derived from the national accounts statistics (European Commission, 2009). This calculation is not straightforward, however, in the case of a “comprehensive” personal income tax (PIT). Real-world PIT systems aggregate several income categories, allow for loss-offset across income types, grant deductions of several personal allowances, and tax the residuum at progressive tax rates. Therefore, one has to implement an apportionment scheme for PIT, which depends on the aim of the analysis. This raises the question of how far the estimated tax burden of one income source depends on the choice of the apportionment system. In particular, losses that are allowed to set off against positive income in a tax year or over time may have a marked impact on the tax share of income sources as well as on implicit tax rates.

In this study, we examine three alternative apportionment schemes for allocating the personal income tax by income sources. The analysis demonstrates the impact of the alternatives on the tax shares and the implicit tax rate of income sources. The first apportionment scheme allocates total PIT liability across the positive income sources according to their share in total positive income. Losses from particular income sources are neglected in this case. A second apportionment scheme, which is used by the European Commission (2009), distributes the tax burden according to an income source’s share in total income, both positive and negative. Hence, the PIT share equals the income amount times the average tax rate. This apportionment scheme accounts for negative income shares of losses, which are set off against current positive income. However, this only applies if total income is positive and thus a tax liability comes due. We propose a third apportionment alternative, which comprehensively accounts for loss offset. In addition to the apportionment alternative 2 we account for losses even if the taxpayer’s total income is negative but at least one income source is positive. For that purpose, we run a separate assessment for total positive income and assign the difference between the fictitious PIT liability for the positive incomes and the actual PIT liability to the loss income types as a negative revenue share. With a direct progressive tax rate function, as it applies in Germany and most of the OECD countries, the negative revenue share of losses turns out to be higher than for alternative 2. This is also the case for losses, which are completely offset against current positive income. Approximately, losses are valued with the aver-

age tax under alternative 2, and with the marginal tax rate under alternative 3. Losses carried forward and carried back are also taken into account applying the alternatives 2 and 3.

We analyze the impact of the alternative schemes using representative micro data from the available years of the tax statistics over the period of 1992 to 2003. Moreover, we point out the impact on macroeconomic implicit tax rates, which we calculate following the approach of the European Commission (2009). Besides the personal income tax we include social contributions and the other taxes on business income (local business tax, corporate income tax). The use of micro data from tax statistics instead of macro data from revenue statistics or national accounts allows us, for the first time for Germany, to allocate the overall tax burden on business income to households (including the sole proprietors) and corporations (including partnerships) according to the concept of national accounts.

We find that the choice of the apportionment scheme markedly affects the tax share of the income sources. Alternative 1 involves higher income tax shares and implicit tax rates for income types that are running losses. Only tax liabilities on positive income count for the tax share although the tax base for calculating implicit tax rates is reduced by losses. Therefore, this apportionment scheme is not well suited for the calculation of implicit tax rates. Our calculations show noticeable differences in the results of alternatives 1 and 2 for capital income, in particular for income from renting and leasing, since losses from these incomes have been dominating during the last decades in Germany. Interpreting the macroeconomic implicit tax rate as tax burden of the “average individual”, one might better rely on alternative 2, which is also used by the European Commission (2009).

Alternative 3 puts more weight on losses, compared to alternative 2. This results in lower shares of capital and business income in total income tax burden, in particular due to the high losses from renting and leasing. This impact accounts for more than one percentage point during the nineties. For capital and business income of households including the self-employed this difference makes up 1.5 percent at that time, since losses from renting are concentrated at the household sector. Due to the decline of losses from renting these differences decrease considerably until the last years. Correspondingly, income sources without significant losses such as labor income or transfer incomes move in the opposite direction. They show higher tax shares and implicit tax rates. Thus, the apportionment alternative 3 provides significant information if single income sources run losses to a larger extend and over longer periods, as it was the case for income from renting in Germany over the last decades.

Appendix 2.2

Table A2.2-1 Business and capital income in the personal income tax statistics, 1983–2004

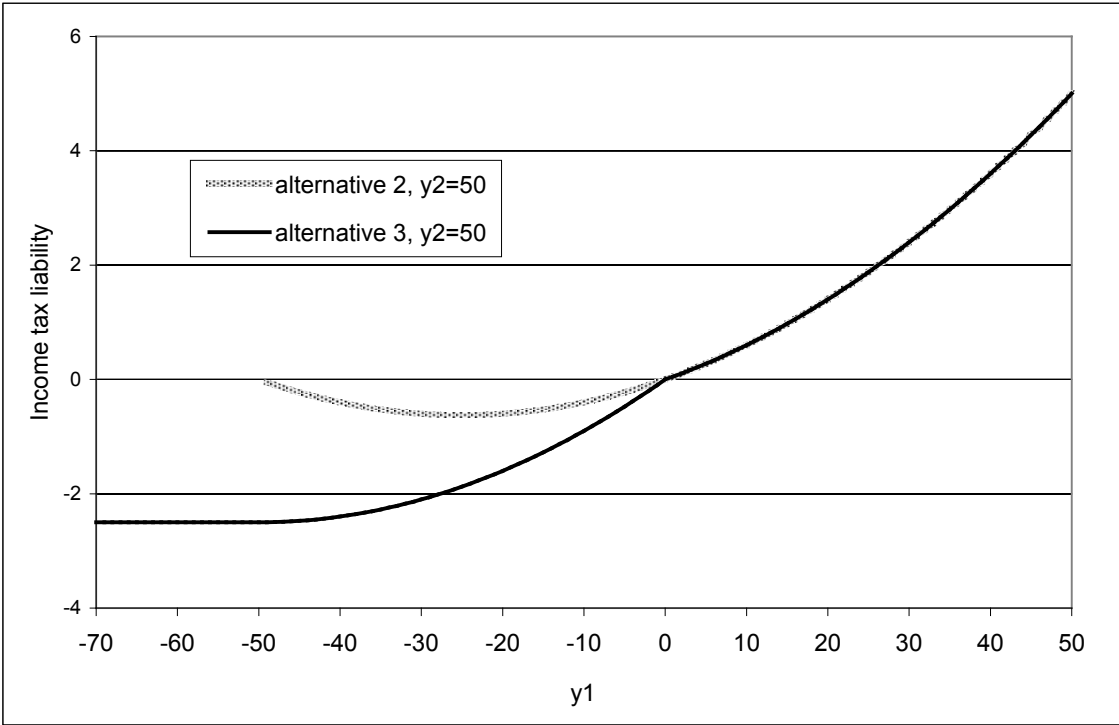
Income source	1983	1986	1989	1992	1995	1998	2001	2002	2003	2004
Income from	in billion Euro									
agriculture and forestry	4.3	4.6	5.8	6.1	6.4	7.7	7.4	7.0	6.8	7.2
positive income	4.5	4.8	6.1	6.7	6.9	8.2	7.9	7.6	7.4	7.7
negative income	- 0.1	- 0.2	- 0.3	- 0.5	- 0.5	- 0.5	- 0.5	- 0.6	- 0.6	- 0.5
business enterprise	44.6	50.6	67.2	67.3	62.0	86.7	70.7	71.6	71.8	78.4
positive income	46.1	52.4	73.2	78.4	77.2	103.8	88.9	87.7	85.1	90.8
negative income	- 1.5	- 1.8	- 6.0	- 11.1	- 15.2	- 17.1	- 18.2	- 16.0	- 13.3	- 12.4
self-employed activities	18.3	20.7	24.9	35.3	40.0	48.6	51.8	53.4	52.4	55.5
positive income	18.4	20.9	25.4	36.1	40.9	49.7	52.9	54.6	53.6	56.6
negative income	- 0.2	- 0.2	- 0.5	- 0.7	- 1.0	- 1.1	- 1.1	- 1.1	- 1.2	- 1.1
capital investment	9.9	12.8	16.1	28.6	18.3	22.7	32.3	19.7	17.0	16.7
positive income	9.9	12.9	16.4	28.8	18.6	23.0	32.8	20.2	17.4	17.0
negative income	- 0.1	- 0.1	- 0.2	- 0.3	- 0.3	- 0.3	- 0.5	- 0.4	- 0.4	- 0.4
renting and leasing ¹⁾	- 9.8	- 10.5	- 5.0	- 9.3	- 18.6	- 16.5	- 3.4	- 1.4	0.9	5.2
positive income	7.1	8.4	10.0	12.9	15.7	19.3	20.6	21.6	21.9	23.0
negative income	- 16.9	- 18.9	- 15.1	- 22.2	- 34.3	- 35.8	- 24.0	- 23.0	- 21.0	- 17.8
Total income	67.2	78.3	108.9	128.0	108.1	149.2	158.7	150.4	148.9	163.0
positive income	86.0	99.5	131.1	162.9	159.4	204.0	203.1	191.6	185.4	195.2
negative income	- 18.8	- 21.2	- 22.1	- 34.8	- 51.3	- 54.8	- 44.4	- 41.2	- 36.6	- 32.2
For information:	as percent of GDP									
Total income	7.7	7.8	9.3	7.8	5.8	7.6	7.5	7.0	6.9	7.4
positive income	9.9	9.8	11.2	9.9	8.6	10.4	9.6	8.9	8.6	8.8
negative income	- 2.2	- 2.1	- 1.9	- 2.1	- 2.8	- 2.8	- 2.1	- 1.9	- 1.7	- 1.5
1) 1983 and 1986: less imputed rental value from owner-occupied dwellings (estimated). Sources: Federal Statistical Office Germany (Destatis); own calculations.										

Illustration of the apportionment alternatives 2 and 3 for the personal income tax

In a simple example, we consider two types of income (y_1, y_2). The progressive tax function (T) is assumed to be given by: $T = 0.001 * (y_1+y_2)^2$.

For a constant level of income type 2 (equal to 50), Figure A2.2-1 shows the share (in absolute terms) of the income tax, which falls on income type 1, depending on the level of y_1 in a range between -70 und +50. First, it can be easily seen, that the share of the income tax falling on income type 1 is the same in both alternatives if the value of y_1 is positive (and therefore, the values of both types of income in the example are positive).

Figure A2.2-1 Tax liability assigned to income type 1 according to the apportionment alternatives 2 and 3



If the values for income type 1 start to be negative, both alternatives assign a strictly negative tax share to income type 1 at first. The value of this share is higher in alternative 3 compared to alternative 2. In alternative 2, the amount is equal to average tax rate calculated at $(-y_1+y_2)$ times y_1 . In the case of a loss of just one unit for y_1 , the tax share assigned to income type 1 in alternative 2 is equal to the average tax rate (calculated at $(-y_1+y_2)$). In alternative 3, the tax share assigned to income type 1 for negative values of y_1 is defined as the difference of the tax calculated at y_2 and the tax calculated at $(-y_1+y_2)$. For (negative) values of y_1 , which are close to zero, the tax amount assigned to income type 1 is nearly equal to the marginal tax rate calculated at $y_2=50$, with a negative sign. For the progressive tax function assumed, this

marginal tax rate is obviously higher than the respective average tax rate applied in alternative 2.³⁰

In case that the loss for income type 1 exceeds the positive income of type 2, the tax assigned to income type 1 remains negative in alternative 3. The amount is equal to the tax due to the positive income of income type 2 ($y_2=50$), however, with the opposite sign.

³⁰ For a linear tax function, for example $T=0.1(y_1+y_2)$, the results of alternatives 2 and 3 would be equal also for negative values of y_1 as long as the sum of both values remains positive. Consider, for example, the values $y_1=-1$, $y_2=50$, $y_1+y_2=49$. For these, the tax assigned to income type 1 according to alternative 2 is equal to $-1/49*(0,1*49)=-0,1$. According to alternative 3, the tax amount assigned to income type 1 is equal to $-(0,1*50-0,1*49)=-0,1$.

3 Business Taxation

This Chapter presents two studies on business taxation, based on representative micro data sets from tax statistics and the microsimulation model BizTax. Chapter 3.1 provides a microsimulation study on fundamental reform options for the German local business tax. Chapter 3.2 discusses the macroeconomic performance of business taxation against the background of corporate income and presumptive tax base erosion.

3.1 Local Business Taxation – Lessons from an International Comparison and a Microsimulation Analysis

Abstract: The local business tax as the main revenue source of local governments in Germany has been under extensive debate for decades. Proposals for reform range from a pure profit tax to an origin-based value-added tax. Local business taxation systems in OECD countries actually represent the whole spectrum between these two extremes. We use a newly developed microsimulation model for the business sector in Germany to analyze the first round fiscal and distributional effects of the general reform options identified. We also analyze the effects of the actual German business tax reform of 2008 with respect to local business tax revenues.

3.1.1 Introduction

Local business taxation has been a constant source of discomfort and critique among policy makers, taxpayers and academics for a long time, not only in Germany but apparently in many countries. If we look around the world, there is a broad variety of local taxes and charges levied on business. Economists have pointed out that local business taxes are often rather a product of piecemeal legislation enacted over decades and do not follow clear guidelines of local taxation such as fiscal equivalence and the benefits principle (see, e.g., Studenski, 1940, and Testa and Oakland, 1996, referring to the USA or Maiterth and Zwick, 2006, referring to Germany). In Germany, the local business tax is the main source of revenues for local governments and imposes a considerable burden on enterprises. As the tax largely depends on business profits, municipalities are faced with highly volatile tax revenues. Politicians, interest groups and economists have proposed various options for reform ranging from a pure

profit tax to an origin-based value-added tax. The literature weighting the pros and cons of the different taxation systems is extensive.³¹

In spite of the magnitude and importance of the debate, empirical information on the fiscal and distributional impact of different local business taxation systems based on micro data is scarce. The purpose of this paper is to contribute to filling this gap. For the empirical analysis in this paper we use our newly developed microsimulation model, BizTax. It is based on individual tax file data from the official local business and income tax statistics for 2001, which are updated to 2008. For the first time in Germany, the first round fiscal and distributional effects of different fundamental reform options for local business taxation can be quantified in detail on the basis of representative micro data.

Existing studies of business taxation have been dominated by case studies and showcase calculations (e.g., Devereux et al., 2002, Spengel, 2003). One reason is that detailed and representative individual firm and tax file data was hardly available in the past, especially about small and medium sized enterprises (SMEs).³² In Germany, fortunately the Research Data Centre of the statistical offices has made tax statistics increasingly accessible recently. Another reason for the scarce empirical literature is that the behavior of firms is hard to model because it has many dimensions – financing, investment, hiring, incorporation, entry, and exit decisions all interact. Dynamic CGE models calibrated to the German economy such as ifo-MOD consider the investment, financing, and factor demand behavior of firms (Stimmelmayer, 2007, Radulescu, 2007). However, a modeling of the German local business tax in this framework would require simplifying assumptions concerning the specific characteristics of the tax rules. Moreover, the highly aggregate structure of such models does not allow analyzing distributional effects across firm size, industries, or regions.

The field of microsimulation first covered the household sector, where representative survey or tax return micro data has been available for a longer time, and the main economic decisions, labor force participation and work intensity, are more easily modeled. Microsimulation is only slowly expanding into the business sector as researchers are gaining more experience with it and computational power is growing at the same time. Maiterth and Zwick (2006) used

³¹ Examples for the German discussion are Döring and Feld (2005), Petersen et al. (2005), Vesper (2004), Fuest and Huber (2003), Maiterth (2003), Junkernheinrich (2003), Zwick et al. (2003), Jarass and Obermaier (2003), Bach and Versper (2002), Scherf (2002), and Zimmermann (2002).

³² Data on large corporations has been used for research more often as they are obliged to publish financial statements.

a microsimulation model to assess the first round effects of two reform options for the German local business tax on 253 example municipalities, which were selected from the total of almost 14,000 municipalities in Germany. Zwick (2007) analyzed a local surcharge on the personal and corporate income tax, using representative micro data for all municipalities.

In the section following this introduction, we identify general models of local business taxation based on theory and an international comparison. We describe the institutional background in Germany and define five fundamental tax reform options for the German local business tax. In Section 3.1.3, we describe the data and the microsimulation model BizTax that we use to quantify the effects of these reform options. Section 3.1.4 presents the simulation results. The microsimulation model allows a precise analysis of the fiscal and distributional effects of the reform scenarios by industry, legal form, and by firm size in terms of profit and number of employees. Additionally we are able to analyze the impact of the reforms on different regional categories. For each of the various reform options, we investigate how its implementation would redistribute local business tax revenues between cores of agglomeration, surrounding areas and rural areas, West and East Germany, and between municipalities with high, medium and low local tax revenues per capita. Section 3.1.5 provides a short summary and conclusions.

3.1.2 Options for Local Business Taxation

3.1.2.1 Local Business Taxation in Public Finance Theory

The basic idea behind fiscal federalism theories is “fiscal equivalence” (Olson, 1969, Bird, 1999): If there are public services that benefit certain regions or groups, the pertinent beneficiaries shall decide on their quantity and quality but at the same time pay for them. This prompts citizens and firms to reveal their preferences and put some pressure on local governments for the efficient provision of public services. Where specific beneficiaries of public services can be identified, user charges are the preferred option. They are often ruled out for technical reasons or due to transaction costs, however. In these cases, taxation has to carry out the job.

In particular the German tradition in local public finance theory and practice highlights local firms and residents as the two main consumer groups of local public services (Zimmermann, 2002). Correspondingly, both groups are required to contribute to the local budget via specific taxes in order to balance the different claims for public services. However, it is difficult to apportion the share between both groups properly, since the main public services of the mu-

municipality benefit both groups, e.g., transportation infrastructure or secondary education. Thus, the idea of sharing the local tax burden between firms and residents can only serve as an institutional yardstick for political decision making.

The inclusion of immobile components in the local tax base ensures that the local beneficiaries bear the local tax burden. This speaks in favor of a broad-based taxation at the local level. According to this principle, the tax base of a local business tax may include profits, interest expenses, and other financing costs as well as the payroll. Taxing all income components leads to a tax on local net value added. Such a system exists in Italy (see below, Section 3.1.2.2). The other alternative is a tax on business property, obviously measured by real estate, plant, or equipment that could easily be assigned to the local jurisdiction. All these broad-based taxation systems imply a shift of the tax burden to the taxed production factors. In particular, the tax burden is likely to be shifted to the less mobile factors if the “benefit tax view” does not apply, i.e., if the tax burden exceeds the location’s productivity enhancing benefits (see the recent discussion in Zodrow, 2008).

The contrasting option for a local business tax is a pure tax on business profits. A local business profit tax is levied in Luxembourg and Japan. This system meets the claims of the business community not to tax cost elements and to refrain from placing a high tax burden on economic ability. It is argued that the taxation of cost components such as interest and wage expenses can cause liquidity problems for companies during periods of low profits or losses and thus hamper the recovery of companies in trouble. Risky investments become less attractive as enterprises have to pay taxes even in case of failure. Another argument to tax local profits may derive from the theory of economic geography (e.g., Baldwin et al., 2003, Baldwin and Krugman, 2002), which discusses the existence of location-specific rents. Such rents may, however, also appear as higher wages for managers and high-qualified specialists. Moreover, it is technically difficult to skim rents by taxes on extra profits or wages. In general, it is rather complicated to determine the local profit of a subsidiary or an establishment of a firm operating supraregionally or even internationally. In these cases the taxable income of the entire company or tax group is usually assessed at the national level and allocated to the sub-national jurisdictions by formula apportionment. As this formula uses payroll, sales, capital, or other business properties, the apportionment transforms the local profit tax into a tax on these production factors (Gordon and Wilson, 1986). However, if the firm is running losses, it does not need to pay a profit tax, in contrast to a tax on local net value added.

A further disadvantage of a local profit tax is the high volatility of revenues, which are strongly dependent on the business cycle. This is particularly problematic in the presence of region-

al structural change. In Germany, for example, tax revenues in a single municipality often depend on the economic performance of a small number of large enterprises and may be hit hard by the downturn of an industry dominating the regional economy. It may be argued that the government rather than the private sector should provide insurance against cyclical fluctuations in the tax base, but this task should be fulfilled at the state and federal levels rather than at the local level. Borrowing limits are stricter for local authorities than at the state or federal level in Germany, which makes it difficult for them to borrow during recessions and smooth expenses over the business cycle.

3.1.2.2 International Comparison

In this section, we compare the local business taxation systems in the main OECD countries in order to identify the basic models, which are actually implemented. All countries listed in Table 3.1-1 raise a land or property tax that is usually levied on the whole real estate value, including residential buildings as well as plants and other commercial buildings. This corresponds to the principle of taxing immobile factors at the local level. Moreover, it can be observed that in several countries local governments are endowed with some discretion to tax business properties as well as the resident population's income.

Beyond the land tax, the international comparison displays a wide range of local or regional business taxation systems (Table 3.1-1 and Table 3.1-2).³³ Nearly all conceivable combinations of the different production factors can be found as the tax base. From this variety of taxation systems some general models can be identified.

- A local *business profit tax* exists in Luxembourg and Japan.
- In some countries there are local *rates* to the national or single state *corporate income tax*. Examples are Portugal, Switzerland, and the USA. These local rates are levied on the profit share apportioned to the local jurisdiction, usually allocated by a formula using payroll, sales, capital, or a weighted index of these factors. In the USA, the state and local franchise

³³ The revenue impact reported in Table 3.1-1, which we derived from the OECD revenue statistics (OECD, 2006), only includes pure business taxes. It does not include revenues from land or property taxes falling on business properties, because the statistics do not allow distinguishing between the shares of the business and the private spheres. Thus, the reported revenue shares underestimate the overall local tax burden on business properties. In many countries, local land or property taxes impose a much higher tax burden on real estate than in Germany. Particularly, in most states of the USA the local property taxes extend to a wider range of fixed assets, so the tax revenue is considerably higher than the reported one which arises from the local franchise taxes.

taxation systems often extend or replace the corporate income tax base by elements of capital or payroll.

Table 3.1-1 Tax base and revenue of local business taxes¹⁾ in selected OECD countries

Country	Tax Base							Revenue 2004 ²⁾		For information:	
	Business value added			Business capital		Local corporate income tax	Other production factors	as percentage of		Land / property tax	Local income tax
	Profit	Interest expenses	Wage expenses	Fixed assets	Equity / net capital			GDP	Local tax revenue		
Germany	✓	✓						1.3	50.0	✓	
France				✓				1.3	26.4	✓	✓
Belgium							✓			✓	✓
Netherlands										✓	
Austria			✓					0.8	20.7	✓	
Denmark										✓	
Finland										✓	✓
Sweden										✓	✓
Luxembourg	✓							1.7	91.3	✓	
United Kingdom										✓	
Ireland										✓	
Italy	✓	✓	✓					2.3	33.4	✓	
Spain								0.2	1.6	✓	
Portugal						✓		0.2	12.4	✓	
Greece										✓	
Poland										✓	
Czech Republic										✓	
Slovak Republic										✓	
Hungary	✓	✓	✓					1.5	65.0	✓	
Norway										✓	
Switzerland					✓	✓	✓	0.5	10.9	✓	✓
Turkey										✓	
United States	✓	✓	✓	✓	✓	✓	✓	0.0	1.0	✓	✓
Canada										✓	
Japan	✓					✓		0.0	21.5	✓	✓
Australia										✓	
New Zealand										✓	

1) Business taxes with considerable discretion over the tax revenue assigned to the local government, in particular the right to set the tax rates at least in certain limits.- 2) Excluding property tax revenue from plants and other business assets.
Sources: Mennel and Foerster (2006), OECD (2006), European Commission (2007), IBFD (2007).

- Austria transformed its former “Gewerbsteuer” historically adopted from Germany, to a local *payroll* tax during the 1990s. The payroll is taxed at 3 percent, without any discretion of the local government over the tax rate.
- Taxes on business *capital* are in place in France, in the Canadian provinces, in the Swiss cantons, and in the USA. The historical “taxe professionnelle” has survived to this day in France as a local business tax on fixed assets, measured by the rental value. The former payroll component of the tax was phased out until 2003. The Canadian provinces levy taxes on the equity capital of incorporated firms. Swiss cantons tax net wealth of individuals and corporations. The municipalities are allowed to levy surcharges on the cantonal tax. In the USA, the state and local franchise taxation systems often include a capital component. Moreover, many local property tax systems in the USA do not only tax real estate including commercial buildings but also fixed assets such as machinery, motor vehicles, or other equipment.

Table 3.1-2 Local and regional business taxes¹⁾ in selected OECD countries

Country	Designation	Taxpayer	Tax Base	Tax Rate
Germany 2008	Gewerbesteuer (local business tax)	Business enterprises, excluding farmers, professionals	Local operating profit plus 25% of all interest expenses including interest portion of rents, leasing rates, and royalties, exceeding Euro 100,000. Allowance of Euro 24,500 for non-incorporated firms	7%-18%, average: 13.7%
Germany 2007	Gewerbesteuer (local business tax)	Business enterprises, excluding farmers, professionals	Local operating profit plus half the interest expenses on long-term debt. Allowance of Euro 24,500 for non-incorporated firms	9%-20%, average: 16.3%; lower rates for small firms
France	Taxe professionnelle (local business tax)	Business enterprises and professionals, excluding farmers	Local fixed assets rental value, reduced by 16%	Limited to 3.5% of gross value added
Austria	Kommunalsteuer (municipality tax)	Entrepreneurs or other employers subject to VAT	Wage expenses, low threshold for small firms	3%
Luxembourg	Impôt commercial (local business tax)	Business enterprises, excluding farmers, professionals	Local operating profit. Allowance of Euro 40,000 for non-incorporated firms and Euro 17,500 for incorporated firms	6%-9%
Italy	Imposta regionale sulle attività produttive - IRAP (regional business tax)	Entrepreneurs, non-profit organizations and public bodies	Local net value added from the provision of goods and services (subtraction method), wage expenses for non-profit organizations	Standard rate 4.25%, region's discretion of +/- 1%-point
Portugal	Surcharge on corporate income tax (CIT)	Corporations subject to CIT	Local share of CIT liability	0%-10%
Hungary	Helyi iparüzési adó (local business tax)	Entrepreneurs	Local gross value added (subtraction method). Allowance of Euro 10,500 (optional)	0%-2%
Switzerland				
Canton de Genève	Taxe professionnelle (local business tax)	Business enterprises and professionals, excluding farmers	Local business sales, rental value of fixed assets, number of employees	
All cantons	Cantonal corporate income tax (CIT), local surcharge	Corporations subject to national CIT	Cantonal/local share of CIT liability	Cantons: 2 %-10% local: 2 %-10%
	Vermögenssteuer (cantonal net worth tax, local surcharge)	Enterprises subject to cantonal PIT or CIT	Equity capital	0.05 %-0.5%
Spain	Impuesto sobre actividades económicas (local business tax)	Business enterprises and professionals, excluding farmers	Industry sector and floor space used, number of employees, electricity consumption. Exemption up to a turnover of Euro 1,000,000	
United States	Various types: surcharge on national CIT and PIT, franchise (income) tax, property tax on business fixed assets	Enterprises subject to PIT or CIT	Local share of business income or CIT liability, partly wage expenses, fixed assets, or equity capital	usually 1%-2% (local CIT surcharge)
Canada (provinces)	Capital tax	Incorporated enterprises	Equity capital	0.3%-0.5%
Japan	Enterprise Tax	Business enterprises and professionals, excluding farmers	Local operating profit	3%-12%

1) Business taxes with considerable discretion over the tax revenue assigned to the local government, in particular the right to set the tax rates at least in certain limits.
Sources: Mennel and Foerster (2006), OECD (2006), European Commission (2007), IBD (2007).

- A tax on local *value added* exists in Italy and Hungary. Both countries use the subtraction method to define the value added, i.e., sales revenues minus operating expenses on the purchases of goods and services. In contrast to the national VAT that is applied in nearly all OECD countries as a tax on final consumption, this value-added tax is origin-based and

thus does not provide an input tax credit, and exports to outside the jurisdiction are not exempted. The tax base of the Italian IRAP goes beyond the mere cash flow base of the national VAT by providing depreciation allowances for investments in fixed assets and accounting for capital gains and losses on operational assets. Hungary applies a gross cash flow base: Neither expenditures for investment goods nor depreciation allowances can be set off against the tax base.

- Finally, there are local business taxes that are levied on various *business properties*, e.g., floor space used, number of employees, electricity or energy consumption. Spain has such a taxation system, similar forms of local business taxation exist in the Swiss canton of Geneva, Belgium, and other countries. These taxes and charges usually do not raise considerable revenues, however.

3.1.2.3 Local Business Tax in Germany

The German local business tax (“Gewerbesteuer”, sometimes also called the “trade tax”) has its origins in the 19th century “taxe professionnelle” tradition and has been assigned to the local layer of German fiscal federalism since the 1930s. To this day, the local business tax is the main tax source of local governments in Germany (OECD, 2006). Originally, it rested on the pillars “profit before interests” (with adjustments), “capital” and “payroll”. The idea was to tax a broader base of local value-added. However, over the last decades several reforms increasingly washed out the tax base. The optional payroll component was discarded in 1980, the addition of interest expenses on long-term debt to the taxable income was reduced by half in 1984, and the business capital tax was abolished in 1998. Since its early days, the tax has exempted liberal professions such as physicians, lawyers, architects, and journalists, as well as farmers.

Today, the main source of the local business tax base is the operating profit attributed to the local jurisdiction. Therefore, received dividends are not subject to the tax (if they stem from shareholdings of more than 10 percent), and, correspondingly, if a company has a holding in a currently loss-making partnership, it cannot set off its share of these current losses against own taxable income. Moreover, the tax base is augmented by half of the interest expenses on long-term debt. Based on the resulting taxable income, the local business tax is determined in two steps. In the first step, the taxable income is multiplied by a basic federal tax rate (“Messzahl”) of 5 percent (in 2007) in order to obtain the uniform basic tax. Unincorporated firms, in particular SMEs, benefit from an allowance of Euro 24,500 and reduced basic federal tax rates up to a taxable income of Euro 72,500. The uniform basic tax is allocated to the

local jurisdictions involved. In the second step, the local jurisdictions apply a multiplier (“Hebesatz”), which they are entitled to determine, to their allocated share of the uniform basic tax. These multipliers range from a minimum rate of 200 percent to almost 500 percent in high-performing agglomerations such as Munich, Hamburg, or Frankfurt. Taking into account that the local business tax liability reduces its own tax base as deductible expense, the effective local tax rates ranged from a minimum rate of 9 percent to almost 20 percent in 2007. The average rate was about 16 percent. Sole proprietors and partners of non-incorporated firms can credit at least parts of the local business tax against their personal income tax liability (the credit is a multiple of the uniform basic tax).

Thus, the local business tax imposes a rather high tax burden in particular on incorporated companies that do not benefit from the allowance, the reduced tax rates on low income and the income tax credit. Corporations account for almost 60 percent of the tax revenue, which is highly concentrated on big and highly profitable enterprises. The local business tax rates considerably contribute to the high statutory tax rates on business profits in Germany, which are among the highest in Europe.

Consequently, the main intention of the federal government’s recent business tax reform, which came into effect on January 1, 2008, was to reduce the overall statutory tax rate on corporate profits to below 30 percent and broaden the tax base. Besides the reduction of the corporate income tax to 15 percent, the reform also included some changes to the local business tax. The basic federal tax rate of the local business tax was lowered from 5 percent to 3.5 percent, and the reduced basic tax rates for enterprises with low profits were abolished. At the same time, the deduction of the local business tax from its own tax base as well as from the corporate and personal income taxes was eliminated.³⁴ Moreover, the reform repealed the declining-balance method of depreciation and provided tighter regulations against tax planning schemes, e.g., a new earnings-stripping procedure against excessive external debt financing or impediments to the relocation of high profit functions to abroad.³⁵ The tax base of the local business tax was further affected by a modified addition of interest expenses: The addition of half the interest expenses on long-term debt was replaced by the addition of 25 percent

³⁴ For sole proprietors and partners of non-incorporated firms this was compensated by a higher credit against the personal income tax.

³⁵ Furthermore, received dividends of shareholdings of more than 10 percent were not subject to the local business tax before the reform, this threshold was increased to 15 percent. In the microsimulation model, this change is taken into account approximately by subtracting only 95 percent of the corresponding reductions from the local business tax base. Individual information on the size of shareholdings was not available.

of all interest expenses including a lump sum interest portion of rents, leasing rates, and royalties inasmuch as they exceed an allowance of Euro 100,000. With the tax rate reductions and complementary measures, the reform basically aimed at the urgent needs to improve the competitive position of the German business location in international tax competition and to reduce the incentives for tax planning (Bach et al., 2007a,b). A fundamental reform of local business taxation and of local public finance institutions was not attempted and remains at the top of the agenda.

3.1.2.4 Reform Options for Germany

The international comparison of local business taxation systems and the discussion of the theoretical foundations lead us to the definition of five fundamental tax reform options for the German local business tax.

1. Integration of liberal professionals and farmers in the local business tax. They are also included in the following reform options 2-5.³⁶
2. Local business income tax: pure profit tax.³⁷ Like the actual business tax reform of 2008, but in contrast to the other scenarios considered here, this tax is not deductible from its own tax base, because it is not considered a cost component.
3. Local comprehensive business income tax (CBIT): tax on profits, all interest expenses, and interest portions of rents, leasing rates and royalties.³⁸
4. Local business value-added tax: additionally to the CBIT, the tax base includes the sum of wages and salaries.³⁹
5. Local business property tax: The tax base comprises 10 percent of the fixed assets of an enterprise, which can be interpreted as a hypothetical rate of return on real business capital.

³⁶ The exemption of liberal professionals and farmers, which has survived since the 19th century, is contrary to the benefits received principle, as liberal professionals typically use public services in the same way as other self-employed people, especially in the service sector. Furthermore, one might consider including non-profit organizations or even state and federal public bodies, which also benefit from local public services, in the tax base. This is the case in Italy, for instance.

³⁷ This reform option could also be implemented as a surcharge on the corporate and personal income tax, as advocated by the Federation of German Industries (BDI) and the German Chemical Industry Association (VCI) (2001).

³⁸ A similar reform (“Kommunalmodell”) was proposed by the German local authority central organizations (Bundesvereinigung der kommunalen Spitzenverbände, 2003).

³⁹ Compare the discussion of an origin-based value-added tax (“Wertschöpfungsteuer”) by Bach and Vesper (2002).

We simulate the fiscal and distributional effects of each of these reform scenarios using our microsimulation model, BizTax. The law of 2007 is the starting point for the definitions of the reform scenarios. Deviating from this, we assume that the reduced federal basic tax rates for enterprises with low profits are abolished, as in the actual business tax reform of 2008. The allowance is left unchanged, except for the business value-added tax, here it is increased because of the substantially broader tax base. Specifically, it is set at a level that exempts the same share of firms with a positive tax base from the tax as if the actual law of 2007 were applied (almost a third). Finally, for each reform scenario we determine the federal basic tax rate, which makes the reform neutral with respect to total local business tax revenue. Additionally, we simulate the effects of the actual German business tax reform of 2008, but without the changes regarding the determination of profits due to a lack of data (see Section 3.1.4).

3.1.3 Microsimulation Model for the Business Sector

Microsimulation models have developed into increasingly capable tools for the “ex ante” analysis of fiscal and distributional effects of tax and social policy reforms. The prerequisite is a representative micro data basis of relevant agents such as individuals, households or firms. The models simulate the effect of a given policy reform for each individual agent and find the overall fiscal effect by aggregation, which can be split by group characteristics such as income classes or industries to analyze the distributional effects. While microsimulation models for household taxation are increasingly available, e.g., EUROMOD for several EU countries (Lietz and Mantovani, 2007) or STSM for Germany (Steiner et al., 2008), empirically based microsimulation models for the business sector are still rare, partly due to limited data availability. Examples of research in this area are models developed for the UK and Italy in the context of the European Commission’s DIECOFIS project (Parisi, 2003).

This section introduces our newly developed microsimulation model BizTax for business taxation in Germany.⁴⁰ It is based on individual firms’ official local business tax files, which are provided by the Federal Statistical Office.⁴¹ Thus, it represents the heterogeneity of enterprises in Germany with respect to key variables. We use the latest data wave available, which

⁴⁰ For a documentation of the microsimulation model BizTax and its data basis in full detail, see Bach et al. (2008a).

⁴¹ The data is also available at the Research Data Centre of the statistical offices, <http://www.forschungsdatenzentrum.de>

consists of tax files for the year 2001.⁴² This data base enables us to calculate each firm's local business tax liability. After correction of a few cases with obviously erroneous data, the simulated tax liability for 2001 equaled the actual tax liability for that year given in the data in 99.978 percent of the firms, the remaining firms were negligible in terms of their tax liability. After this initial data editing, we drew a 10 percent stratified random sample (247,314 observations) from the full set of local business tax files to make the computationally intensive simulation and further analysis manageable. As large enterprises have a potentially high impact on total local business tax revenues (with or without a reform), a higher sampling probability was chosen for enterprises with either a higher local business tax base in 2001 or, more generally, with a higher value added from business. The biggest enterprises were completely included in the sample.

The local business tax statistics provide all the variables needed to simulate each firm's local business tax liability for the governing law from 2001 to 2007.⁴³ The most important of these are the profit, the various additions and reductions, the legal form, and the local business tax multipliers effective for each enterprise. Additionally, the statistics include the wage expenses and the value of fixed assets, which are important for simulating the local business value-added tax and the local business property tax.⁴⁴ Information on the industry and region are also available, which we use for the tabulation of the results. The number of employees is estimated from the payroll, using average wages by industry provided by the national accounts (Federal Statistical Office, 2001).

As mentioned in Section 3.1.2.3, liberal professionals and farmers are exempted from the local business tax today and are therefore not included in the local business tax statistics. We use information about individuals with income from a liberal professional or farming activity from a representative 10 percent stratified random sample from the official personal income

⁴² The next wave of official local business tax statistics will cover 2004.

⁴³ The deduction of the local business tax from its own tax base is calculated using the iteration method, which is flexible with regard to tax reforms.

⁴⁴ A number of firms obviously did not fill in information on these two variables correctly, however. The tax authorities did not make inquiries in these cases, as these items were not needed for the tax assessment. Thus, we replaced implausible extreme values with imputed values following Zwick (2007). Furthermore, the local business tax statistics only include information about interest expenses for long term liabilities, not about rents, leasing rates, and short term interest expenses. Following Zwick et al. (2003), the aggregates of rents and leasing rates are assigned to the individual enterprises proportionally to their business property and payroll, and the short term interest expenses are assumed to amount to 77 percent of the long term interest expenses. When the local business tax statistics for 2008 become available, they will include individual in-

tax (PIT) files for 2001. The task was to generate data sets, which represent the firms of these individuals in order to add them to our data base. If the liberal professional or farmer is operating alone, the profit of the firm equals his or her individual income from the mentioned activities, which is given in the PIT files. These files also tell if a taxpayer is active in a business partnership, but not how many parties are involved. To generate a corresponding data set representing a partnership in such a case, we assigned a number of parties to it randomly in a way that replicates the distribution of the number of parties in partnerships in Germany. The distribution was obtained from statistics about partnerships in Germany (Federal Statistical Office, 2001). We adjusted the generated partnership's sampling weight according to the number of partners and its profit, assuming that it was distributed uniformly over the partners within the partnership. Furthermore, the PIT files lack some information necessary to calculate the local business tax base, e.g., interest expenses. These variables were imputed from groups of comparable firms included in the local business tax statistics.⁴⁵ Finally we drew a 10 percent stratified random sample again, analogously to our sample from the local business tax statistics, and added 124,166 observations representing the firms of the liberal professionals and farmers to our data base.

Using the combined data base, we want to simulate the effects of different tax reform options in the year 2008, the year the actual German business tax reform has come into effect. Thus, the cross sectional data for 2001 must be extrapolated to reflect the situation of German enterprises in 2008. We identify changes in the German business sector's composition with respect to industries and legal forms, using the yearly turnover tax statistics. This allows us to adjust the weights of the firms in the data base so that it represents the changed proportions in the population with respect to these characteristics. Furthermore, the relevant variables such as profits and interest expenses are extrapolated to reflect the changes in the corresponding aggregates reported by the national accounts (Federal Statistical Office, 2001-2007) and the corporate balance sheet statistics (Bundesbank, 2004-2007). The German government's medium term projection (Federal Ministry of Economics and Technology, 2007) is used for extrapolation after 2006. This static data ageing procedure can only roughly capture the business cycle developments and the restructuring that has taken place within German firms during the

formation about these components of the financing costs, as the business tax reform of 2008 includes them in the tax base (see Section 3.1.2.3).

last years, but as no more recent representative micro data is available, the model must rely on this approximation.

Based on the edited and extrapolated data, we use the microsimulation model to simulate the reform options discussed in Section 3.1.2.4 for the year 2008, including the main components of the business tax reform of 2008.⁴⁶ The law of 2007 (before the business tax reform of 2008) is used as the reference scenario for the determination of the fiscal and distributional effects of the reform scenarios. This allows us to compare the effects of the business tax reform of 2008 with the other reform scenarios.

The strengths of microsimulation models such as BizTax are the detailed implementation of the tax legislation and reform options, the representative incorporation of the real world's heterogeneity, and the ability to split the fiscal effects of tax reforms by detailed group characteristics. The model currently does not predict behavioral responses of companies that may be triggered by tax reforms, e.g., changes in financing and investment decisions, entries and exits of firms, and profit shifting of multinational corporations. The simulation results can thus be characterized as first round effects, i.e., before firms may adjust their behavior. As such behavioral responses normally take some time, this approach is especially suitable for short term analyses. Further, the model can determine the fiscal effects of assumed behavioral responses.

3.1.4 Empirical Results

Table 3.1-3 shows the fiscal and distributional effects of the reform options for local business taxation that we discussed in Section 3.1.2.4. The leftmost column displays the local business tax revenue in millions of euro if the law of 2007 is applied to the extrapolated data for 2008. This is the reference scenario. The six columns to the right show the increase or decrease of the revenue (in percent) relative to the reference scenario if the respective reform option were

⁴⁵ As firms with cost structures comparable to liberal professionals we drew on business, tax and engineering consultancies, as far as they are included in the local business tax statistics, as well as insurance agents. For farmers the manufacturing sector was used.

⁴⁶ In case of consolidated companies, the local business tax statistics only report the tax base of the subsidiaries, not its components (profits, long term interest expenses etc.). To translate the effects of a tax reform (and also of the extrapolation) to the subsidiaries, we adjust their tax base proportionally to the change in the tax base of non-consolidated companies (separately for different industry groups).

in effect in 2008.⁴⁷ The table splits the overall fiscal effect by categories of profit before tax, number of employees, industries, and legal forms.

First of all it is interesting to look at the revenue distribution if the law of 2007 is applied. 74 percent of the revenue comes from enterprises with profits above Euro 1 million, and still 58 percent from those above Euro 5 million. Consistent with this, 57 percent of the revenues stem from corporations. Partnerships account for a third of local business tax revenues, which reflects their high significance in Germany. Revenues from companies with losses are negligible in spite of the addition of half of the long-term interest expenses to the tax base. The revenue distribution gives support to the view of the German local business tax as a tax for corporations with high profits. If the company size is measured in terms of the number of employees, however, revenues are distributed quite uniformly across the classes. This indicates that firms with a large number of employees do not necessarily report high profits.

For the actual business tax reform of 2008 the simulation results indicate a decrease in local business tax revenue of 9.2 percent in comparison with the law in 2007. The modified rules for the determination of taxable profits are neglected, however, since reliable data, in particular concerning cost accounting, are not available. The Federal Ministry of Finance estimates that the business tax reform of 2008 does not change the overall local business tax revenue if all measures are taken into account (Deutscher Bundestag, 2007).⁴⁸ The distribution of the simulated revenue effects by profits before taxes shows that primarily highly profitable corporations benefit from the reduction of the basic federal tax rate from 5 percent to 3.5 percent. Companies with losses pay more local business taxes, due to the changed rules for the inclusion of financing expenses. Significantly more revenue is levied on small firms with less than 10 employees or profits between the allowance of Euro 24,500 and Euro 72,500 because of the abolishment of the reduced basic tax rates for businesses reporting profits in this range.

⁴⁷ In this paper, we only consider the local business tax (“Gewerbesteuer”) and not its effects on the corporate income tax and the personal income tax (PIT) through its deductibility as a business expense and the lump sum credit against the PIT of sole proprietors and partners of non-incorporated firms. In general, a higher (lower) local business tax leads to lower (higher) revenues from these federal taxes. As a minor share of the PIT revenues is allocated to local jurisdictions, the local fiscal impact of reforms of the local business tax would partly be compensated. Financial equalization schemes between the jurisdictions of the local, state and federal levels are not considered in this analysis either. They would lead to a further levelling of the distributional effects.

⁴⁸ Not considering the effects on the corporate and personal income tax and on fiscal equalization.

Table 3.1-3 Revenue effects of reform scenarios of the local business tax in 2008
by profit before taxes, number of employees, industries, and legal forms

	Local busin. tax revenues if law of 2007 is applied	Actual business tax reform of 2008 ¹⁾	Fundamental reform scenarios ²⁾				
			Inclusion of liberal professionals and farmers	Local business income tax	Comprehensive business income tax (CBIT)	Local business value-added tax	Local business property tax
			Mill. Euro	Increase (+) / decrease (-) of local business tax revenues in %			
Total	38 579	- 9.2	0.0	0.0	0.0	0.0	0.0
By profits before taxes in Euro							
Enterprises reporting losses, total	84	+ 31.8	- 11.7	- 100.0	+2 324.4	+11 883.2	+22 290.7
under - 1 000 000	36	+ 9.1	- 22.0	- 100.0	+3 181.8	+14 763.2	+31 552.8
- 1 000 000 - 0	48	+ 49.0	- 3.9	- 100.0	+1 673.1	+9 695.4	+15 254.6
Enterprises reporting profits, total	38 496	- 9.3	+ 0.0	+ 0.2	- 5.0	- 25.8	- 48.4
0 - 25 000	227	- 21.6	- 19.1	- 38.1	+ 96.2	+ 562.8	+ 549.9
25 000 - 50 000	499	+ 68.8	+ 132.5	+ 117.4	+ 166.6	+ 277.3	+ 42.1
50 000 - 100 000	1 527	+ 32.4	+ 100.8	+ 97.5	+ 99.6	+ 20.7	- 38.4
100 000 - 250 000	3 083	- 4.0	+ 71.4	+ 70.6	+ 58.7	+ 54.8	+ 36.1
250 000 - 500 000	2 338	- 13.3	+ 45.1	+ 44.6	+ 31.7	- 12.0	- 24.2
500 000 - 1 000 000	2 343	- 15.0	+ 14.6	+ 13.8	+ 5.0	- 21.6	- 50.8
1 000 000 - 5 000 000	6 099	- 14.8	- 11.1	- 11.4	- 18.1	- 31.6	- 55.1
5 000 000 and more	22 381	- 12.0	- 22.6	- 21.2	- 27.2	- 53.1	- 69.3
By number of employees							
under 10	6 543	+ 8.0	+ 73.0	+ 72.0	+ 70.7	- 10.0	+ 57.2
10 - 50	8 772	- 14.2	+ 1.2	+ 0.1	- 0.3	- 20.0	+ 0.8
50 - 250	8 173	- 15.8	- 17.4	- 17.9	- 21.6	- 34.5	- 28.3
250 - 500	2 723	- 13.4	- 23.2	- 22.7	- 24.9	- 31.4	- 18.3
500 - 2 000	5 358	- 11.9	- 23.1	- 21.8	- 24.5	- 30.2	- 0.3
2 000 and more	7 011	- 7.7	- 22.5	- 21.0	- 11.9	+ 109.9	- 14.0
By industries							
Agriculture, forestry and fishing	320	- 10.5	+ 155.2	+ 144.4	+ 223.8	+ 40.8	+ 247.1
Mining and quarrying	258	- 13.4	- 19.7	- 19.7	- 25.4	- 26.3	- 52.0
Manuf. of intermed./non-durable goods	6 616	- 11.8	- 21.5	- 21.0	- 24.5	- 29.1	- 54.3
Manuf. of investment/durable goods	6 215	- 13.0	- 21.7	- 21.7	- 25.6	+ 4.1	- 43.9
Electricity, gas and water supply	1 643	- 13.4	- 22.5	- 23.1	- 22.2	- 62.2	- 1.0
Construction	945	+ 3.4	- 4.4	- 6.0	- 1.8	+ 114.9	+ 50.6
Trade, maintenance and repair	7 271	- 9.1	- 16.0	- 16.6	- 20.3	- 22.6	- 58.7
Hotels and restaurants	425	+ 12.9	+ 7.9	+ 3.9	+ 15.4	+ 163.6	+ 38.4
Transport, storage and communication	1 376	- 10.2	- 14.9	- 22.3	+ 7.2	+ 41.9	+ 122.4
Financial intermediation	4 359	- 9.6	- 20.5	- 17.5	- 30.4	- 8.3	- 51.3
Real estate and renting	2 175	- 11.1	- 8.4	- 13.3	+ 29.6	- 37.6	+ 461.2
Business service activities	5 608	- 4.6	+ 24.2	+ 26.4	+ 28.8	+ 29.8	- 3.6
Public and personal service activities	1 369	- 4.1	+ 277.3	+ 279.7	+ 243.1	+ 104.1	+ 2.5
By legal forms							
Sole proprietorships	4 002	+ 18.7	+ 144.4	+ 144.0	+ 129.6	+ 27.3	- 23.2
Partnerships	12 858	- 11.8	- 5.5	- 5.9	- 6.6	- 15.8	+ 1.1
Corporations	21 719	- 12.9	- 23.3	- 23.1	- 20.0	+ 4.3	+ 3.6
Basic federal tax rate³⁾	5.00%⁴⁾	3.50%	3.63%	3.24%	2.95%	0.82%	5.68%⁵⁾
<p>1) Excluding modified rules for the determination of taxable profits.- 2) The basic federal tax rates of the 5 reform scenarios are chosen such that the local business tax revenue is held constant in comparison to the law of 2007. There are no reduced basic federal tax rates for enterprises with low profits in these scenarios.- 3) Municipalities apply a multiplier, which is 390% on average, to their allocated share of the uniform basic tax.- 4) Reduced basic federal tax rates apply for non-incorporated enterprises with taxable income below Euro 72,500.- 5) Applied to 10 % of the value of business properties.</p> <p>Source: Calculations based on the microsimulation model for business taxation BizTax.</p>							

The tightened profit determination rules may have a stronger impact on firms with high profits than on small firms and thus at least partly compensate these effects.⁴⁹

The remaining five hypothetical reform scenarios adopt the abolishment of the reduced basic tax rates for small firms from the actual business tax reform of 2008. The resulting flat basic federal tax rate is chosen such that the total local business tax revenue is held constant in comparison to the law of 2007. This makes the distributional effects of the fundamental reform options comparable. The basic federal tax rates for the different scenarios are shown at the bottom of the table.

In the first of these scenarios, liberal professionals and farmers are integrated in the local business tax. The simulation results show that this reform increases the revenue from enterprises with low and medium profits between the allowance of Euro 24,500 and Euro 1,000,000. The percentage increase is highest for the profit category just above the allowance and below Euro 50,000 (+133 percent) and decreases with higher profit classes. This reflects the profit distribution of liberal professionals. As in the actual business tax reform of 2008, the abolishment of the reduced basic tax rates adds to the increased revenue collected from small firms. In contrast, large enterprises benefit from the reduced basic federal tax rate (3.629 percent instead of 5 percent) that offsets the broader tax base and makes the reform scenario revenue-neutral. Municipalities dominated by personal service industry or agriculture and forestry can expect higher local business tax revenues in this scenario.

The local business income tax shows similar effects because it likewise includes liberal professionals and farmers. As only operating profits are subject to taxes, no revenues are collected from companies with losses. The revenue-neutral basic federal tax rate is 3.243 percent. It is lower than in the scenario discussed before because the local business income tax is not deductible from the tax base. The comprehensive business income tax (CBIT) includes all financing expenses in the tax base. Thus, in contrast to the local business income tax, revenue is levied on companies with losses or with profits below the allowance of Euro 24,500 if their earnings before interests and taxes (EBIT) exceed the allowance. This leads to a sharp increase in revenue especially from companies with reported losses. The basic federal tax rate can be decreased to 2.949 percent due to the broader tax base. Again, large and profitable

⁴⁹ For a detailed analysis focussing specifically on the German business tax reform of 2008, including the changes to the corporate income tax, see Bach et al. (2007b).

corporations benefit from this tax rate reduction. Taxes levied on the financial intermediation industry decrease by 30 percent.

The local business value-added tax additionally includes the sum of wages and salaries in the tax base. To compensate for the much broader tax base, the basic federal tax rate is decreased to only 0.825 percent and the allowance is increased to Euro 36,000 (see Section 3.1.2.4). The inclusion of wages and salaries leads to an even stronger increase of revenue from enterprises making losses or profits below the allowance than the CBIT. The revenue from companies with more than 2000 employees more than doubles while the revenue from companies with fewer employees decreases significantly. On the other hand, less tax is levied on companies with high profits. This shows that the business value-added tax is clearly dominated by the sum of wages and salaries in comparison to the other components of the tax base, i.e., profits and financing expenses. In contrast to the other scenarios, revenues collected from the construction industry and hotels and restaurants more than double, while revenues from electricity, gas and water supply decrease by 62 percent.

Of all the reform scenarios considered here, the local business property tax is the one that most strongly increases revenues from companies reporting losses. Correspondingly, much less revenue is collected from firms with high profits. Local business tax revenues from companies with profits above Euro 500,000 drop by more than 50 percent. The revenue-neutral basic federal tax rate is 5.68 percent, applied to 10 percent of the value of business properties. In contrast to the other scenarios, local business taxes paid by the real estate and renting industry increase by 461 percent, and those paid by the transport, storage and communication industries more than double. Agriculture, forestry and fishery are also taxed most heavily in this scenario. On the other hand, revenues collected from the mining, manufacturing, trade, and financial intermediation industries decrease by about half. Thus, a business property tax triggers the strongest redistribution across firm size, profitability, and industries among the reform scenarios analyzed here.

Table 3.1-4 shows the distributional effects of the reform scenarios with respect to regional categories. In the upper part of the table, the effects are first split by West and East Germany and second by cores of agglomeration, surrounding areas, and rural areas. The lower part displays the effects by regions with high, medium, or low local tax revenues per capita.⁵⁰ The

⁵⁰ The categories “core of agglomeration”, “surrounding area”, and “rural area” refer to definitions by the Federal Office for Building and Regional Planning (2007). These definitions are also the basis for the categori-

first column shows the distribution of local business tax revenues in millions of euro if the law of 2007 is applied. The second column gives the local business tax revenue per capita in the different regional categories. The local business tax per capita is only Euro 254 in East Germany versus Euro 523 in western Germany, which reflects that East Germany still lags behind in terms of productivity and profitability. As the next column shows, the actual business tax reform of 2008 decreases local business tax revenues in East Germany by 0.5 percentage points more than in western Germany (again, not taking into account the tax base broadening measures of this reform). The other five hypothetical reform options, which are revenue-neutral, all increase revenues in East Germany and decrease revenues in western Germany. This effect is strongest when the local business property tax is applied, which doubles local business taxes collected in East Germany and decrease those collected in western Germany by 12.1 percent.

Today, local business tax revenues are highly concentrated in cores of agglomeration in western Germany. In the reference scenario they account for 47 percent of total local business tax revenues. The five hypothetical reform options reduce this concentration by decreasing revenues in cores of agglomeration in western Germany and increasing revenues in East Germany and in rural areas. All of these scenarios decrease revenues in municipalities with high local tax revenues per capita and increase revenues in municipalities with low or medium revenues per capita. Under the local CBIT, the local business value-added tax, and the local business property tax, the revenue increase is relatively higher in the categories with low than in those with medium revenues. This confirms that the five hypothetical reform scenarios, and especially the latter three, distribute local tax revenues more equally across regions. The broader the tax base and the less it relies on profits, the stronger is the redistributive effect. Even the local business income tax redistributes revenues across regions due to the inclusion of liberal professionals and freelancers. The redistributive effect becomes stronger with the inclusion of interest expenses and the payroll in the tax base. The local business property tax has the strongest redistributive effect.

zation by local tax revenue per capita, which was set up by the German Institute of Urban Affairs (Reidenbach, 2007). Local tax revenues per capita are classified as low if revenues per inhabitant were less than 80 percent of the average in the same type of municipality in the period 2002 to 2005, and high if revenues per inhabitant exceeded 120 percent.

Table 3.1-4 Revenue effects of reform scenarios of the local business tax in 2008 by regional categories

Regional categories ¹⁾	Local busin. tax revenues if law of 2007 is applied	Local business tax per capita ²⁾	Actual business tax reform of 2008 ¹⁾	Fundamental reform scenarios ⁴⁾				
				Inclusion of liberal professionals and farmers	Local business income tax	Comprehensive business income tax (CBIT)	Local business value-added tax	Local business property tax
	Mill. Euro	Euro	Increase (+) / decrease (-) of local business tax revenues in %					
Germany, total	38 579	468	- 9.2	0.0	0.0	0.0	0.0	0.0
Western Germany ⁵⁾ , total	34 338	523	- 9.2	- 0.5	- 0.3	- 2.0	- 8.0	- 12.1
Cores of agglomeration	18 130	769	- 8.3	- 3.6	- 1.7	- 5.1	- 12.4	- 18.9
Surrounding areas	9 168	405	- 9.9	+ 3.7	+ 2.4	+ 1.8	- 14.3	- 9.1
Rural areas	7 040	361	- 10.3	+ 1.7	- 0.2	+ 0.9	+ 11.6	+ 1.3
Eastern Germany ⁶⁾ , total	4 244	254	- 9.7	+ 4.4	+ 2.5	+ 16.4	+ 64.1	+ 98.2
Cores of agglomeration	2 249	332	- 8.8	+ 5.0	+ 5.4	+ 12.3	+ 10.7	+ 91.7
Surrounding areas	752	269	- 13.1	+ 0.8	- 3.5	+ 17.0	+ 63.2	+ 77.7
Rural areas	1 242	173	- 9.4	+ 5.5	+ 1.0	+ 23.3	+ 161.4	+ 122.3
High local tax rev. per capita	19 363	913	- 10.0	- 7.2	- 6.3	- 9.2	- 19.7	- 22.6
Med. local tax rev. per capita	12 880	400	- 8.8	+ 7.3	+ 6.8	+ 6.4	+ 8.7	+ 1.6
Low local tax rev. per capita	6 338	218	- 7.7	+ 7.0	+ 5.4	+ 15.0	+ 42.0	+ 65.7

1) Local tax revenues per capita: low if revenues per inhabitant were less than 80% of the average in the same type of municipality in 2002 to 2005, high if revenues exceeded 120% (Reidenbach 2007).- 2) Inhabitants at the end of 2005.- 3) Excluding modified rules for the determination of taxable profits.- 4) The basic federal tax rates of the 5 fundamental reform scenarios are chosen such that the local business tax revenue is held constant in comparison to the law of 2007. There are no reduced basic federal tax rates for enterprises with low profits in these scenarios.- 5) Old federal states excluding West Berlin.- 6) New federal states including Berlin.
Source: Calculations based on the microsimulation model for business taxation BizTax.

The finding that the inclusion of liberal professionals in the local business tax has a redistributive effect could be explained by their relatively even distribution over municipalities. Physicians, for example, are not strongly concentrated in cores of agglomeration. Therefore they would contribute a relatively high share to revenues in surrounding and even rural areas if they became liable to local business tax.

3.1.5 Summary and Conclusions

The taxation of local business to generate revenues for local governments is common in OECD countries. Local authorities usually have some discretion over the tax rate. The international comparison reveals that the composition of the tax base varies widely. Local business tax systems range from a pure profit tax in Luxembourg and Japan to an origin-based value-added tax in Italy and Hungary, which includes interest expenses and the payroll in the tax base. France and some states in the USA tax fixed assets of companies at the local level. As general options for the design of local business taxation we identify a local business income tax, a local comprehensive business income tax (CBIT), a local business value-added tax, and a local business property tax.

Using our newly developed microsimulation model for the business sector, BizTax, we simulate the first round distributional effects of these general reform scenarios if they were implemented in Germany in a revenue-neutral way in 2008. Liberal professionals and farmers, who are exempted from the local business tax in Germany today, are integrated in these reform scenarios. We find that today's high concentration of local business tax revenues on corporations with high profits decreases if the tax base is broadened by integrating more taxpayers and by including more elements of value added. The reform scenarios with a broader tax base also distribute the local business tax revenue per capita more equally across regional categories, especially by reducing today's high concentration of revenues on cores of agglomeration in western Germany. Revenues from local business taxation in rural areas and in East Germany increase.

The results also show that the reform scenarios including components other than profits in the tax base strongly increase the tax revenues collected from companies reporting losses or low profits. This does not necessarily imply that these scenarios impose a higher tax burden on sole proprietors or partners of small businesses, however, as they can credit the local business tax against their personal income tax (the credit is a multiple of the uniform basic tax). The business tax reform of 2008 abolished the deductibility of the local business tax from the tax base and compensated this by a higher credit for unincorporated firms. This credit would clearly also apply to liberal professionals and farmers if they were integrated in the local business tax. This certainly increases the political feasibility of including these groups in the local business tax, and of a tax base broadening reform in general, but the tax credit undermines the fiscal equivalence principle. Furthermore, it decreases the transparency of taxation and brings about bureaucracy, and if the federal level is taken into account, the tax reform options are no longer revenue-neutral. With or without the credit, a broadening of the tax base of the local business tax in the direction of an origin-based value-added tax or a business property tax with reduced tax rates would provide a more stable and reliable revenue source for local governments in Germany and distribute local tax revenues per capita more equally across regions.

For additional insights into the long-term effects of the tax reform options, further research may focus on modeling behavioral responses of enterprises to changes in the tax system. Municipalities may also react to the tax reforms by adjusting the local business tax multipliers. The business tax reform of 2008, for instance, increased the tax competition between German municipalities, because it allocated more weight to the local business tax relative to the corporate income tax. A further research aim would be the construction of an integrated microsimu-

lation model capturing all taxes on business income, i.e., the local business tax, the corporate income tax, and the personal income tax. If legal concerns can be dispelled, merging the different tax statistics would allow analyzing the interactions between these taxes on the level of individual enterprises. In order to estimate the overall effective business tax burden micro data from financial accounting should be included.

3.2 Revenue Trends, Implicit Tax Rates, and Tax Base Erosion of Business Income Taxation

Abstract: This study presents comprehensive measures of the business taxation revenue in Germany. A comparison of the tax base reported in tax statistics with the macroeconomic corporate income derived from national accounts gives hints to considerable tax base erosion. The high weight of reported tax losses underlines this result. The average implicit tax rate on corporate income was around 20 percent since 2001, and thus falling considerably short of statutory tax rates and effective tax rates discussed in the literature. For lack of detailed accounting data it is hard to give precise reasons for the presumptive tax base erosion.

3.2.1 Introduction

The impact of business taxation on tax revenue, location attractiveness, and economic performance has been under extensive debate in Germany for decades. Traditionally, the German corporate income tax was highly integrated into the taxation of personal income. This was reflected by the full imputation system, which lasted until 2001. The standard rate of the corporate income tax was oriented to the top rate of the personal income tax. Income from partnerships and self-employed income liable to the personal income tax were levied at rising marginal tax rates due to the income tax progression. In addition, the local business tax was largely a tax on business income since decades. Putting together all these taxes, business income in Germany was taxed at relative high statutory tax rates up to the recent past. Likewise, measures of effective tax rates, derived from simulation models following the approaches of King and Fullerton (1984) and Devereux and Griffith (1999, 2003), indicate rather high levels of business taxation in Germany compared to other countries.

At the same time, at least since the mid-nineties, there was a rising public sentiment that business taxation revenue lags behind economic performance and business income growth. The revenue of the corporate income tax relative to GDP decreased, in particular in relation to corporate income. Investment incentives for East Germany via tax allowances and tax credits, tax competition in the course of globalization and European integration, and repercussions of major tax reforms seem to impair business tax revenue. Anecdotal evidence on tax-saving strategies of firms and top-earning individuals was widely spread by the media.

However, there is scarce empirical evidence that gives a clear picture of the economic issues involved. Current tax revenues do not necessarily give a reliable picture of the effective tax liabilities accrued in single years. Moreover, partnerships play an important role in Germany, as even some bigger firms use this legal form. The respective share of business taxation in

personal income tax revenue is not to be isolated from revenue statistics since it is mingled with revenue from other sources of taxable income. Not least, the local business tax has a high revenue impact on overall business taxation in Germany. As it is deemed as a local charge for public infrastructure that is passed to output prices, it is often disregarded in the context of the entire business taxation.

In this study, for the first time for Germany we present comprehensive measures of the entire business taxation revenue and the tax base accrued in single tax years. We use representative data from the business tax statistics, which collect the relevant information from the tax returns. Estimations for the recent past are made by using microsimulation models that capture the main macroeconomic trends and changes in tax law. Based on a similar concept of the European Commission (2009), we derive a corporate income aggregate from the national accounts statistics that approximates the actual taxable income as close as possible. Dividing the tax revenue by the underlying macroeconomic income aggregate, we calculate macroeconomic implicit tax rates on corporate income.

We find that the implicit tax rates on corporate income falling considerably short of statutory tax rates, as well as of effective tax rates discussed in the literature. Our estimations suggest that the average implicit tax rate on German corporate income was around 20 percent since 2001. A detailed comparison of the corporate income measured in national accounts with the corporate tax base reported in the tax statistics reveals a considerable gap that amounts to 5 percent of GDP and more in 2004. This gives hints to considerable tax base erosion in Germany, although some estimation risks should be considered with the corporate income derived from national accounts. This result is emphasized by the high weight of losses reported in tax statistics. Due to the lack of reliable data from tax and financial accounting it is hard to give precise reasons for the presumptive tax base erosion and the high tax losses.

In the following Section 3.2.2, we give an overview on business income taxation in Germany and its main reforms over the last decades. Section 3.2.3 presents the tax revenue and tax base of German business taxation accrued in selected years for which tax statistics are available. This information is compared with the respective macroeconomic figures derived from national accounts, in order to estimate macroeconomic implicit tax rates and dimensions of tax base erosion. Section 3.2.4 looks closer to the importance of losses by industrial composition and discusses some reasons of the presumptive tax base erosion with respect to the determination of taxable income, tax avoidance strategies of multinational firms and of small and medium-sized enterprises, and the impact of inflation.

3.2.2 Business Income Taxation in Germany

Germany's business income taxation comprises the *local business tax* ("Gewerbesteuer"), the *corporate income tax*, the *personal income tax* on the income from unincorporated firms as well as the dividends distributed from corporations to individuals, and the *solidarity surcharge*. Box 3.2-1 at the end of this section summarizes the main reforms over the last two decades.

An outstanding tradition of the German business taxation is its high weight on local taxation. The *local business tax* accounts for 40 percent of the entire business tax revenue paid from corporate business income (see below, Section 3.2.3.1). Historically levied on a broader base of the firm's value added and equity, it has been widely transformed to an extra tax on business income over the last decades. For historical reasons, the tax exempts farmers, liberal professions such as physicians, lawyers, architects, and journalists, as well as unincorporated "private" real estate and portfolio management. The main source of the tax base today is the operating profit attributed to the local jurisdiction. It is augmented by parts of the financing expenses, which represent the remainder of the former comprehensive business income taxation. The local municipalities apply their own tax rate to the firms' tax base. The marginal tax rates relating to taxable income range from a minimum rate of 9 percent to almost 20 percent in agglomerations (2007), the average rate is about 16 percent. The statutory tax rates have been reduced to about 14 percent as of 2008. Sole proprietors and partners of non-incorporated firms benefit from a tax-free basic allowance. Moreover, since 2001 they are allowed to credit the local business tax liability up to a certain cap against their personal income tax liability. Therefore, the local business tax falls mainly on corporations.

With respect to the *corporate income tax*, Germany was running a full imputation system until 2001. Received dividends were part of the taxable income, and double taxation was ruled out by crediting the domestic corporate income tax falling on dividend income against the tax liability, both for the corporate and personal income tax. There was a two-tier tax rate distinguishing between retained profits (40 percent at last) and distributed profits (30 percent at last). In 2001/02, the full imputation system was replaced by a classical system with a uniform tax rate of 25 percent (15 percent as of 2008). Double taxation of dividends distributed within the corporate sector is now avoided by tax exemption, both for dividends from domestic corporations and from abroad. The personal income tax base includes only one half of the dividend income received. This "half-income-procedure" was discarded in 2009 when a final

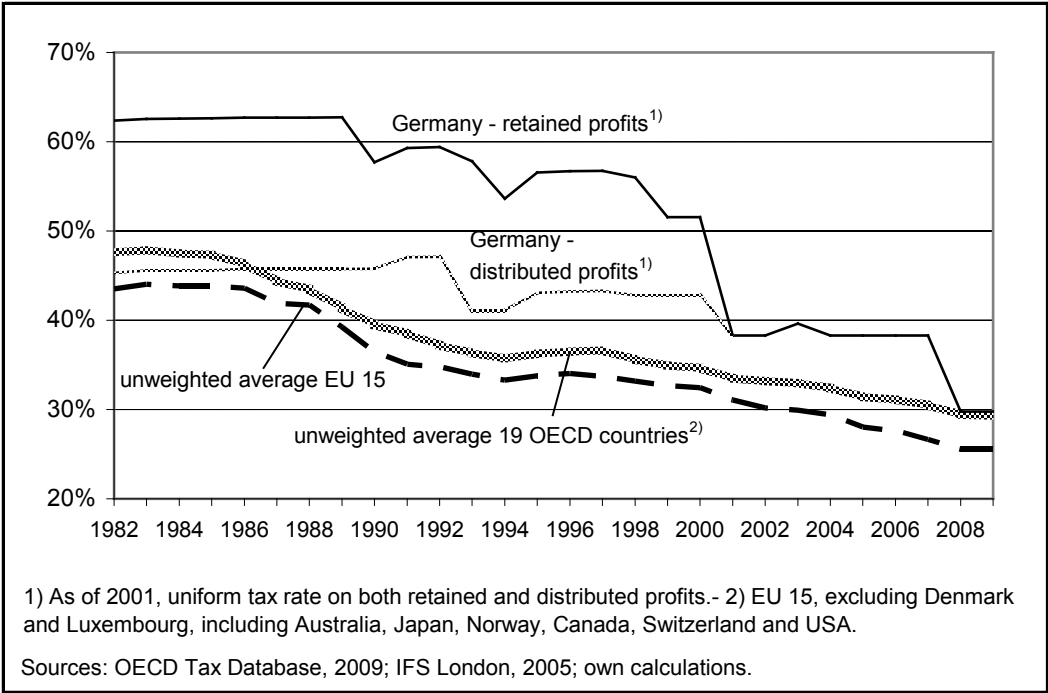
withholding taxation of capital income has been introduced with a flat rate of 25 percent regardless of the shareholder's individual tax rate depending from taxable income.

The business income of the self-employed is liable to the *personal income tax*. This also applies to the entire income of partnerships, both distributed and retained. This income is taxed "transparently", which means that for tax assessment it is passed to their shareholders, who have to enter it into their tax return. Partnerships play an important role in Germany since many medium-sized businesses and even some bigger firms use this legal form. They drew in about 40 to 50 percent of the entire corporate tax base in Germany during the last decades (see below, Section 3.2.3.3). Thus, a considerable part of the business income tax revenue stems from the personal income tax, although sole proprietors and partners of non-incorporated firms credit most of their local business tax liability against their personal income tax liability.

The *solidarity surcharge* is levied on the corporate and personal income tax liability as well as on withholding taxes on capital and wage income associated with the income taxation system. The surcharge was introduced by the federal government in order to raise funds for the hike in public expenditure and deficits that ran up in the course of the German reunification after 1990. The surcharge rate was 3.75 percent 1991-92, 7.5 percent 1995-97, and 5.5 percent since 1998.

If we look at the combined corporate income tax rate in Germany compared with the average level of the EU 15 or the main OECD countries (Figure 3.2-1), the level of statutory tax rates has been rather high over the last decades up to the recent past. The corporate tax rate on retained profits has been high under the former full imputation system. It was oriented to meet the top rate of the personal income tax. The tax was reduced to the lower rate when current profits or retained reserves were distributed to the shareholders. In the course of internationalization and enforced tax competition the high tax rates have been lowered step by step. However, most of the European neighbor countries lowered their corporate income tax rates as well, and in many cases much stronger. As Figure 3.2-1 points out, the unweighted average tax rates on corporate income in the EU 15 decreased from 44 percent at the mid-eighties to 26 percent in 2009. The new member states in eastern Europe apply tax rates around 10 to 15 percent. Even after the major reform of 2001/02, which lowered the combined tax rate to about 38.5 percent, Germany stands out for the highest tax rates in Europe. Only locations in overseas such as Japan or many agglomerations in the United States levy higher tax rates (OECD Tax Database, 2009).

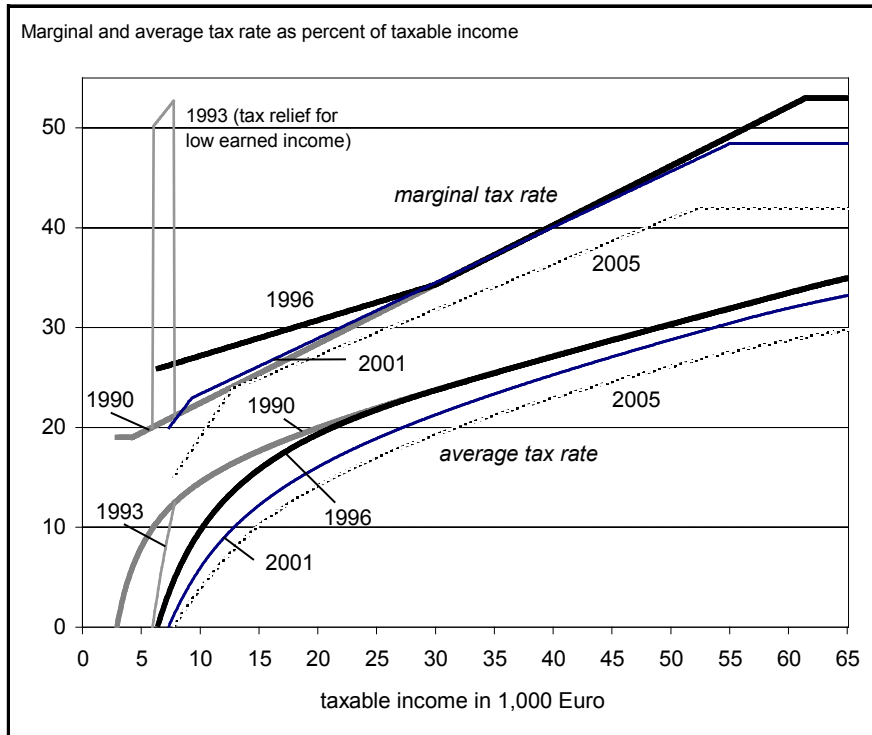
Figure 3.2-1 Statutory tax rates on corporate income in international comparison, 1982-2009
 Company/subsidiary level, excluding taxation of distributed profits at the shareholder level, including sub-central and local government business income tax rates in percent of taxable income



The personal income tax rates in Germany have been reduced several times during the last two decades (Figure 3.2-2). Germany applies a formula schedule with monotonously increasing marginal tax rates for taxable income exceeding the basic allowance. The top rate, which is of particular interest for business and capital income taxation was reduced from 53 percent in 1990 to 42 percent as of 2005. For income from business enterprise liable to the local business tax the top income tax rate has been reduced to 47 percent for the years 1994-1998, and to 45 percent for 1999-2000. The tax credit for the local business tax replaced that top rate limitation since 2001. Since 2007, a second top rate of 45 percent for the “rich” is levied on taxable income exceeding Euro 250,000. It should be noted further that the solidarity surcharge increases the effective marginal tax rates (by 5.5 percent since 1998).⁵¹

⁵¹ For instance, the 2005 top income tax rate of 42 percent is increased by 2.3 percent (42 percent times the surcharge rate of 5.5 percent).

Figure 3.2-2 Personal income tax rates, 1990-2009
as percent of taxable income



As it is widely discussed in the literature as well as in the public debate, for measuring the effective tax burden one has to account for the differences between taxable income and the “true” economic income. Compared to financial investments, real investments often provide beneficial tax treatments and allow for tax avoidance strategies. Income determination rules and tax enforcement were considered to be rather generous in the case of business and capital income taxation in Germany up to the end of the nineties (see OECD, 1991, Ruding Report, 1992). Presumably, this was particularly the case with respect to provisions, depreciation allowances, the treatment of capital gains and losses, group taxation, the transfer of hidden reserves to other assets, and the deduction of losses carried forward or back from other tax years. Moreover, massive investment incentives for East Germany via generous tax allowances and tax credits have been introduced in the nineties. At the same time, the advance in economic internationalization over the last decades might have made German business taxation vulnerable to international tax competition, and tax avoidance strategies of multinational firms and investors respectively. This is plausible in light of the high statutory tax rates in international comparison. The pertinent strategies of multinational companies are profit shifting by transfer pricing, thin capitalization, royalties, or the transfer of business “functions” such as R&D, marketing, distribution, patents, and software, etc. Private investors enter tax havens to escape capital income taxation.

Several tax reforms addressed these topics (see Box 3.2-1 at the end of this section). Tax rates were reduced and the tax base has been broadened step-by-step, according to the “tax-cutting and base-broadening”-strategies that have been enforced in other countries since the eighties. However, it is hard to measure and evaluate the impact of those reforms given the complexity of the taxation system and the horizon of an investment over many years.

Measures of effective tax rates try to capture the main features of the interplay between the tax base and tax rates. Widely used in economic literature and policy advice are “forward-looking”-measures calculated according to the methodology set out by King and Fullerton (1984) and enlarged by Devereux and Griffith (1999, 2003). They analyze the impact of taxation for hypothetical investment projects or firms in the context of standard investment theory, thus taking into account cash flows arising through the life of the investment project. “Effective marginal tax rates” (EMTR) measure the proportionate difference between the cost of capital and the required post-tax real rate of return. This is relevant for existing firms considering the size of investment. “Effective average tax rates” (EATR) address discrete choices for investments and locations in which a profit above the minimum rate of return (economic rent) is expected to be earned. Therefore, for a given pre-tax net present value of an investment project or firm the impact of taxation is measured by the effect on the post-tax net present value. These measures describe the impact on the tax burden for different opportunities regarding the assets invested in (intangibles, industrial buildings, machinery, financial assets and inventories), financing sources (new equity, debt, retained earnings), and legal form, as well for as different alternatives regarding the economic background such as profitability, real interest rate and inflation.

These measures have been often utilized for the description of the business tax burden over time or across countries (European Commission, 2001, Devereux, Griffith and Klemm, 2002, Devereux et al., 2008, Elschner and Vanborren, 2009). The German Council of Economic Advisors (“Sachverständigenrat”) frequently resorted to these measures in assessing the German business tax burden and its reform (2001: 296, 2003: 308, 2006: 153). The EATR measure is rather relevant for the impact analysis of the business tax system on revenues since it is closer to standard “backward looking” measures of tax ratios, i.e., the relation of the tax revenue accrued in a single year to the respective business income, taken from company accounts or macroeconomic statistics. The latter is discussed for Germany in depth below.

In Figure 3.2-3 we present time series of EATRs taken from Devereux, Griffith and Klemm (2002) including updates to 2005 provided by the IFS London (2005). The figure displays the “base case” of an investment in plant and machinery, either financed by equity or retained

earnings or by debt, simulated at the corporate level, i.e., without taking into account the taxation of the shareholder. Basically, for both financing sources the results show a much higher tax burden for Germany compared to the unweighted average of the 19 main western OECD countries included. The trend of falling tax rates is rather similar to those reported for the statutory tax rates in Figure 3.2-1, although the decline in the statutory tax rate was stronger both for Germany and the OECD average. Thus, regarding the properties and assumptions of this modelling, the positive difference of the German business tax rates compared to the main OECD countries also applies to the effective average tax rates, and has rather aggravated during the nineties. Not until after the business tax reform of 2008 Germany's business tax rates might have largely closed the gap on the western OECD average. Unfortunately, there is no data available for EATR time series as defined here up to 2009.⁵²

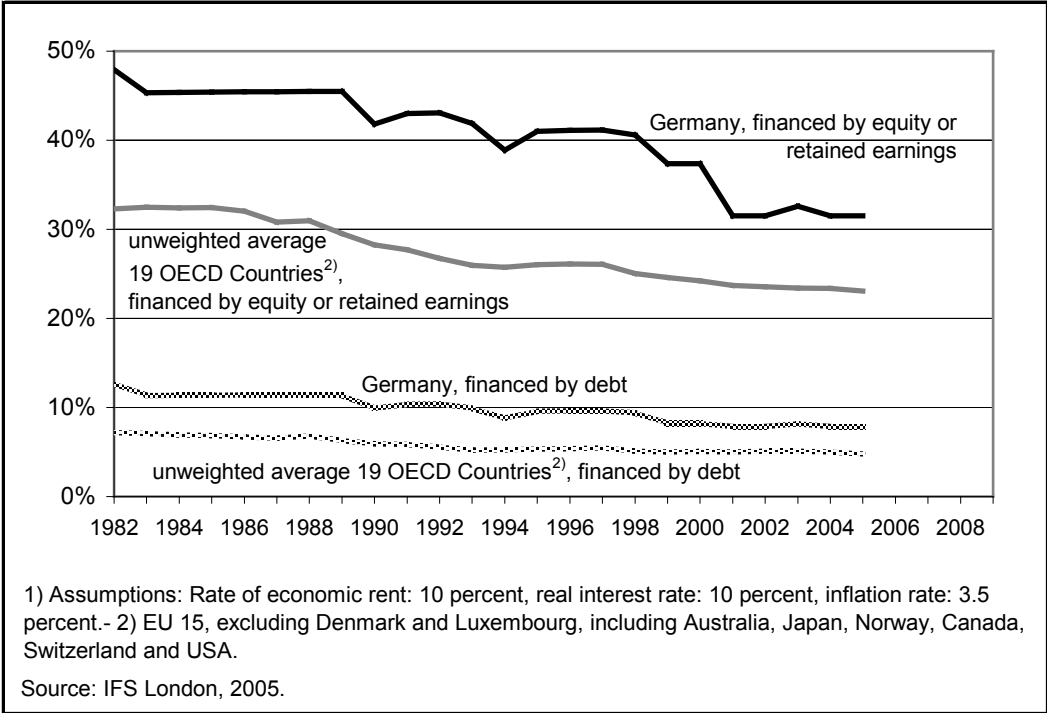
The results reported here and similar studies show remarkable differences in effective tax rates depending on the assumptions made on economic conditions and other factors that influence the tax burden. For instance, debt finance leads to much lower effective tax rates (Figure 3.2-3). These result from beneficial tax provisions such as accelerated depreciations combined with the deductibility of the interest expenditure. With respect to the assets invested in, the studies usually show higher effective tax rates for commercial property, residential buildings, and, not surprisingly, for financial assets (European Commission, 2001, Devereux, Griffith and Klemm, 2002, Devereux et al., 2008), which clearly has to do with the tax depreciation rules. With respect to higher profitability, the EATR converges to the statutory tax rate since the relative impact of tax provisions declines. A more complex picture is painted when the provisions of international taxation are taking into account for cross-border investment.

In reality, economic decisions are affected by several other tax base provisions, beyond depreciation and inventory valuation. Model-firm approaches based on financial accounting standards and tax assessments try to capture these impacts closer to reality. The "European Tax Analyzer" set out by the University of Mannheim and ZEW (Jacobs and Spengel, 1999, 2002, Spengel 2003) provides such calculations for Germany and some other main OECD countries. Likewise, the results see Germany at the top of effective tax rates in international comparison for most parameterizations.

⁵² See, however, the detailed analysis of Devereux et al. (2008) which ranges to 2007, where somewhat different assumptions are made, and the analysis of Spengel et al., 2007, for the effects of the German business tax reform of 2008 on the average tax burden of model firms based on a broader simulation model.

Figure 3.2-3 Effective average tax rates for investments in plant and machinery¹⁾ financed from different sources, 1982-2005

Company/subsidiary level, excluding taxation of distributed profits at the shareholder level, including sub-central and local government business income tax rates in percent



To sum up, the standard “forward-looking” modelling tools that analyze the impact of business taxation for hypothetical investment projects or firms do not give clear hints that the tax base provisions in Germany have been or are still much more generous compared to the other western OECD countries. Insofar, the common notion provided by the pertinent literature is that Germany was a high-tax country up to the recent reform of 2008, at least for profitable investments that do not benefit from specific tax incentives.

However, with respect to current tax revenue compared to macroeconomic business income, which will be analyzed in depth for Germany in the following section, such measures of effective tax rates for hypothetical investment projects or firms should be treated with caution, in particular in the short run (Devereux, Griffith and Klemm, 2004: 373, 378, Egger et al., 2008). As these measures point out the considerable incentives and distortionary impacts of tax provisions, even conclusions on the overall location attractiveness of the business tax system are dodgy to draw. Firm-level evidence from published financial statements reveals a large variance of the underlying economic conditions as well as the complexity of the tax provisions that actually impact effective tax rates (Gorter and de Mooij, 2001, Becker and Fuest, 2004, Egger et al., 2008). It stands to reason that these incentives and distortions might significantly affect the decisions of firms and investors.

Thus, one has to weight the results for single countries with the empirical distribution of the influencing business structure, which is unsuitable in many cases due to the lack of detailed representative firm data. Moreover, tax avoidance and tax evasion strategies that depend on the level of tax burden are mostly not taken into account. There is much anecdotal evidence and at least some empirical evidence that tax avoidance affects countries with high statutory business tax rates such as Germany and the USA stronger than others (see below, Section 3.2.4.3).

In contrast, the periodical tax revenue depends on the past investments and the timing of income streams, as well as the changes in tax provisions and tax rates over time. If there are many firms with low profitability, running losses, or larger stocks of losses carried forward that could be deducted from current taxable income, the link between “forward-looking” measures of effective tax rates and “backward-looking” measures of past tax revenue over corporate income might differ significantly for broader groups of firms, or even for the corporate sector as a whole.

However, in the long run “forward-looking“ and “backward-looking” measures should not diverge so much as it seems to be the case in Germany, as it will be shown in the following sections (see also the discussion by Becker and Fuest, 2006). This questions the representativeness and suitability of the “forward-looking“-measures, which are widely used for the analysis of business taxation and its reform in Germany.

Box 3.2-1 Significant reforms of business taxation in Germany since 1990

1990: Corporate tax rate cut from 56 percent to 50 percent for retained profits. Significant reduction of the personal income tax rates, introduction of a linear-progressive formula schedule with a constant increase of marginal tax rates up to the top rate, which was lowered from 56 percent to 53 percent. Several personal income tax exemptions and allowances were abolished or reduced.

1991: Investment Promotion Act (“*Fördergebietsgesetz*”) provided generous incentives for investments in East Germany for the following years, in particular high first-year allowances (up to 50 percent) and investment grants. The solidarity surcharge has been introduced for the years 1991-92 with 3.75 percent on the corporate and personal income tax liability.

1993: Location Preservation Act (“*Standortsicherungsgesetz*”) reduced the corporate income tax rate for retained profits to 45 percent, the tax rate for distributed profits to 30 percent, and the top marginal rate of personal income tax to 47 percent for income from business enterprise above about Euro 50,000. The declining-balance depreciation rate was reduced for movable fixed assets (from 30 percent to 25 percent) and for immovable fixed assets, the declining-balance depreciation for commercial buildings was replaced with a straight-line rate of 4 percent. Introduction of special depreciation allowances for SMEs. Provisions against thin capitalization were introduced.

1995: Re-introduction of the solidarity surcharge with 7.5 percent on the corporate and personal income tax liability.

1997: The net wealth tax was suspended, both for individuals and for corporations, due to a sentence of the Federal Constitutional Court.

1998: Abolition of the local business tax on capital, repeal of allowances for contract loss provisions. Reduction of the solidarity surcharge rate to 5.5 percent.

1999: Tax Relief Act (“*Steuerentlastungsgesetz 1999/2000/2002*”) reduced the corporate income tax rate for retained profits to 40 percent and limited the top marginal personal income tax rate for income from business

enterprise to 45 percent in 1999 and to 43 percent in 2000. The top marginal income tax rate was reduced to 51 percent in 2000 and to 48.5 percent in 2001. The tax base was broadened by restrictions for provisions, for write-offs to the lower going-concern value, for tax-neutral transfers of assets between partners and their partnerships, and by the introduction of a minimum taxation that restricted the offset of higher losses between income from different sources and from loss allocation vehicles. Several personal income tax exemptions and allowances were abolished or reduced.

2001: Tax Reduction and Business Taxation Reform Act (*“Gesetz zur Senkung der Steuersätze und zur Reform der Unternehmensbesteuerung”*) reduced the corporate income tax rate on both retained and distributed profits to 25 percent. The then full imputation system was replaced by a tax exemption for dividends within the corporate sector, both received from domestic corporations and from abroad, and by a half-income shareholder relief for resident individuals liable to the personal income tax. Capital gains from domestic shareholdings were exempted. A personal income tax credit for the local business tax was introduced, which amounts to almost the half of the local business tax liability up to a certain cap. Further reduction of personal income tax rates, in particular of the top rate to 45 percent in 2004 and 42 percent in 2005. Cutting back of depreciation allowances: the declining balance rate for movable fixed assets was reduced from 30 percent to 20 percent, the straight-line depreciation rate for commercial buildings from 4 percent to 3 percent. The thin capitalization rules have been further restricted.

2003: Introduction of statutory documentation regulations for transfer pricing.

2004: Reform of the minimum taxation: repeal of the loss offset-restrictions across income types, introduction of a restriction on the use of loss carryforwards for taxable income exceeding Euro 1 million, from which only a share of 60 percent allows for loss deduction. The thin capitalization provisions have been reformed and enlarged to shareholders liable to domestic taxation.

2006: Increase of the declining balance rate for movable fixed assets from 20 percent to 30 percent for investments of the years 2006 and 2007.

2007: Introduction of a second top personal income tax rate of 45 percent on taxable income exceeding Euro 250,000.

2008: Business Taxation Reform Act 2008 (*“Unternehmenssteuerreformgesetz 2008”*) reduced in the corporate income tax rate from 25 percent to 15 percent and the uniform base rate (Steuermesszahl) of the local business tax from 5 percent to 3.5. For unincorporated firms liable to the personal income tax, retained profits are taxed at lower rates (around 30 percent) until they are distributed. The business tax credit to the personal income was enlarged. A final withholding taxation of capital income has been introduced with a flat rate of 25 percent as of 2009. The tax base was broadened by the repeal of the declining-balance depreciation, by the enlargement of the local business tax base addition to all financing expenses (with a share of 25 percent), by the abolition of the local business tax deduction from the corporate and personal tax base as well as from its own tax base, by the introduction of an interest limitation (*“Zinsschranke”*), which refuse the deduction of interest expenses for firms with higher leverage and lower earnings before interest, taxes and depreciation (EBITDA) (not applicable to smaller firms with an interest below on million Euro or to companies that are not part of an affiliated group or to allied companies whose equity ratio of the last year was as high or even higher as the ratio of the affiliated group), by a more restricted immediate write-off of low-value assets, by stricter transfer pricing rules regarding the relocation of business “functions” to abroad, by restrictions on tax-avoiding securities lending, and by restrictions to the use of loss carryforwards in the case of a material change in the firm’s ownership.

2009: The First Economic Stimulus Package (*“Konjunkturpaket I”*) re-introduced the declining-balance depreciation for movable fixed assets at a rate of 25 percent and increased special depreciation allowances for small and medium-sized enterprises, both temporarily for investments of the years 2009 and 2010.

3.2.3 Tax Revenue, Macroeconomic Implicit Tax Rates, and Tax Base Erosion

We now turn to the effective business taxation revenue in Germany and the average macroeconomic tax rates measured by the ratio of tax revenue over total corporate income. Furthermore, a comparison of corporate income measured in national accounts with the corporate tax base reported in the tax statistics discloses considerable tax base erosion in Germany.

3.2.3.1 Effective Business Taxation Revenue

Table 3.2-1 presents the entire business tax revenue in Germany by its components for the tax statistics years from 1992 to 2004. For the years 2007 and 2008, we present estimates of microsimulation models based on updated micro data from the tax statistics.

We use data from the tax statistics in order to trace the detailed information from the tax base. The underlying data sets include nearly all items of the tax return forms, which are stored electronically by the fiscal authorities. Another main advantage of the tax statistics is that they precisely report the actual assessed tax liability accrued in the tax year. Revenue statistics, which are often used for empirical analysis and international comparisons, might considerably miss the actual tax liability for a given year. They capture current interim payments, which are based on previous tax assessments, as well as supplementary payments or repayments after the assessment for previous tax years. These timing differences to the assessed tax liability might heavily fluctuate with the business cycle or after major tax reforms. Disadvantages of the tax statistics are, however, that they were collected only in triennial intervals up to 2004, and that the data is rather old due to the long-lasting assessment procedures (the recent wave is of 2004).

The revenue from the local business tax is calculated on the basis of representative micro data from the tax statistics, taking into account the local municipalities' tax rate. Since there is no local business tax statistics available for 1992, we estimate the revenue for that year from the 1995 wave and the yearly revenue statistics. As measure of the corporate income tax revenue we use the assessed tax liability after deduction of domestic corporate income tax (until 2001, when Germany applied the full imputation system to avoid double taxation of distributed profits). This equals the owed corporate tax liability plus withholding taxes on capital investments credited against the assessed tax liability.

For the personal income tax we estimate the portion of the tax liability falling on business income. The starting point is the assessed tax liability after deduction of child allowances from taxable income. Using representative micro data from the income tax statistics of the respective years we allocate the individual tax liability according to the share of business income in total income, both positive and negative (for details of the estimation procedures see Bach and Buslei, 2009a). The precise information of the income tax statistics allows us to confine these estimations to income from business enterprise only (i.e., less income from agriculture and forestry or from self-employed activities), to income from partnerships (i.e., less income from sole proprietors), or to dividend income received from corporations. Moreover,

we estimate the withholding taxes on capital investments, which are not credited against domestic personal or corporate income tax, thus paid by foreigners or tax exempted residents. For that purpose, we compare the cash revenue from these taxes with the credits for these taxes reported in the personal and corporate income tax statistics for the particular years.

For the years 2007 and 2008, we use estimates of our microsimulation model on business taxation BizTax for Germany (Bach et al., 2008a) and of the personal income tax microsimulation model of the Fraunhofer Institute for Applied Information Technology FIT, Sankt Augustin. Both models are built up and operated on behalf of the German Federal Ministry of Finance in order to evaluate the fiscal and distributional impact of tax reforms. The models are based on representative micro data from the last available waves of the tax statistics (currently 2004). The model data sets are updated to the present using pertinent macro data and forecasts. Recent tax reforms are implemented in the tax assessment program code.

All in all, Germany's business income taxation including the income taxes on dividends generates revenue between 4 and 5 percent of gross domestic product (GDP) (line 26 of Table 3.2-1). The fluctuations are influenced by the business cycle. At the same time, tax base erosion and the impact of tax reforms might have had an impact (see below, Section 3.2.3.3). In the course of the tax reform of 2001 the revenue was rather weak. For 2004, for which the last tax statistics are available, the total tax revenue amounts to Euro 89 billion or 4.0 percent of GDP. In the years after, the tax revenue increased markedly due to the macroeconomic upturn and boosting business income. According our estimates that are calibrated to the performance of macroeconomic income aggregates and tax revenue, total business taxation revenue would increase to Euro 124 billion in 2007, or 5.1 percent of GDP. Due to the last reform of business taxation and the beginning recession in the wake of the financial crises, a slight decline in revenue is expected for 2008.

Table 3.2-1 Business taxation revenue in Germany, 1992-2004, and forecast up to 2008
billion Euro

No.		1992 ¹⁾	1995 ¹⁾	1998 ¹⁾	2001 ¹⁾	2004 ¹⁾	2007 ²⁾	2008 ²⁾
Local business tax								
1	Assessed local business tax ³⁾	22.5	20.7	24.5	23.2	28.5	40.7	40.1
2	Sole proprietors	3.4	2.1	2.2	2.4	2.5	3.4	4.6
3	Partnerships	7.9	6.2	7.0	7.7	8.7	12.3	11.5
4	Corporations	11.3	12.3	15.3	13.0	17.2	24.9	24.0
Corporate income tax								
5	Owed corporate income tax liability ⁴⁾	16.3	13.5	18.7	8.8	16.5	21.8	13.7
6	Withholding taxes on capital credited ⁵⁾	2.0	4.4	7.7	8.2	6.3	9.2	11.0
7	Gross revenue	18.3	17.9	26.4	16.9	22.8	32.6	26.8
8	Solidarity surcharge on gross revenue	0.7	1.3	1.5	0.9	1.3	1.8	1.5
Personal income tax								
9	Assessed personal income tax liability ⁶⁾	136.9	142.3	165.1	170.6	180.8	209.2	214.5
10	Assessed personal income tax liability after deduction of child allowances ⁷⁾ thereof ⁸⁾	136.9	142.3	151.5	152.1	163.0	191.3	196.4
11	on total business income	31.7	28.9	36.3	30.1	30.0	38.7	41.5
12	on income from business enterprise	21.1	17.9	23.2	16.0	15.7	20.3	21.8
13	on partnerships' business income	11.0	11.7	15.8	11.0	11.1	14.3	15.4
14	on dividend income	- 1.3	- 1.6	- 0.9	- 0.9	1.0	1.3	1.4
15	Assessed solidarity surcharge thereof ⁸⁾	5.3	9.9	8.2	8.3	8.6	10.0	10.3
16	on total business income	1.2	2.0	1.8	1.5	1.4	1.8	2.0
17	on income from business enterprise	0.8	1.2	1.2	0.8	0.8	1.0	1.0
18	on business income of partnerships	0.4	0.8	0.8	0.5	0.5	0.7	0.7
19	on dividend income	0.0	- 0.1	0.0	0.0	0.0	0.1	0.1
Withholding taxes on capital not credited								
20	Withholding taxes on capital not credited	1.8	3.8	4.0	13.4	3.9	6.4	7.7
21	Solidarity surcharge	0.1	0.3	0.2	0.7	0.2	0.4	0.4
Total business taxation								
22	Taxes on business and dividend income (1+7+8+11+14+16+19+20+21) thereof	75.0	73.3	93.8	85.9	89.1	123.8	121.5
23	Taxes on business income (1+7+8+11+16)	74.4	70.8	90.5	72.6	83.9	115.6	111.9
24	Taxes on income from business enterprise (1+7+8+12+17)	63.4	59.1	76.7	57.9	69.0	96.4	91.2
25	Taxes on income of corporations and partnerships (3+4+7+8+13+18)	49.6	50.3	66.8	50.2	61.7	86.7	79.9
Business taxation revenue as percent of gross domestic product (GDP)								
26	Taxes on business and dividend income thereof	4.6	4.0	4.8	4.1	4.0	5.1	4.9
27	Taxes on business income	4.5	3.8	4.6	3.4	3.8	4.8	4.5
28	Taxes on income from business enterprise	3.9	3.2	3.9	2.7	3.1	4.0	3.7
29	Taxes on income of corporations and partnerships	3.0	2.7	3.4	2.4	2.8	3.6	3.2
Business taxation revenue as percent of total tax revenue⁹⁾								
30	Taxes on business and dividend income thereof	20.4	18.1	21.0	18.0	18.5	21.5	20.5
31	Taxes on business income	20.2	17.5	20.3	15.2	17.4	20.1	18.9
32	Taxes on income from business enterprise	17.2	14.6	17.2	12.1	14.3	16.7	15.4
33	Taxes on income of corporations and partnerships	13.5	12.4	15.0	10.5	12.8	15.0	13.5
<p>1) Results from the tax statistics of the respective year.- 2) Estimation.- 3) 1992: Estimation.- 4) Tax liability after crediting withholding taxes on capital income and domestic corporate income tax on received dividends (full imputation procedure until 2001).- 5) Including withholding tax on interest.- 6) After crediting corporate income tax up to 2001.- 7) As of 1998: Assessed income tax liability minus tax relief from child allowances (estimation of Federal Ministry of Finance Germany).- 8) Allocation of assessed income tax and solidarity surcharge liability according to the share of business income in total income, both positive and negative.- 9) Less social contributions, from national accounts.</p> <p>Sources: Federal Statistical Office Germany (Destatis); Federal Ministry of Finance Germany; own estimations.</p>								

The taxes on business income (line 23 of Table 3.2-1) do not include the dividend tax revenue. They represent the tax burden at the firm level. The taxes on income from business enterprise (line 24 of Table 3.2-1) neglect the personal income tax falling on the income from agriculture and from other self-employed activities (in particular liberal professions), which make up about 0.7 percent of GDP in 2004. It should be noted that these income sources are not liable to the local business tax. The taxes on income of corporations and partnerships (line 25 of Table 3.2-1) represent the taxes on “corporate income” in the narrow sense, which is analyzed in detail in the following sections. This broader definition of the corporate sector refers to the concept of national accounts and international standards that include partnerships. As mentioned in Section 3.2.2, partnerships play an important role in Germany. They account for more than one third of the business tax revenue levied on the entire corporate sector.

The analysis also demonstrates the high importance of local business taxation, which raises more than 40 percent of the business tax revenue from corporations including partnerships, and about 35 percent of the tax revenue from total business income. Moreover, the personal income tax share of the entire business tax revenue is remarkable in Germany. Beside partnerships it also includes the sole proprietors’ taxes. The revenue share of the corporate income tax is rather low in Germany, which is also demonstrated by the following international comparison.

International comparisons of macroeconomic tax ratios mostly rely on the OECD revenue statistics (OECD, 2009). Table 3.2-2 highlights the tax revenue from corporate income over GDP for the main OECD countries. The OECD revenue statistics relies on the national revenue statistics and might therefore be flawed by distortions mentioned above regarding the timing of the revenue. Moreover, in the case of Germany these statistics are particularly misleading since they only include the revenue falling on incorporated firms. Indeed, Germany’s tax-to-GDP ratio is rather low compared to the OECD and EU 15 average, and the other main OECD countries listed in the table. As demonstrated above, one should at least include the partnerships’ share into the revenue of corporate business taxation. If we therefore refer on the business tax revenue on income of corporations and partnerships over GDP (line 29 of Table 3.2-1), Germany’s tax-to-GDP ratio turns out to be much higher. However, even relying on these numbers the tax revenue was rather low in 2001. During the last years up to 2007 the German tax revenue was catching up to the international average, although the other countries also increased their revenue, presumably due to the boosting economy up to 2007.

Moreover, the international comparison indicates that in other countries the tax revenue from corporate income significantly rose since 1992, although the tax rates in many countries have been lowered markedly (see above, Section 3.2.2). This “corporate income tax rate-revenue paradox” might have something to do with changes in the size and profitability of the corporate sector, but might also reflect some broadening of the tax base and thus utilizing a larger part of corporate income for taxation (see Piotrowska and Vanborren, 2008).

Table 3.2-2 Tax revenue from corporate income in international comparison, 1992-2007
as percent of gross domestic product (GDP)¹⁾

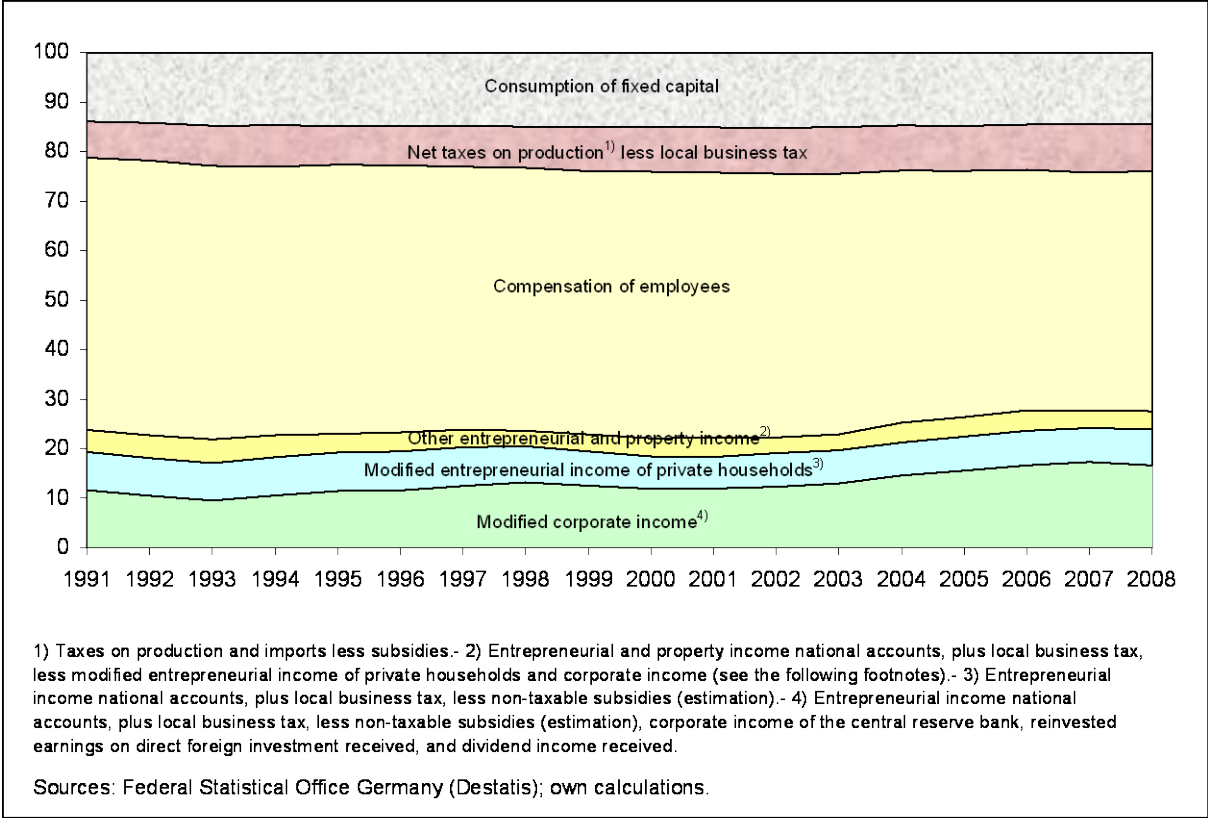
	1992	1995	1998	2001	2004	2005	2006	2007
Tax revenue from corporate income, OECD revenue statistics								
OECD total	2.4	2.7	3.1	3.3	3.4	3.7	3.9	3.9
EU 15	2.2	2.6	3.3	3.4	3.1	3.3	3.4	3.5
France	2.0	2.1	2.6	3.4	2.8	2.4	3.0	3.0
Italy	4.2	3.5	2.9	3.5	2.8	2.8	3.4	3.8
Sweden	1.4	2.8	2.8	2.9	3.1	3.7	3.7	3.8
Netherlands	2.9	3.1	4.2	3.9	3.1	3.8	3.3	3.3
United Kingdom	2.1	2.8	3.9	3.5	2.8	3.3	3.9	3.4
USA	2.3	2.9	2.8	1.9	2.5	3.2	3.4	3.1
Canada	1.8	2.9	3.6	3.1	3.6	3.5	3.8	3.7
Japan	4.9	4.3	3.7	3.5	3.7	4.3	4.7	4.8
Germany	1.5	1.0	1.6	0.6	1.6	1.7	2.1	2.2
For comparison:								
Germany, assessed tax revenue incl. local business and income tax share of partnerships ²⁾	3.0	2.7	3.4	2.4	2.8	3.2	3.5	3.6
1) Unweighted average.- 2) Own calculations (see line 29 of Table 3.2-1). Sources: OECD: Revenue Statistics 2009; own calculations.								

3.2.3.2 Macroeconomic Corporate Income and Implicit Tax Rates

Instead of gross national product (GDP) one should use an adequate aggregate of corporate income as denominator for calculating macroeconomic implicit tax rates on corporate business income. Based on a similar concept of the European Commission (2009), we derive a yearly corporate income from the income accounts of the national accounts statistics (see Figure 3.2-4 and Table 3.2-3). The idea is to approximate the actual taxable income as close as possible. Starting point is the net entrepreneurial income as measured in German national accounts (ESA 95 Code: b.4n) for the corporate sector (S.11 and S.12). This income is derived from the net operating surplus (ESA 95 Code: b.2n), which approximates the earnings

before interest and taxes (EBIT) from ordinary business operations, plus received property income, minus paid property income (ESA 95 Code: d.4rec/pay)⁵³.

Figure 3.2-4 Distribution of gross national income (GNI), 1991-2008 structure in percent



We modify this approach with respect to the following items (see the adjustment items in Table 3.2-3). First, we deduct the reinvested earnings on direct foreign investment received by resident firms (ESA 95 Code: d.43rec) since in almost all cases these incomes are not liable to domestic taxation. Second, we subtract the dividend income received (ESA 95 Code: d.42rec) in order to avoid double counting of these income at the paying and the receiving firm. Third, we increase the corporate income by the local business tax revenue since this revenue is already deducted in calculating the net operating surplus.⁵⁴ Fourth, we reduce capital and busi-

⁵³ The property income of the national accounts includes interest and dividend income, reinvested earnings on direct foreign investment, rents on land, and property income attributed to insurance policy holders.

⁵⁴ This comes from the historical tradition of the German local business tax (“Gewerbesteuer“) which was formerly levied on a broader base of the firm’s value added and equity. Although the local business tax nowadays is largely levied on business income, it is still factored into the position “other taxes on production” in the generation of income account (ESA 95 Code: d29), like property taxes or taxes on motor vehicles and other fixed assets, or payroll taxes. Instead of that, it should be booked into the category “taxes on income” of the secondary distribution of income account (ESA 95 Code: d51). German statistical authorities are currently reconsidering this assignment.

ness income by the non-taxable subsidies, which we roughly estimate by 20 percent of the category “production subsidies other than on products” (ESA 95 Code: d.39rec) (Bach und Dwenger, 2007: 62), and the corporate income of the central reserve bank.

Figure 3.2-4 highlights the upgrowth of the resulting modified corporate income in the context of the distribution of the gross national income (GNI) (for a similar approach see Piotrowska and Vanborren, 2008, and Sørensen, 2007). Note that the GNI, formerly known as gross national product (GNP), differs only little from the gross domestic product (GDP) by the current external balance of primary incomes.⁵⁵ We likewise modify the entrepreneurial income of households in adjusting for local business tax and non-taxable subsidies and calculate the other entrepreneurial and property income as difference to the total entrepreneurial and property income aggregate. Correspondingly to the increase of entrepreneurial income by the local business tax, the taxes on production and imports less subsidies (ESA 95 Code: d.2-d.3) are lowered by this amount. The other income components are directly taken from the allocation of primary income account of national accounts.

Table 3.2-3 Tax revenue, corporate income, and implicit tax rates of corporations incl. partnerships, 1992-2004, and forecast up to 2008

	1992 ¹⁾	1995 ¹⁾	1998 ¹⁾	2001 ¹⁾	2004 ¹⁾	2007 ²⁾	2008 ²⁾
	billion Euro						
Tax revenue and corporate income							
Taxes on corporate income ³⁾	49.6	50.3	66.8	50.2	61.7	86.7	79.9
Reference income corporations, national accounts							
Entrepreneurial income, corporations	189.5	230.5	300.7	321.0	393.0	510.7	516.7
- reinvested earnings on foreign investm. received	0.0	1.6	5.2	- 16.0	18.8	30.2	32.3
- dividend income from residents (estimation)	19.4	18.7	38.8	66.7	34.3	37.3	46.5
Corporate income, European Commission	170.0	210.2	256.7	270.2	339.9	443.2	437.9
- other dividend income received	6.9	10.8	13.8	32.8	36.8	47.1	49.4
+ local business tax	21.8	20.5	24.5	23.3	26.9	38.1	40.2
- non-taxable subsidies (estimated), corporate income of the central reserve bank	11.5	10.6	10.8	10.8	4.6	8.4	8.5
Modified corporate income	173.4	209.4	256.6	250.0	325.4	425.8	420.1
Implicit tax rates	percent						
based on corporate income, European Commission	29.2	23.9	26.0	18.6	18.1	19.6	18.3
based on modified corporate income	28.6	24.0	26.0	20.1	18.9	20.4	19.0
1) Results from the tax statistics of the respective year.- 2) Tax revenue: Own estimation.- 3) Local business tax, corporate income tax, personal income tax share on partnership income, solidarity surcharge.							
Sources: Federal Statistical Office Germany (Destatis); own estimations.							

⁵⁵ Balance of primary incomes receivable from the rest of the world less primary incomes payable to non-resident units. This balance currently makes up +1.5 percent of GDP.

As a result, the share of our modified corporate income in GNI increased by more than 6 percentage points from 1992 to 2008, from 10.5 to 16.6 percent, whereas the share of the other entrepreneurial and property income components slightly decreased over that period (Figure 3.2-4). This striking trend in “corporatization” can also be observed for many other European countries (Piotrowska and Vanborren, 2008). The reasons behind these trends might be an increasing profitability of the corporate sector, an increasing share of economic activity performed under corporate legal forms, or income shifting from personal to corporate income tax. The share of total entrepreneurial and property income in GNI increased by 5 percentage points in Germany from 1992 to 2008, while the compensation of employees falls by 7 percentage points in that period. The taxes on production and imports less subsidies rose by 2 percentage points due to the increase in indirect taxation (VAT, eco taxes) and the modest retrenchment in subsidies. The share of the consumption of fixed capital (i.e., the depreciation aggregate) remains almost constant. Thus, with respect to net national income at factor cost, i.e., the sum of the compensation of employees and total entrepreneurial and property income, there was a considerable redistribution of factor income in favor of corporate income and at the expense of labor income in Germany, in particular since 2001.

Calculated in absolute terms, the modified corporate income rose by 140 percent since 1992, while GNI only increased by 53 percent and the compensation of employees only by 34 percent. At the same time, the taxes on corporate income, i.e., on the income of corporations and partnerships (see line 25 of Table 3.2-1), rose by merely 61 percent since 1992. This means that the average tax burden in relation to corporate income decreased markedly over that period.

In Table 3.2-3 we present implicit tax rates on corporate income calculated according to the concept of the European Commission (2009). Accordingly, we divide the taxes on corporate income (taken from line 25 of Table 3.2-1, including the business tax share of the partnerships) by the modified corporate income aggregates derived in Table 3.2-3. Beside our modified corporate income concept described above, we also take into account the European Commission’s income concept. This allows to better compare the implicit tax rates on corporate income with those for other countries reported in European Commission (2009: 328). The implicit tax rates on corporate income reported there do not include figures for Germany since the revenue statistics used in this study do not allow an apportionment of the local business tax and the personal income tax revenue by partnerships and other taxpayers (see above, and Bach and Buslei, 2009a). Due to the comprehensive utilization of tax statistics we present here, for the first time for Germany, macroeconomic implicit tax rates on corporate income.

Figure 3.2-5 Statutory tax rates, effective average tax rates (EATR)¹⁾ and implicit tax rates (ITR) on corporate income in Germany, 1991-2009
 including sub-central and local government business income tax rates
 in percent

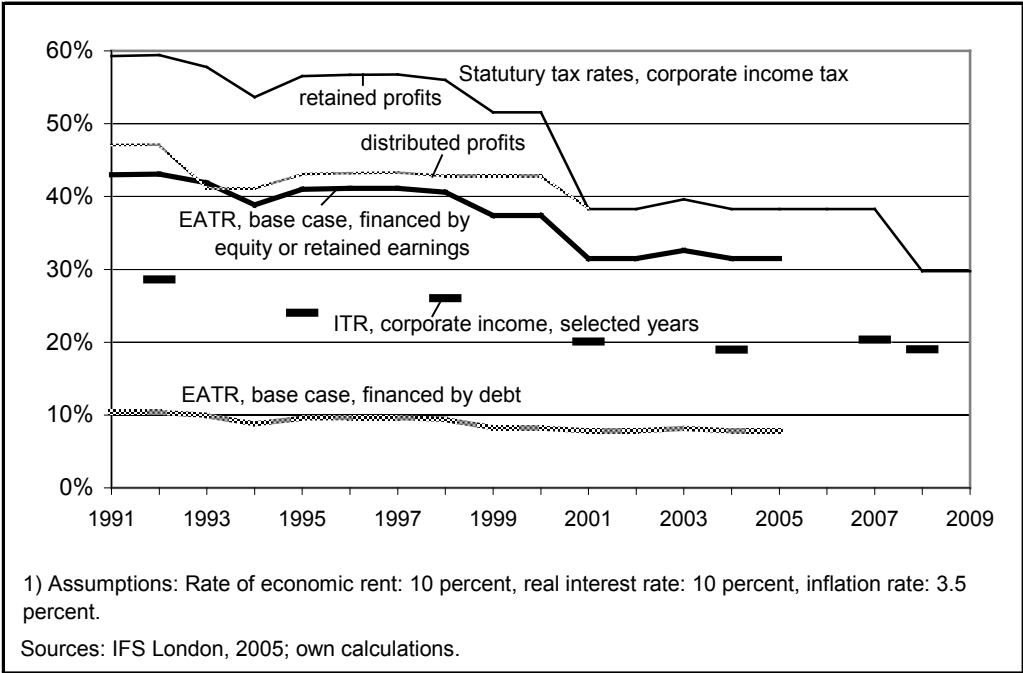


Figure 3.2-5 puts the resulting implicit tax rates (ITR) into the context of the statutory tax rates as well as the effective average tax rates (EATR) calculated according “forward-looking“ simulation models (see Figure 3.2-1 and Figure 3.2-3 in Section 3.2.2). The results show implicit tax rates falling considerably short of the statutory tax rates and also of the simulated effective tax rates. For the years as of 1998, the implicit tax rates based on our proposed modified corporate income are slightly higher than those based on the Commission’s corporate income, but the differences do not count much. Moreover, there is a trend in declining implicit tax rates since the beginning of the 90ies, although the tax rates remained rather high in Germany up to 1998. This reflects the rising tax base erosion compared to the macro-economic corporate income, which could be observed in that years (see below, Section 3.2.3.3). In the years after 1998, the substantial tax rate cuts have further impaired the implicit tax rates similar to the EATRs. According to our projections for the years since 2004, the implicit tax rates increase moderately, as the estimated tax revenue increase somewhat stronger than the corporate income. For 2008, we estimate a slight reduction due to the tax reform. All in all, our estimations suggest that the average implicit tax rate on German corporate income was around 20 percent since 2001.

3.2.3.3 Corporate Tax Base Erosion

The trends in implicit tax rates presented in the previous Section 3.2.3.2 give hints to considerable tax base erosion in Germany, i.e., taxable income falling short of economic income. In this section we compare the corporate tax base reported in the tax statistics with the corporate income measured in national accounts.

As a starting point for the comparison we use our modified corporate income derived from national accounts data. We further modify this concept by the following items taking from the national accounts data in order to be line with as close as possible with the adjusted gross income concept of taxation (see also the complete calculation scheme in the upper panel of Table 3.2-4, starting from the entrepreneurial income of national accounts). First, we do not generally deduct received dividends from the reference income of corporations. For the years up to 2001 we do not deduct dividend income since this corresponds to the full imputation scheme, which was applied until 2001, when received dividends increased taxable income, and double taxation was ruled out by crediting the corporate income tax. For the following years the reference income of corporations is reduced by 95 percent of the dividends received by non-financial corporations. The remaining 5 percent reflect the adjustment for business expenses based on tax-free dividend income (see Sec. 8b German Corporate Income Tax Code). In the case of financial corporations we reduce the reference income by an estimated 30 percent of the dividends received, which roughly accounts for the only partial exemption of dividend income received by the financial sector (see the special regulation of Sec. 8b sub. 7 and 8 German Corporate Income Tax Code).⁵⁶ Second, the local business tax revenue is added to the reference income as of 2008 since the local business tax liability is not deductible from taxable income any more. The other adjustments made for the modified corporate income described in the previous Section 3.2.3.2 (see Table 3.2-3) still apply, as regards reinvested earnings on foreign investments, estimated non-taxable subsidies, and corporate income of the central reserve bank.

⁵⁶ The banking statistics of the Deutsche Bundesbank provides current information on the shareholdings, both in portfolio investments and in shares in affiliated enterprises, http://www.bundesbank.de/statistik/statistik_banken_tabellen.en.php

Table 3.2-4 Business income of corporations incl. partnerships in national accounts and tax statistics, 1992-2004, and forecast up to 2008

No.		1992 ¹⁾	1995 ¹⁾	1998 ¹⁾	2001 ¹⁾	2004 ¹⁾	2007 ²⁾	2008 ²⁾
		billion Euro						
National accounts, corporations³⁾								
1	Entrepreneurial income	189.5	230.5	300.7	321.0	393.0	510.7	516.7
	thereof:							
2	Non-financial corporations	147.6	180.2	242.2	268.7	324.1	408.1	416.8
3	Financial corporations	41.9	50.3	58.5	52.3	68.9	102.6	99.9
4	- non-taxable subsidies nonfinancial corporations ⁴⁾	4.1	5.3	5.2	4.9	4.3	4.9	5.0
5	- corporate income of the central reserve bank ⁵⁾	7.4	5.2	5.6	5.8	0.3	3.5	3.5
6	- tax-exempted dividend income as of 2002 ⁶⁾					44.4	49.4	58.0
7	- reinvest. earnings on foreign investm. received	0.0	1.6	5.2	- 16.0	18.8	30.2	32.3
8	+ local business tax							40.2
9	Reference income corporations, national accounts (1-4-5-6-7+8)	177.9	218.3	284.7	326.2	325.3	422.8	458.1
Tax statistics, partnerships and corporations								
Statistics of partnerships and similar communities								
	Profit cases							
10	Adjusted gross income	54.1	59.6	88.6	99.2	106.1	143.0	166.2
	Loss cases							
11	Adjusted gross income	- 18.8	- 35.9	- 34.5	- 44.5	- 30.7	- 30.1	- 29.5
Corporate income tax statistics								
	Profit cases							
12	Adjusted gross income ⁷⁾	63.6	83.0	129.6	118.4	111.0	138.1	173.0
13	Taxable income	58.8	67.0	102.6	95.1	92.8	117.2	150.5
	Loss cases							
14	Adjusted gross income ⁷⁾	- 52.2	- 55.7	- 46.4	- 85.7	- 58.8	- 53.2	- 53.3
15	Loss carryforward at the end of year	128.4	241.3	295.5	388.2	520.6	.	.
Local business tax statistics								
	Share of corporations and partnerships at							
16	losses of partnerships (addition)	.	- 2.6	- 8.2	- 18.3	- 9.2	- 11.9	- 14.4
17	profits of partnerships (reduction)	.	5.6	17.8	34.5	24.2	31.3	37.8
18	Balance	.	3.0	9.6	16.2	15.0	19.5	23.4
Total tax statistics								
	Adjusted gross income							
19	Profit cases (10+12)	117.7	142.6	218.2	217.6	217.1	281.1	339.2
20	Profit cases without share at partnership profits ⁸⁾ (10+12-17)	.	137.1	200.4	183.1	192.9	249.8	301.4
21	Total (10+11+12+14)	46.7	51.0	137.3	87.4	127.7	197.8	256.5
Difference to reference income corporations								
22	Profit cases	60.3	75.7	66.5	108.6	108.1	141.7	118.8
23	Profit cases without share at partnership profits ⁸⁾	.	81.3	84.3	143.1	132.3	173.0	156.7
24	Total	131.3	167.3	147.4	238.8	197.6	225.0	201.6

1) Results from the tax statistics of the respective year.- 2) Tax base: Own estimation.- 3) Including partnerships in terms of commercial law and tax law.- 4) Estimated share of 20 percent.- 5) According to national accounts.- 6) Assumption: 95 percent of dividends received by non-financial corporations and 30 percent of dividends received by financial corporations.- 7) Including share at partnership income or losses, including dividends received from residents liable to corporate income tax (full imputation procedure up to 2001).- 8) Correction of double counting of income from partnerships.
Sources: Federal Statistical Office Germany (Destatis); own estimations.

Due to the full addition of dividend income up to 2001 the resulting reference income of corporations (line 9 of Table 3.2-4) is much higher for that years compared with the modified corporate income used for the calculation of the implicit tax rates above (see Table 3.2-3). For

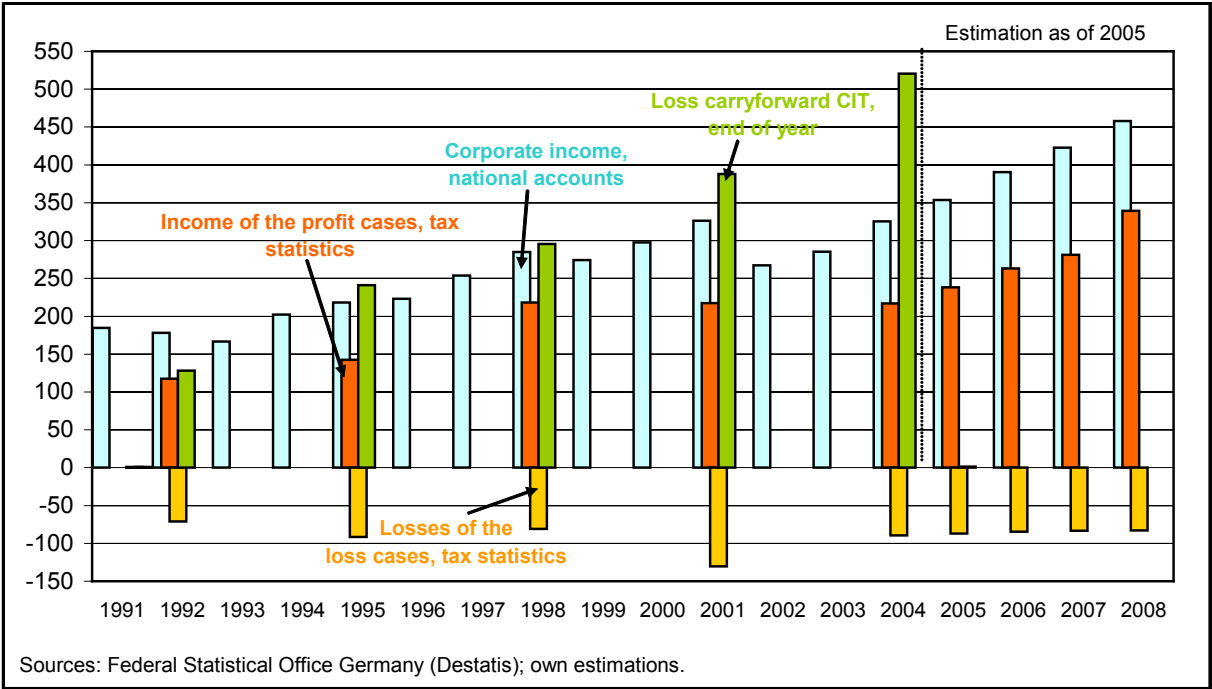
the years until 2007, the only partly addition of dividend income and the deduction of the local business tax largely cancel each other out. In 2008, the repeal of the local business tax deduction re-increases the difference.

The corporate tax base is measured by the adjusted gross income (“Gesamtbetrag der Einkünfte”) reported in the respective tax statistics. This income comprises the sum of taxable income from different sources such as income from business enterprise, agriculture, self-employed activities etc, after deduction of operating expenses, other income-related expenses, income-specific allowances, and deductible donations or contributions. If the taxpayer is parent of a tax group, the assigned income of the subsidiaries is included in adjusted gross income. The corporate income tax statistics also report the taxable income after deduction of losses carried forward from previous tax years or carried back from following tax years, on which the tax rate is applied. Moreover, the statistics discloses the stock of tax loss carryforwards at the end of year. The statistics of partnerships, however, does not provide such information from the assessment since the taxable income is passed to the shareholders who have to enter it into their tax return. Due to this “transparent” taxation of partnerships, we should adjust the aggregate corporate income collected from the tax statistics for profit and loss transfers of partnerships to other affiliated corporations including affiliated partnerships, in order to avoid double counting of income. We take this information from the local business tax statistics except for the year 1992, for which no such information is available. With respect to the statistics of partnerships it should be noted that they include not only medium-sized businesses and even some bigger firms, which often use unincorporated legal forms. The statistics of partnerships also includes other companionships such as unincorporated consortia, communities of heirs, joint ownerships of real estate, or other and civil law associations not liable to corporate income tax. Such institutions and organizations are mostly assigned to the household sector in national accounts. However, as they should not involve higher income aggregates, we should not overestimate corporate income so much in tax statistics.

The results for the adjusted gross income reported in the tax statistics indicate a considerable erosion of the tax base, compared with the corporate income derived from national accounts (Table 3.2-4, Figure 3.2-6). Astonishing is the high weight of running tax losses in the observed tax years. The ratio of losses over income was very high in 1995 and 2001, but also in the other years it was rather high (see also the detailed analysis below, section 3.2.4.1). For instance, for 2004, the last available year of the tax statistics, the ratio was 53 percent for the corporate income tax, and 29 percent for the partnerships. The difference between adjusted

gross income and taxable income reported in the corporate income statistics demonstrate the impact of intertemporal loss offset. The considerable amount of running losses increased the stock of tax loss carryforwards in high gear. From 1992 to 2004, the latter increased by more than 400 percent. In 2004, the tax loss carryforwards amounted to Euro 521 billion, which equates to 23.5 percent of GDP or 4.7 times the positive adjusted gross income of that year. For partnerships, the income tax statistics provide no direct information on the stocks of tax loss carryforwards due to the “transparent” taxation. As far as partnerships’ running tax losses are passed to shareholders liable to the personal income tax, the shareholders often would have offset these losses against positive income from other sources (see Bach and Buslei, 2009a). Actually, loss allocation vehicles mostly use partnership legal forms in Germany. The 2004 tax statistics collect the tax loss carryforwards of the local business tax for the first time. For partnerships liable to the local business tax (farmers and liberal professionals are exempted), the amount of local business tax loss carryforwards amounted to Euro 145 billion, which equates to 2.2 times the positive taxable gross income of that tax (“Gewerbeertrag”). Notably, the German tax legislation restricted the use of loss carryforwards as of 2004.

Figure 3.2-6 Business income of corporations incl. partnerships in national accounts and tax statistics, 1992-2004, and forecast up to 2008
billion Euro



Altogether, our calculations reveal a considerable gap between corporate income derived from national accounts and taxable gross income reported in the tax statistics. Even if we refer to the positive adjusted gross income only, the difference adds up to Euro 108 billion in 2004

(line 22 of Table 3.2-4), which equates to almost 5 percent of GDP. Since the tax losses of the loss cases should be incorporated in the macroeconomic figures from national accounts as well, we actually should refer to the difference based on the balanced income aggregate of profit and loss cases (line 24 of Table 3.2-4), which leads to a gap of almost Euro 200 billion in 2004. Even this number is not adjusted by the double counting of profit and loss transfers between partnerships and other affiliated corporations, which makes up another Euro 15 billion on balance (line 18 of Table 3.2-4). According to the projections of our microsimulation models, the gap might have increased over the years up to 2007. For 2008, our estimates suggest a marked decline due to the assumed broadening of the tax base involved by the 2008 reform of business taxation.

3.2.3.4 How Reliable Are the Entrepreneurial Income Aggregates of German National Accounts?

Before further analyzing the considerable gap between corporate income measured in national accounts and in tax statistics as an indicator for tax base erosion, one should scrutinize how reliable are the corporate income aggregates of national accounts effectively. This raises questions with respect to conceptual differences in the income definition and determination rules. Another issue regards the impact of insufficient data sources for an independent bottom-up calculation of the entrepreneurial income for the total economy, which is especially a problem for Germany,

Conceptual differences in the income definition and determination rules between national accounts and financial or tax accounting are often discussed in the literature (Luh, 1996, Görzig and Schmidt-Faber, 2001, Heckemeyer and Spengel, 2008, European Commission, 2009: 365, Federal Statistical Office, 2009: 176). The main issues in this field are picked out in the following. Basically, the goal of creditor protection (lowest value principle, recognition-of-loss principle) plays a central role in German financial and tax accounting. With respect to the valuation of assets and liabilities, the lowest value principle and the recognition-of-loss principle applies, which systematically leads to hidden reserves in the firms' balance sheets. In contrast, the income concept of national accounts aims to capture the economic income generated and accrued in a certain period. For this reason, consumption of fixed capital is not calculated at acquisition prices as it is mandatory in financial accounts, but at replacement costs of the current period. In times of inflation this would lead to higher depreciation valuations in national accounts. On the other hand, accelerated depreciation schemes or special depreciation allowances for SMEs are neglected in national accounts, which generally

apply straight-line depreciation. Furthermore, the national accounts usually consider a longer economic service life of fixed assets. These effects might largely offset the higher valuation at replacements costs. A comparison of depreciation aggregates between national accounts and representative data from financial statements, which is available in Germany only for selected industries, suggest a slight overestimation of national account depreciations.⁵⁷ Likewise, in valuing inventories, the national accounts apply other concepts than those of financial accounts.⁵⁸ Moreover, the national accounts only measure financial transactions with respect to interest income, rents, and distributed or retained profits. They do not take into account all other items of the financial or extraordinary result in the firms' income statement of financial or tax accounting, such as capital gains and losses, neither unrealized nor realized, gains and losses from mergers and reorganizations, restructuring and reorganization costs, or losses from extraordinary damage. Furthermore, national accounts neglect provisions, e.g., for pensions, or for uncertain obligations, warranties, expected losses, etc.

All these conceptual divergences might cause considerable differences in the income accrued in a single year. However, as these differences finally result from different timing schemes of cash flows, they might offset over time, especially in the long run (see also Heckemeyer and Spengel, 2008: 41). For instance, the rise of tax base erosion in the mid-nineties might be significantly caused by the tax incentives for East Germany such as the accelerated depreciation schemes. However, the higher depreciation allowances deducted in the first years after investment would clearly reduce the depreciation allowances in the following years, and thus increase the taxable income compared to an income accrual over time for which straight-line depreciation is applied. Therefore, the mentioned differences in income concepts could only explain the observed gap in income aggregates as the firms' tax planning strategies have increasingly utilized opportunities for generating hidden reserves (see below, section 3.2.4.2).

With respect to tax exemptions, we correct for the income of the central reserve bank and the non-taxable subsidies (see above, section 3.2.3.2). There are some other institutions included in the corporate sector of the national accounts that are exempted from taxation, for instance public utilities (sewage and waste disposal, street cleaning, social and cultural services) or

⁵⁷ Deutsche Bundesbank provides a statistic on the financial statements of German enterprises, http://www.bundesbank.de/download/statistik/stat_sonder/statso5_1994_2003.en.pdf

⁵⁸ Output stocks are valued at basic prices for national accounts purposes and input stocks at replacement cost for use in production. Paper profits which can arise in financial accounts when the price of stocks rises are thus eliminated in the national accounts.

non-profit institutions, the latter are included in the corporate sector only if they supply their services predominately to corporations. It is hard to quantify the income generated by these institutions. However, due to their non-profit character they should not imply a noteworthy income aggregate that impairs our analysis. It should be noted in this context that basically all public corporations in Germany, even public authorities, are liable to corporate income and local business taxation regarding their income from market-related business activities (Sec. 4 German Corporate Income Tax Code).

Beside the conceptual and institutional divergences one should take into account that, unlike other countries, Germany's national accounts do not include an independent bottom-up calculation of the entrepreneurial income for the total economy (Federal Statistical Office, 2009: 175). There is no data available from financial or tax accounting that is representative and sufficient detailed to allow such calculations in terms of the national account concept. Actually, the net operating surplus (including the mixed income) of the non-financial corporations and households is determined residually from gross national income (GNI), i.e., by subtracting consumption of fixed capital, taxes on production less other subsidies, and the compensation of employees. An independent bottom-up income calculation is realized only for the financial corporations (S.12), based on the comprehensive banking statistics of the Deutsche Bundesbank, and for the government sector (S.14), based on public budget accounting. The remaining business income is allocated to the non-financial corporations and households by rough estimates. Thus, all the estimation risks regarding GNI as well as the other income components including the households' share in entrepreneurial income might impair the residual assigned to corporations.

The estimation error involved is hard to quantify. The German Federal Statistical Office (2009: 374) reports "balancing differences" for the GDP accounting results according to the production and expenditure approaches that range up to 2 percent of GDP. With respect to the production approach of the GDP calculations, data problems arise with industries in the service sector for which often no reliable accounting data is available, in particular for industries with a high share of small companies. For the expenditure approach data deficits might have an impact in particular on the households' final consumption expenditure and the changes in inventories (Görzig and Schmidt-Faber, 2001).

If we, for instance, set the estimation risk involved here up to 2 percent of GDP, which amounted to Euro 50 billion per year in 2008, a considerable share of the observed gap in corporate income could result from an overestimation of the entrepreneurial income in national accounts. The implicit tax rates calculated above (Table 3.2-3) would be higher by about

2.6 percentage points in the recent years. Such an estimation error would imply, however, that either the GDP is accordingly overestimated, or the other income components are underestimated. Moreover, the estimation error in national accounts could also imply an underestimation of macroeconomic corporate income, which would increase the gap in the corporate income aggregates. In any case, there is no evidence that the continuous trend of tax base erosion is simply the result of a systematic overestimation of corporate income in national accounts.

3.2.4 Economic Backgrounds

3.2.4.1 Corporate Tax Losses by Industries

Before discussing selected economic backgrounds in order to shed more light on the corporate tax base erosion in Germany, we closer look at the importance of corporate tax losses by industrial composition, reported in the tax statistics waves available. According to a similar approach of Altshuler et al. (2008), we measure the importance of losses by the ratio of losses (total income for firms with negative income) to positive income (total income for firms with positive income), each calculated at the level of adjusted gross income (“Gesamtbetrag der Einkünfte”), and both by firms liable to corporate income tax (Table 3.2-5) and by partnerships (Table 3.2-6). The corporate income tax statistics also reports the stock of tax loss carryforwards at the end of year, which we also put into relation to positive income (Table 3.2-5). Information for the year 1992 is not available for partnerships.

Basically, the losses fluctuate heavily over the years observed. This might be influenced by the business cycle, by financial market valuations that trigger off capital gains and losses, or by tax reforms. For instance, the rather high impact of losses in 1992 and 1995 might be influenced by the tax allowances granted for investments in East Germany. In 2001 and 2004, the lower macroeconomic performance, the downturn in stock-market prices, or the several tax reforms since 1999 might have had an impact.

With respect to the incorporated firms liable to the corporate income tax, the following industries report loss importances above average: Real estate and renting, hotels and restaurants, business services, public and personal services, transport, storage and communication, and construction. Agriculture shows very high losses in the nineties, but has little importance for the corporate sector. The manufacturing sectors, the hotel and restaurant industries, the real estate industry, partly the energy and water suppliers, and the construction sector face rather

high losses in 1992 and 1995. This is probably due to the tax allowances for investments in East Germany.

Table 3.2-5 Tax losses and loss carryforwards in relation to taxable income, 1992-2004 of taxpayers liable to corporate income tax by industrial composition

	1992	1995	1998	2001	2004
Running losses¹⁾ as % of running profits²⁾					
Agriculture, forestry and fishing	936	213	129	48	60
Mining and quarrying	91	212	48	17	40
Manuf. of intermed./non-durable goods	126	39	25	35	42
Manuf. of investment/durable goods	97	132	36	45	50
Electricity, gas and water supply	75	35	13	17	13
Construction	190	98	79	100	73
Trade, maintenance and repair	68	60	46	59	38
Hotels and restaurants	402	165	128	91	145
Transport, storage and communication	118	195	44	136	61
Financial intermediation	19	5	5	52	39
Real estate and renting	89	150	118	140	113
Business service activities	62	107	40	113	62
Public and personal service activities	125	119	103	106	96
Total	82	67	36	72	53
Loss carryforwards end of year as % of running profits²⁾					
Agriculture, forestry and fishing	2 510	1 703	1 770	931	954
Mining and quarrying	224	1 466	573	306	264
Manuf. of intermed./non-durable goods	289	231	229	250	336
Manuf. of investment/durable goods	229	530	218	320	373
Electricity, gas and water supply	417	244	172	139	160
Construction	464	301	405	592	715
Trade, maintenance and repair	156	256	251	292	287
Hotels and restaurants	844	715	776	586	1 089
Transport, storage and communication	306	767	317	744	856
Financial intermediation	43	26	28	104	229
Real estate and renting	225	747	782	935	1 306
Business service activities	166	372	204	319	518
Public and personal service activities	340	560	609	607	881
Total	202	291	228	328	469
For information:					
Structure of running profits¹⁾ in %					
Agriculture, forestry and fishing	0.2	0.2	0.2	0.3	0.3
Mining and quarrying	0.6	0.4	0.5	0.5	0.7
Manuf. of intermed./non-durable goods	14.5	17.6	14.2	13.9	12.0
Manuf. of investment/durable goods	8.7	11.6	17.5	14.7	14.2
Electricity, gas and water supply	1.7	4.7	4.3	5.0	5.0
Construction	5.1	4.0	2.6	2.5	2.4
Trade, maintenance and repair	16.4	12.8	9.8	10.9	12.7
Hotels and restaurants	2.2	0.5	0.3	0.5	0.4
Transport, storage and communication	9.3	2.0	5.6	3.6	4.5
Financial intermediation	21.7	25.5	20.9	14.5	15.4
Real estate and renting	2.1	3.9	3.7	4.5	4.3
Business service activities	11.3	14.0	17.7	25.7	24.2
Public and personal service activities	6.1	2.8	2.7	3.4	3.9
Total	100.0	100.0	100.0	100.0	100.0
1) Adjusted gross income for taxpayers with negative adjusted gross income.- 2) Adjusted gross income for taxpayers with positive adjusted gross income. Sources: Federal Statistical Office Germany (Destatis); own calculations.					

In 2001 and 2004, the loss importance was low in manufacturing, as well as in energy and water supply. The financial industries report a rather low importance of losses in the nineties,

whereas in 2001 and 2004 losses became significant, perhaps due to capital losses from the bursting dotcom bubble. With respect to partnerships, higher losses are reported by the industries of transport, storage and communication, hotel and restaurants, and real estate, for the latter especially in 1995 and 1998.

Table 3.2-6 Tax losses in relation to taxable income, 1995-2004 of partnerships by industrial composition

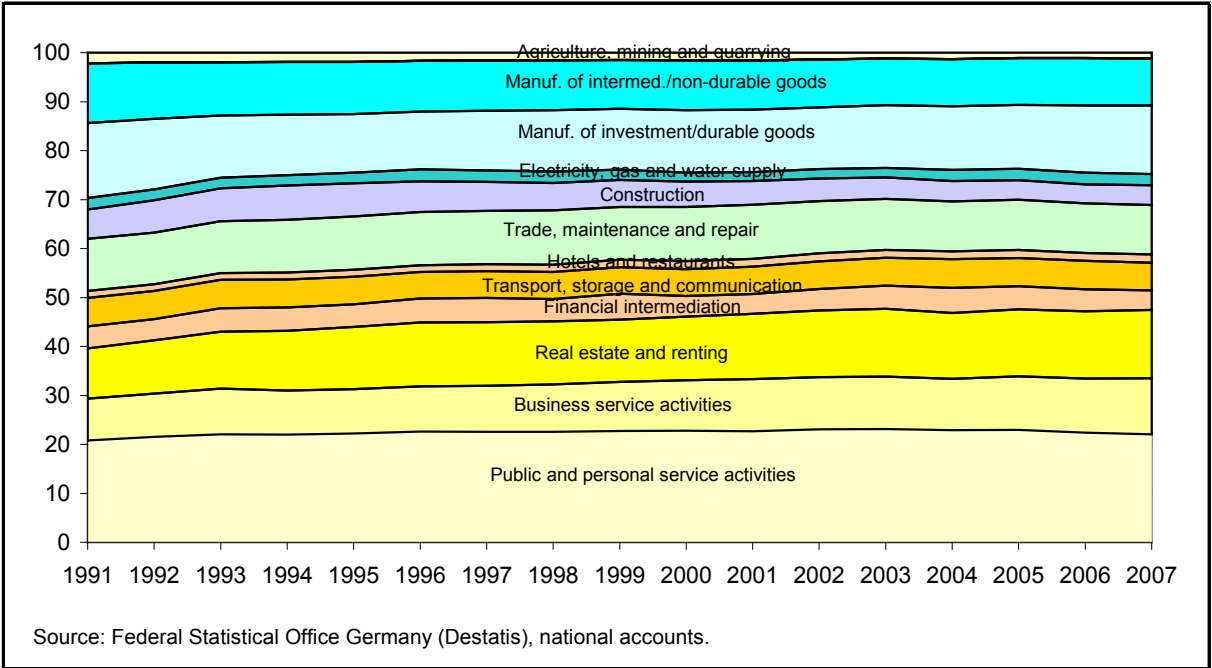
	1995	1998	2001	2004
Running losses ¹⁾ as % of running profits ²⁾				
Agriculture, forestry and fishing	24	11	16	11
Mining and quarrying	7	18	12	11
Manuf. of intermed./non-durable goods	24	16	27	19
Manuf. of investment/durable goods	27	19	24	18
Electricity, gas and water supply	40	61	142	60
Construction	31	29	38	28
Trade, maintenance and repair	28	21	30	14
Hotels and restaurants	85	64	48	49
Transport, storage and communication	103	51	160	94
Financial intermediation	108	16	21	47
Real estate and renting	273	99	75	47
Business service activities	28	32	51	23
Public and personal service activities	36	37	35	29
Total	64	39	45	29
<i>For information:</i>				
Structure of running profits ¹⁾ in %				
Agriculture, forestry and fishing	1.1	1.5	1.8	1.5
Mining and quarrying	1.8	0.8	1.0	0.7
Manuf. of intermed./non-durable goods	18.5	16.0	14.3	12.7
Manuf. of investment/durable goods	12.1	11.5	13.3	10.0
Electricity, gas and water supply	1.8	1.4	1.0	1.5
Construction	5.0	3.7	2.8	2.4
Trade, maintenance and repair	17.2	16.3	15.0	14.6
Hotels and restaurants	1.1	0.9	0.9	0.7
Transport, storage and communication	3.0	4.5	2.4	3.3
Financial intermediation	0.9	1.6	3.2	1.8
Real estate and renting	13.1	14.0	15.9	15.7
Business service activities	15.0	17.7	18.2	23.4
Public and personal service activities	9.5	10.0	10.3	11.6
Total	100.0	100.0	100.0	100.0
1) Adjusted gross income for taxpayers with negative adjusted gross income.- 2) Adjusted gross income for taxpayers with positive adjusted gross income. Sources: Federal Statistical Office Germany (Destatis); own calculations.				

Generally, it is hard to assess the underlying trends without using detailed information on the composition of the aggregate corporate income. As discussed in the following Section 3.2.4.2, there is no representative data available for Germany that allows a breakdown to the relevant components of financial accounting, in particular with respect to the operating result, to the financial result, to extraordinary effects like capital gains and losses, and to tax allowances.

Thus, it is hard to isolate what the impact of the business cycle is, and what effects might have had asset revaluation, tax reforms, or tax base erosion phenomena.

A brief look at the structural change of the industrial composition in Germany since 1991, measured by the gross value added from national accounts, might give some further clues to the backgrounds of the trends in tax base erosion (Figure 3.2-7). Since 1991, the shares of manufacturing and trade decreased. These are sectors with lower ratios of tax losses over income. Under the stronger loss-making industries, the construction sector lost importance. Rising shares can be observed for the real estate industry, the business related services, and the personal service activities. In particular, real estate activities are often running high tax losses.

Figure 3.2-7 Gross value added at current prices by industrial composition, 1991-2007 structure in percent



3.2.4.2 Insufficient Data from Financial Accounting

In order to look behind the aggregate trends of corporate tax base erosion and tax losses observed above, it suggested itself to scrutinize the firms’ income determination components based on reliable data sets. First, one should analyze the operating result of the corporate sector, i.e., the result from ordinary activities less the financial result. Broadly speaking, this figure represents the firms’ surplus from “real economic” activities, before taking into account financial transactions. Therefore, it is good comparable with the net operating surplus measured in national accounts (ESA 95 Code: b.2n). Second, the financial result as well as the

balance sheet information on capital gives an impression on the financing activities, including write-downs of financial assets. These data should be separated by transactions with affiliated companies, and others. Third, the extraordinary result encompasses capital gains and losses from sales of assets, from mergers, restructurings and reorganizations, from extraordinary damages, and from other discontinued transactions. Generally, one should collect the underlying information as detailed as possible, in order to capture tax provisions that refer to single items, for instance, accelerated depreciation schemes for certain categories of assets, or provisions for certain issues.

As already mentioned in Section 3.2.3.4, there is no information system in Germany that includes sufficient detailed data from financial and tax accounting. The assessment of business taxes in Germany collects only those items from the firms' tax accounting, which are immediately necessary to determine the tax liability. It starts from the net income/net loss for the financial year before appropriation, which already includes all items from the ordinary and extraordinary result. In addition, only single items are queried in tax assessments, such as the additions and reductions for the calculation of the local business tax base, or the non-deductible expenses for the corporate income tax. Thus, the business tax statistics in Germany do not allow further investigation of the tax base erosion, in contrast to countries like the UK or the USA (for the latter, see Altshuler et al., 2008).

Published financial statements, in particular the income statements, are only available for larger incorporated firms, according to the provisions of German commercial law. Although these firms should comprise a large share of business taxation, it is hard to assess the representativeness of such data bases. Even larger firms, which are part of an affiliated group, are not obliged to publish a financial statement, and often don't do so. Moreover, firms are only committed to disclose the main components of the balance sheet and the income statements. Therefore, results available from the DAFNE data base provided by the Bureau van Dijk, the Hoppenstedt data base, or the statistics of financial statements of the Deutsche Bundesbank (2006) do not give sufficient detailed information and should be treated with caution with respect to representativity. Furthermore, financial accounting data does not include specific adjustments for tax purposes, especially with respect to asset valuation or allocation of provisions.

Nevertheless, such information should be used in order to shed more light on the issues discussed here. It is quite likely that the opportunities to create hidden reserves (e.g., by the lowest value and the recognition-of-loss principle, or by accelerated depreciation schemes) in combination with tax-preferred treatment of capital gains could explain a considerable part of

the tax base erosion. Thus, even rough information could give some impression on the driving forces behind.

3.2.4.3 Tax Avoidance Strategies of Multinational Firms

When we published a first study on tax revenue and corporate income in January 2007 (Bach and Dwenger, 2007),, which comprised a preliminary version of the approach presented in Section 3.2.3, the results caused some stir. Against the background of the public and parliamentary debates on the business tax reform of 2008, the observed gap between the macroeconomic corporate income and the taxable income was widely discussed in the context of international tax avoidance, although our research gave no specific hints to these implications.⁵⁹

Actually, there is rising anecdotal and some empirical evidence that the advance in economic internationalization increasingly enables profit shifting at the expense of German tax revenue (see, e.g., Wamser and Overesch, 2007, Weichenrieder, 2009, Buettner and Wamser, 2009). This is plausible in light of the high statutory tax rates in international comparison,, which were applied in Germany up to the recent past. Specifically, multinational firms might utilize strategies in the field of transfer pricing, thin capitalization, allocation of royalties, or the location of business “functions” such as R&D, marketing, distribution, patents, and software. However, these issues can explain parts of the tax base erosion, measured above as difference between macroeconomic corporate income and taxable income, only insofar as the macroeconomic income figures are not impaired in the same way. For instance, transfer pricing strategies of firms should reduce the valuations of transactions or stocks in both tax accounting and internal financial accounting. As business surveys used for national accounts rely on the latter data sources, macroeconomic business income aggregates should also be underestimated. Only insofar as national accounts statistics consistently integrate all the available data sources under the constraint of the accounting identities of the economic circuit, they might disclose such income components escaping taxation. However, as pointed out above (Section 3.2.3.4), such residual estimates might be flawed by all other estimation errors.

⁵⁹ Our results have been explicitly quoted in the statement of the bill introduced by the then “great coalition” parliamentary fractions as evidence on the presumable tax base erosion in Germany, which calls for a cut in tax rates and broadening the tax base, see Deutscher Bundestag (2007: 29). See also Heckemeyer and Spengel (2008), and Jonas (2009).

In any case, since detailed micro data from the firms' tax or financial accounting are not available for Germany, it is hard to assess the specific impact of international tax avoidance on German tax base erosion. The following paragraphs seek to assess some potential impact from selected issues of international tax avoidance.

A rough estimation on the potential revenue effect of transfer pricing in the case of goods and services traded internationally is given in Table 3.2-7 (see also the similar approaches of Schaumburg, 2006, and Jonas, 2009). Using the national accounts statistics, we calculate the foreign trade volume of Germany by adding up exports and imports. Yet there is no empirical evidence on the extent of intra-firm trade for Germany. According to data from other western OECD countries, the shares of intra-firm trade of affiliates under foreign seem to be rather high (OECD, 2005: 181, Dunning and Lundan, 2008: 482). In order to illustrate the potential impact on tax base and tax revenue, we simply assume a 30 percent share of intra-firm trade based on the entire foreign trade volume. Moreover, we suggest an average level of price adjustments by 3 percent, and an average business tax rate of 30 percent for Germany.

Table 3.2-7 Estimation of the potential fiscal impact of transfer pricing based on exports, imports, and foreign trade volume of goods and services from national accounts, 1992-2008

	1992	1995	1998	2001	2004	2007	2008
Foreign trade volume	billion Euro						
<i>Exports</i>							
Exports of goods and services (fob)	379.7	428.7	546.5	716.0	828.4	1 116.2	1 155.2
Imports of goods and services (cif)	370.8	395.7	493.9	643.2	684.6	912.1	964.7
Total	750.5	824.4	1 040.4	1 359.2	1 513.0	2 028.2	2 119.9
Foreign trade volume	as percent of GDP						
Exports of goods and services (fob)	23.1	23.2	27.8	33.9	37.5	46.0	46.3
Imports of goods and services (cif)	22.5	21.4	25.1	30.4	31.0	37.6	38.7
Total	45.6	44.6	52.9	64.3	68.4	83.5	84.9
Potential revenue impact of transfer pricing	billion Euro						
Assumption: Share of intra-firm trade 30.0%	225.1	247.3	312.1	407.8	453.9	608.5	636.0
Assumption: Price adjustments 3.0%	6.8	7.4	9.4	12.2	13.6	18.3	19.1
Impact on domestic business tax revenue with a average tax rate of 30.0%	2.0	2.2	2.8	3.7	4.1	5.5	5.7
Source: Federal Statistical Office Germany (Destatis), national accounts; own estimations.							

Beside the ad-hoc assumptions on the share of intra-firm trade and the extend of price adjustments, the rapidly increasing foreign trade volume since the mid-nineties underlines the rising impact of the internationalization for the German economy. From 1995 to 2008, the ratio of foreign trade volume over GDP nearly doubles. The potential for transfer pricing should have increased correspondingly. Together with the presumably high and rising share of intra-firm trade, this might suggest some relevance for tax base erosion and tax revenue. However,

transfer pricing regulations have been restricted step by step over the last decade, in particular by the introduction of statutory documentation regulations as of 2003. Finally, further conclusions on the precise quantities involved are hard to draw due to the lack of detailed data.

Information on income streams and capital stocks involved with direct investment is provided by the balance of payments statistics of the Deutsche Bundesbank (2009a).⁶⁰ The main figures on the income from direct investment are illustrated in Table 3.2-8, both for outbound investments (i.e., investments of residents abroad) and for inbound investments (i.e., investments of foreigners in Germany). The information mainly stems from the foreign direct investment stock statistics of the Deutsche Bundesbank (2009b), which is based on mandatory reports by enterprises and individuals on their direct investments abroad or in Germany.⁶¹

The statistics mainly confirm what one would expect with respect to the incentives of business taxation. For German outbound investment, debt financing plays a minor role, as shown by the low share of interest income on shareholder loans. The reported profit income markedly increased over the last decade. In particular, the retention of profits from investments abroad rose strongly over the last years, whereas in the first half of the last decade foreign reserves have been withdrawn on average. In contrast, foreign direct investments in Germany are much more leveraged by shareholder loans, as the figures on interest income in relation to profits suggest. The reinvestment of earnings also does not play an important role.

These results are in line with the common notion that debt finance was rather attractive in Germany. Interest expenses are basically deductible from the income tax base and only partly

⁶⁰ According to the definition of the Deutsche Bundesbank (2009: 18), direct investment are financial operations with German and foreign enterprises in which the investor directly holds 10 percent or more of the shares or voting rights (up to end-1989 25 percent or more, from 1990 to end-1998 more than 20 percent); including branches and permanent establishments. Up to end-1995 direct investments comprise capital shares, including reserves, profits and losses carried forward, and long-term loans. Direct investments also include all investments in real property.

⁶¹ According to the applicable German foreign trade and payments regulation, reports are required to be submitted

(1) for *German foreign direct investment* by German enterprises and households which, on the reporting date, have direct (primary) holdings of 10 percent or more, or direct and indirect (secondary) holdings totaling more than 50 percent of the capital shares or voting rights in an enterprise abroad which has a balance sheet total of more than (the equivalent of) Euro 3 million. Reports are also required of German enterprises that maintain branch offices or permanent establishments abroad with operating assets in excess of Euro 3 million.

(2) for *foreign direct investment in Germany* by every German enterprise with a balance sheet total of more than Euro 3 million in which a non-resident (or several economically linked non-residents) holds 10 percent or more of the shares or voting rights in the German enterprise on the balance sheet date. Reports are also required of non-residents' branch offices or permanent establishments in Germany with operating assets in excess of Euro 3 million.

liable to the local business tax (25 percent, 50 percent until 2007). Regarding the high statutory tax rates up to the recent past, it was attractive to finance home investment by debts from abroad up to the limits of thin capitalization rules. The latter have been strengthened step by step, in particular with the introduction of the interest limitation (“Zinsschranke”) as of 2008.

Table 3.2-8 Income from direct investment, interest on shareholder loans
bill. Euro

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
German direct investment abroad (outbound)										
Income from equity (excl. leasing and rents on land)	10.5	12.2	0.7	5.0	11.7	36.4	43.4	58.0	60.6	53.6
Dividends and other distributed profits	8.8	17.4	19.0	18.3	15.7	17.6	22.8	25.2	23.9	26.0
Undistributed (reinvested) earnings	1.7	- 5.2	- 19.8	- 13.3	- 4.0	18.8	20.6	32.9	36.7	27.6
Interest on shareholder loans	2.8	5.2	3.9	2.4	1.6	2.2	2.8	3.8	5.8	7.1
Foreign direct investment in Germany (inbound)										
Income from equity (excl. leasing and rents on land)	4.8	3.3	- 9.6	5.7	8.6	9.3	19.4	18.8	23.6	22.2
Dividends and other distributed profits	10.6	10.2	11.6	12.7	11.9	13.3	16.1	18.7	23.9	17.8
Undistributed (reinvested) earnings	- 5.8	- 6.9	- 21.3	- 7.0	- 3.3	- 4.1	3.3	0.1	- 0.3	4.3
Interest on shareholder loans	4.4	10.8	14.4	14.7	14.0	11.9	12.0	13.9	16.4	16.7
Source: Deutsche Bundesbank, balance of payments statistics.										

Due to the former full imputation system of the corporate income tax, there were incentives for multinationals to primarily distribute domestic corporate income, as the tax rates on distributed income were much lower compared to the tax rates on retained income. The dividend distributions of foreign subsidiaries were often used for internal financing. They were exempted from domestic taxation in most cases according to Germany’s double taxation provisions, but only as long as they were not passed to domestic shareholders. This was regarded as a certain break against aggressive profit shifting to abroad, but ended with the transition to the classical system of corporate income taxation. The markedly increase of retained profits from direct investment abroad might be influenced by these implications of taxation.

In order to shed more light on the tax incentives for cross-border finance one should analyze the data in depth. Unlike the general data limitations on financial and tax accounting data, the foreign direct investment stock statistics of the Bundesbank is accessible to scientific research, even on the level of the micro data. Studies show an impact of tax rates and thin capitalization regulations on finance decisions of the firms (see Ramb and Weichenrieder, 2004, Wamser and Overesch, 2007, Buettner et al., 2008, Weichenrieder and Windischbauer, 2008, Weichenrieder and Ruf, 2009, Weichenrieder, 2009, Buettner and Wamser, 2009).

The balance of payments statistics also accounts the cross-border receipts and expenditure for patents and licenses (Table 3.2-9). Royalties for the use of such property rights are often deemed as vehicle for profit shifting, as it is rather reasonable to transfer them to foreign loca-

tions. International tax law usually allocates the right to tax to the owner’s country of residence,, which is also applied by Germany in most cases. The figures of Table 3.2-9 indicate only a slight net outflow of royalty income in Germany if one balances receipts and expenditure. Changing double taxation provisions in favor of the country where the property rights are used would insofar not raise much tax revenue in Germany. This does not imply that there is no such profit shifting, however. Given the strongholds in technological capabilities of many German firms, in particular in the manufacturing industries and some business related service sectors, one might expect that there is a net inflow of royalty income in Germany.

Table 3.2-9 Cross-border receipts and expenditure for patents and licenses¹⁾
bill. Euro

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Receipts	2.9	3.2	3.7	4.1	4.0	4.4	5.7	5.5	5.8	6.0
Expenditure	4.8	6.2	6.1	5.6	4.7	4.7	6.9	7.4	8.0	8.2
Balance	- 1.9	- 3.0	- 2.4	- 1.5	- 0.7	- 0.3	- 1.2	- 1.9	- 2.2	- 2.1

1) Industrial and other property rights.
Source: Deutsche Bundesbank, balance of payments statistics.

To sum up, international tax avoidance might be a reason of rising importance for tax base erosion over the last decades. Due to the lack of reliable data from tax or financial accounting it is hard to draw precise conclusions on the quantities involved. The figures derived from the foreign trade and payments statistics presented in this section suggest that profit shifting to abroad might easily sum up to a couple of Euro 10 billion. However, there is no evidence that international tax avoidance largely causes the observed gap between macroeconomic corporate income and the corporate tax base of Euro 100 billion and more.

3.2.4.4 Tax Avoidance of SMEs and Impact of Tax Enforcement

Small and medium-sized enterprises (SMEs) typically do not benefit so much from the prospects of tax avoidance in the course of internationalization. However, as their own tax haven, they could try to set off private consumption expenditures against tax liability. The regulations of separating business expenses from private expenses are rather intricate and hard to retrace in practice, thus inviting to manipulations. In particular, this refers to cars and vans available for private use, traveling and subsistence expenses, entertaining expenses, remunerations and withdrawals in non-cash form, and beneficial employment contracts, loan arrangements or other transactions with spouses, relatives, partners, shareholders, or other related parties. All in all, considerable amounts might be involved here. For instance, there are 5 mil-

lion company cars registered in Germany, of which 3 million are available for private use. Similar to the issues of transfer pricing and thin capitalization discussed in the preceding section, there might be some leeway to manipulate the respective business transactions for tax saving. However, it is hard to quantify the impact of these issues to the corporate tax base due to the lack of reliable data.

In the case of firms liable to the corporate income tax, the contractual compensation of managers is deductible from the tax base even if the managers are shareholders of the firm, which is often the case for SMEs. The compensation of owner-managers is taxed as wage income by the personal income tax, as far it is deemed as appropriate. Since the payroll information collected in business surveys and national accounts also include these compensations, insofar the corporate income in national accounts should not diverge from the corporations' taxable income.⁶²

Another relevant issue in this field could be lax tax enforcement. There are rising complaints that fiscal authorities in Germany increasingly fail to effectively enforce the tax law due to shortage of staff and organizational deficits (Bundesrechnungshof, 2006). This is particular true with respect to the complex tax law and assessment procedures in the field of business taxation. In this context, disincentives of the German fiscal federalism might also play a significant role. In Germany, the administration of direct taxes is the matter of the single state governments ("Länder"), although the larger part of the tax revenue is transferred to the federal state and the municipalities. Together with highly redistributive fiscal equalization schemes this generates clear disincentives for the state governments to fully utilize the tax base (Plachta, 2008: 80).

Similar to the impact of tax avoidance strategies of multinational firms discussed above, the issues discussed here could only insofar contribute to explain the measured gap between taxable corporate income and macroeconomic corporate income as the latter is not impaired in the same way. In the case of manipulated business expenses mentioned above, national accounts might factor these items into private consumption, which would correspondingly increase macroeconomic corporate income. In other cases, for instance with hidden private use of

⁶² Actually, the aggregate wage income of national accounts exceeds the wage income reported in the personal income tax statistics by 5 percent in 2004 (in this year the income tax statistics includes the employers' wage-tax returns of taxpayers that do not file an own income tax return). This difference can be well explained by tax-free or lump-sum taxed wages of short-time employment, draftees, etc., which are not registered individually by the tax authorities.

company cars, the business surveys and thus the national accounts might be blurred as well, since the respective numbers are drawn from the firms' bookkeeping.

3.2.4.5 Decreasing Effective Tax Rates Due to the Decline in Inflation

Thanks to the Bundesbank's notorious monetary policy of providing a stable currency, the inflation rates in Germany have been significantly lower compared to other OECD countries over the last decades (Table 3.2-10). Moreover, as in most other countries, inflation rates markedly declined since the seventies, according to the changes in monetary and macroeconomic policy. With respect to the issues of business taxation discussed here, the relevant implication is that lower inflation rates increase the real value of capital allowances, and reduce the taxation of mere "paper profits" from inflation, respectively. Notably, German tax law consequently applies the "nominal value principle". There are no adjustments for inflation, neither for depreciation allowances, nor for the valuation of other assets, provisions, capital gains, or loss-carryforwards.

Table 3.2-10 Price indices in international comparison, 1971-2007
yearly average changes in percent

	1971- 1975	1976- 1980	1981- 1985	1986- 1990	1991- 1995	1996- 2000	2001- 2005	2006- 2007
Price indices national accounts								
Gross domestic product								
Germany	6.3	3.9	3.1	2.4	3.2	0.2	1.1	1.2
OECD Europe	8.2	8.1	6.7	4.2	3.3	2.2	3.5	3.1
OECD Total	8.3	7.2	5.2	3.4	2.5	1.6	2.3	2.5
<i>Difference Germany-OECD Total</i>	- 2.0	- 3.2	- 2.1	- 0.9	0.7	- 1.4	- 1.2	- 1.4
Actual individual consumption								
Germany	6.8	4.2	3.6	1.7	2.8	0.6	1.4	1.3
OECD Europe	8.7	8.2	7.1	3.8	3.7	2.3	3.5	3.1
OECD Total	8.5	7.7	5.5	3.5	2.8	2.0	2.4	2.5
<i>Difference Germany-OECD Total</i>	- 1.6	- 3.4	- 1.9	- 1.7	0.0	- 1.3	- 1.0	- 1.2
Consumer price index, all items								
Germany	6.1	4.0	3.9	1.4	3.6	1.3	1.5	1.9
OECD Europe	10.0	12.7	10.3	6.6	8.3	6.6	3.6	2.6
Major Seven	8.3	9.2	6.1	3.4	3.0	1.9	1.9	2.3
OECD Total	9.0	11.0	9.6	7.5	5.5	4.5	2.8	2.6
<i>Difference Germany-OECD Total</i>	- 2.9	- 7.0	- 5.7	- 6.2	- 1.9	- 3.2	- 1.2	- 0.6
Sources: OECD, National Accounts Statistics, Main Economic Indicators; own calculations.								

While the average inflation rates in Germany ranged between 2.5 to 3.5 percent up to the mid-nineties, measured by the GDP deflator, they decreased to less than 1.5 percent over the last decade. Even if we take into account some downward distortion due to the macroeconomic stagnation of the years 2001-2005, Germany's inflation rates decreased by at least 1 percent-

age point compared to the level of the eighties and the first half of the nineties, and much stronger compared to the seventies. In relation to the OECD average inflation rate, the inflation rates in Germany have been lower by 1 to 1.5 percent over the last decade, measured by the GDP deflator or the consumption deflator of national accounts. In the seventies and early eighties, the difference was much higher.

Neither the retrenchment in inflation over time nor the backlog in inflation compared to other countries might explain the level of tax base erosion in Germany discussed in the previous sections. However, this could explain, *ceteris paribus*, a significant decrease in real tax base and effective tax rates over time or compared to other countries. For a rough estimation of the effects involved, we simply rely on the corporations' net fixed capital stock at current purchasers' prices (i.e., at replacements cost) from German national accounts. This figure amounts to Euro 2,400 billion in 2004. That means, a decrease in the inflation rate by 1 percentage point would decrease the taxation of "paper profits" by Euro 24 billion per year,, which equates to more than 1 percent of GDP, or 7.4 percent of the modified corporate income calculated above (see Section 3.2.3.2, Table 3.2-3). The effective tax rate for 2004 (see Table 3.2-3) would decrease by 1.3 percentage points.

3.2.5 Summary and Conclusions

Business income in Germany has been taxed at relative high statutory tax rates up to the recent past. Measures of effective tax rates, derived from simulation models following the approaches of King and Fullerton (1984) and Devereux and Griffith (1999, 2003), also indicate rather high levels of business taxation in Germany compared to other countries. At the same time, there was a rising presumption in tax policy that business taxation revenue lags behind economic performance and business income growth. Tax expenditures, European and international tax competition, and the effects of tax reform seem to impair business tax revenue. However, there is scarce empirical evidence on the economic issues involved.

For the first time for Germany we present comprehensive measures of the entire business taxation revenue and the tax base accrued in single tax years. We use representative data from the business tax statistics which collect the relevant information from the tax returns. Estimations for the recent past are made by using microsimulation models that capture the main macroeconomic trends and changes in tax law. For the personal income tax we estimate the portion of the tax liability falling on business income. Using representative micro data from the income tax statistics we allocate the individual tax liability according to the share of business income in total income.

We compare the tax revenue and tax base reported in the business tax statistics with the macroeconomic income aggregates measured in the national accounts statistics. Based on a similar concept of the European Commission (2009), we derive a corporate income aggregate that approximates the actual taxable income as close as possible. Dividing the tax revenue by the macroeconomic corporate income aggregate, we calculate macroeconomic implicit tax rates on corporate income.

We find that the implicit tax rates on corporate income falling considerably short of statutory tax rates, as well as of effective tax rates discussed in the literature. Our estimations suggest that the average implicit tax rate on German corporate income was around 20 percent since 2001. A detailed comparison of the corporate income measured in national accounts with the corporate tax base reported in the tax statistics reveals a considerable gap that amounts to 5 percent of GDP and more in 2004. With respect to the precise level of corporate tax base erosion in Germany these results should be treated with caution, due to some shortcomings of the entrepreneurial income aggregates of German national accounts. However, the high weight of losses reported in tax statistics emphasizes the presumptive tax base erosion. There are many firms running tax losses, the ratio of running losses over positive income is rather high. From 1992 to 2004, the stock of corporate income tax loss carryforwards increased by more than 400 percent to Euro 521 billion, which equates to 23.5 percent of GDP, or 4.7 times the positive adjusted gross income of that year. Real estate industry, hotels and restaurants, and business services show higher importance of corporate tax losses.

Due to the lack of reliable data from tax and financial accounting it is hard to give precise reasons for the presumptive tax base erosion and the high tax losses. International tax avoidance might be a cause, as anecdotal evidence and several empirical studies suggest. This is plausible in light of the high statutory tax rates in Germany and the advance in economic internationalization. However, cautious evidence from foreign trade and payments statistics suggest that this arguably explains only a minor part of the gap. Presumably, the opportunities to create hidden reserves, given by the income determination provisions in combination with tax-preferred treatment of capital gains, tax-saving strategies of small and medium-sized firms with respect to hidden private expenses, and lax tax enforcement could explain a considerable part of the tax base erosion. However, there is no information system in Germany that includes representative and sufficient detailed data from tax or financial accounting.

In order to shed more light on these implications, detailed accounting information should be collected from the firms' tax assessment. Currently, the tax assessment procedures in Germany collect only those items from tax accounting, which are immediately necessary to deter-

mine the tax liability. Therefore, it would be desirable that tax authorities electronically collect the main items of the firms' tax accounting, which could then be utilized for tax statistics (see Bach et al., 2008b, Luh, 1996). This is a standard practice in other countries and would, by the way, substantially improve the information base for a direct calculation of corporate income in national accounts.⁶³

⁶³ See, e.g., Office for National Statistics UK (2000: 100), Statistics Netherlands, National Accounts Department (2008: 210), Statistics Sweden (2008: 125), or U.S. Department of Commerce, Bureau of Economic Analysis (2009: 3-13).

4 Ecological Tax Reform

4.1 Introduction: Topics and Studies

From the beginning of the nineties, the idea of an “ecological tax reform” increasingly gained attention in the German public. On the one hand, the requirements of downsizing energy consumption and greenhouse gas emissions called for broad-based economic incentive instruments, such as environmental charges or eco taxes, respectively. On the other hand, taxes on energy or other broad-based use of resources harming the environment could raise considerable revenue for the treasury. Particularly the latter makes eco taxes rather attractive to policy makers. Ecological tax reform means that these funds are to be recycled to the economy via reducing existing taxes, instead of using them for financing environmental programs or other public expenditures. The overall tax burden would not be increased by such a “revenue-neutral” tax reform and somewhat shifted away from the conventional value-added and consumption items to environmentally unfriendly consumption: “tax bads, not goods”. Obviously, those taxes should be reduced that impair the economy. Both the environmental situation and the tax system might be improved, pledging a “double dividend”.

Yet in the early seventies, when environmental awareness grew and broader environmental protection programs were implemented in Germany, charges have been considered as economic instruments (Umweltgutachten, 1974). At that time they could not be established against the predominance of the conventional command-and-control regulations or agreements with polluters and industry associations. However, in terms of the effectiveness and efficiency of environmental policy there was a rising discontent with these instruments. This is in particular the case with respect to environmental goals that aim at mitigating long-term impacts of energy consumption and other uses of natural resources, in particular wastewater, waste accumulation, land consumption, and transportation. In these fields it is hard to optimize command-and-control regulations or voluntary agreements across the economy with respect to abatement and compliance costs, since there are many heterogeneous uses in production or consumption. Insofar, economic incentive instruments such as environmental charges or emission cap and trade schemes promise essential advantages as they use the market mechanism in order to achieve long-term goals in an effective and cost-efficient way.

The idea of taxing energy and unburden labor income at the same time already stood at the center when the term “ecological tax reform” was first introduced in the German discussion (Binswanger et al., 1978, 1983). A later attention-getting study proposed to replace the con-

ventional taxes by different kinds of environmental taxes (UPI, 1988). In particular, the requirements for reducing greenhouse gas emissions, agreed either nationally or under the European “burden sharing“ agreement,⁶⁴ focused the discussion on energy taxes. At the same time, structural unemployment further increase during the nineties and social security contribution rates rose significantly. Against this background and promoted by agenda setters (Weizsäcker 1989, 1992) and environmental lobbyists (Görres et al., 1994, FÖS, 1997, Krebs et al., 1998), the ecological tax reform became a top issue at the political agenda at the mid-nineties. Industry organizations, unions, environmental NGOs, and think-tanks took up the debate. Nearly all parties discussed the issue and were somewhat in favor of it. In theoretical economics, the prospects for a “double dividend” from such a tax reform were deliberated intensively (for an overview, see Bovenberg, 1999, Schöb, 2005). Policy-oriented scientists and research institutes carried out conceptual studies and empirical assessment analyses (for an overview, see Schlegelmilch, 2005, Beuermann and Santarius, 2006).

Although its merits have been widely recognized in the public debate, the drawbacks of the ecological tax reform were focused in the same way, strongly enforced by political lobbying. In particular, fears for the competitiveness of energy-intensive industries have been raised. Another topic was the increasing tax burden for low-income households that would not be compensated by lower taxes or social security benefits. It became clear very quickly that the reform could only be implemented if there were exemptions or special provisions in these fields. Actually, when the red-green government introduced the ecological tax reform since 1999, such reservations had been made. However, exemptions and special provisions infringe the environmental and economic motivation of the reform, in particular, if they reduce marginal tax rates. This conflict lasts up to the present days. Due to the rapid increase in energy prices and intense lobbying, ecological tax reform continued to be a momentous issue in the public debate (Schlegelmilch, 2005, Beuermann and Santarius, 2006).

⁶⁴ In 1990 the German federal government announced the national target of reducing CO₂ emissions in Germany to 25 percent below 1990 levels by 2005. This goal was failed. Following the 3rd Conference of Parties to the Framework Convention on Climate Change in December 1997 in Kyoto, Germany committed itself at international level and under the terms of the European burden-sharing agreement to reducing the emissions of six greenhouse gases (CO₂, CH₄, N₂O, PFC, HFC and SF₆) by 21 percent within the target period of 2008 to 2012.

Since its breakup in the early nineties, DIW Berlin attended the discussion on the ecological tax reform in Germany with several studies and comments.⁶⁵ In May 1994, we published a comprehensive concept and assessment study (Bach et al., 1995), which was highly influential to the public debate. A viable concept of an ecological tax reform was elaborated in detail and its macroeconomic and structural effects were estimated. According to the results, the reform would be feasible in legal and institutional terms. It would not have any significant adverse effect on inflation or economic growth. Moreover, it could considerably reduce both energy consumption and unemployment. However, the study also mentioned some energy-intensive industries, which might have faced a significant higher tax burden and negative employment effects. In a further study we discussed the scope of tax allowances that address the dangers for the competitiveness of energy-intensive industries (Bach et al., 1998). In a rather comprehensive study on behalf of the Federal Environment Agency (Umweltbundesamt) and together with FiFo Köln, we analyzed in depth the requirements for tax reform under both traditional tax and environmental policy goals (DIW Berlin and FiFo Köln, 1999).

In this chapter we present the main results of assessment studies we carried out on the effective implementation of the ecological tax reform in Germany since 1999. Together with other researchers, we ran a first systematic impact analysis on behalf of the German Federal Ministry of Finance (Bach et al., 2001, 2002, 2003). Update studies carried out in 2005 took into account the increased energy prices and examined the 2003 reform of special provisions for the goods and materials sectors (Kohlhaas, 2005a, Bach, 2005b, 2007, Kohlhaas and Bach, 2007). In a recent study yet unpublished, we analyzed the distributional effects of the reform, using representative micro data on income and consumption of households from 2003.

We start with a survey on the institutional framework of the German ecological tax reform in Germany 1999-2006 and present the main findings of the impact analyses on macroeconomic performance and structural change (Chapter 4.2). The reform's impact on the business sector and the effects of special provisions granted to agriculture and the goods and materials sectors are outlined in Chapter 4.3. Findings on the distributional effects for the household sector are presented in Chapter 4.4.

⁶⁵ For an overview, see http://www.diw.de/de/diw_02.c.101874.de/ueber_uns/forschungsabteilungen/staat/forschungsprojekte/forschungsprojekte.html?id=diw_02.c.299151.de

4.2 Ecological Tax Reform in Germany 1999-2003: Concept, Macroeconomic Impact and Incentives for Structural Change

Abstract: With the ecological tax reform in Germany of 1999-2003, energy taxes have been increased and public pension contributions were reduced. We carried out a first comprehensive, model-based impact analysis of this reform. An econometric input-output model and a dynamic computable general equilibrium model are applied. Both models show that Germany's ecological tax reform helps to reduce energy consumption and CO₂ emissions without having a substantial adverse effect on overall economic growth. It could have a slightly positive effect on employment. Exemptions and special provisions for energy-intensive industries widely reduce the incentives to a more pronounced structural change towards less energy-intensive production.

4.2.1 Tax Provisions, Fiscal Impact and Revenue Recycling

The ecological tax reform in Germany encompasses a step-by-step increase of existing energy taxes and the introduction of an electricity tax over the period 1999-2003 (Table 4.2-1).⁶⁶ This rise in tax rates is commonly apostrophized as “eco tax”. The rates on gasoline and diesel fuel have been increased in annual steps between 1999 and 2003 by both 3.07 Euro cent per liter and year, adding up to 15.35 ct within five years. The increase of 2.05 ct per liter light heating oil was executed in the first step only. Since 2000, the former different tax rates on heavy fuel oil for heat and power generation were unified to 1.79 ct per kg and this rate was further increased by 0.71 ct per kg in 2003. The tax on natural gas was raised by 0.164 ct per kilowatt hour (kWh) in 1999 and another 0.200 ct in 2003.⁶⁷ Furthermore, a tax on electricity of 1.02 ct per kWh was introduced 1999 and raised by 0.26 ct in the following four years, thus achieving the level of 2.05 ct per kWh on 2003.

Coal products remained completely untaxed until 2006 when the European Community framework for the taxation of energy products and electricity was to be finally implemented. Germany introduced a coal tax at the European minimum rate of 33 ct per gigajoule (GJ).

Figure 4.2-1 depicts the entire energy tax burden reached in 2003 and in 2006 respectively (coal), relative to the involved carbon dioxide (CO₂) emissions. The stacking bars show the portion of the ecological tax reform implemented by the red-green government since 1999 as well as the tax increase carried out by the precedent conservative-liberal government since

⁶⁶ On top of energy taxes, the value added tax (VAT) of 19 percent (16 until 2006) is levied, so that the total price increase will be larger than indicated by these tax rates.

⁶⁷ The energy tax on liquid gas has been increased by 1.278 ct per kg in 1999, in 2003 the tax rate was increased by a further 2.226 ct per kg.

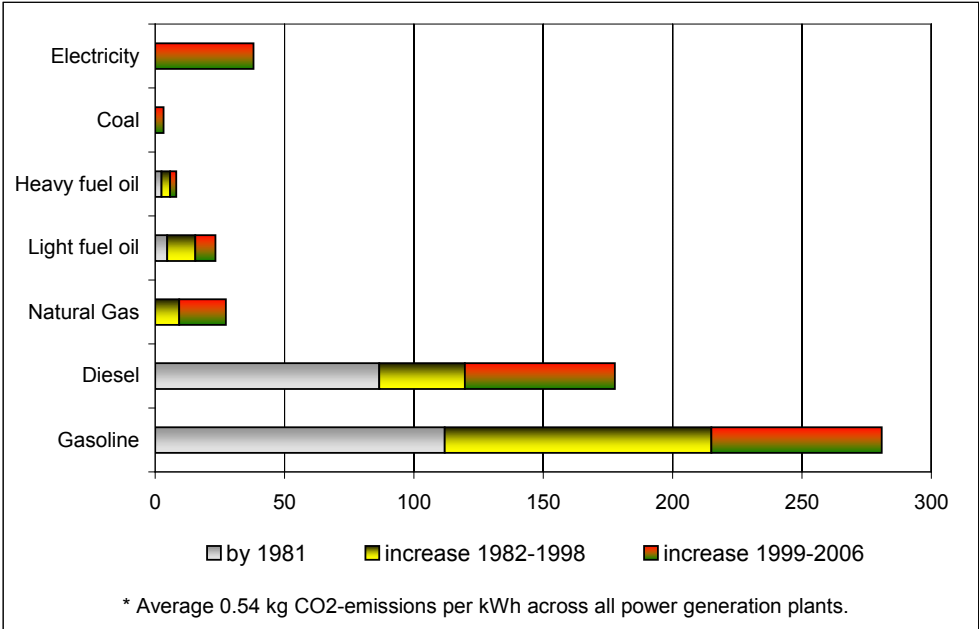
1982. Relative to energy content or CO₂ emissions both the overall energy taxation and the share of eco taxation are mainly born by motor fuels. The ecological tax reform also puts a significant tax burden on electricity. The other fuels are only moderately taxed. This differentiation in tax rates should meet the concerns of business community and households against heavy taxation of heating fuels and basic industrial process energy. With respect to the latter, several exemptions, reductions and special provisions have been introduced (see below).

Table 4.2-1 Changes in energy tax rates, 1999-2006

Energy source	Unit	Tax rate before April '99	Tax rate increase by the ecological tax reform			Energy tax reform 2006	Total increase 1999-2006 (cumulative)		
			1999	annually, 2000-03	2003		Cent/unit	Euro/GJ	Euro/tCO ₂
		Cent/unit	Cent/unit	Cent/unit	Cent/unit	Cent/unit	Cent/unit	Euro/GJ	Euro/tCO ₂
Motor fuels									
Gasoline	l	50.10	3.07	3.07	-	-	15.35	4.74	65.87
Diesel	l	31.69	3.07	3.07	-	-	15.35	4.29	57.97
Natural Gas (heating)	kWh	0.19	0.164	-	0.200	-	0.364	1.01	18.04
Light fuel oil (heating)	l	4.09	2.05	-	-	-	2.05	0.57	7.77
Heavy fuel oil (heating) ¹⁾	kg	1.79	-	-	0.71	-	0.71	0.18	2.31
Coal (heating)	GJ	-	-	-	-	33.00	33.00	0.33	3.24
Electricity ²⁾	kWh	-	1.02	0.26	-	-	2.05	5.69	37.96

1) As of 2000, uniform rate on heavy fuel oil.- 2) Average 0.54 kg CO₂-emissions per kWh across all power generation plants.

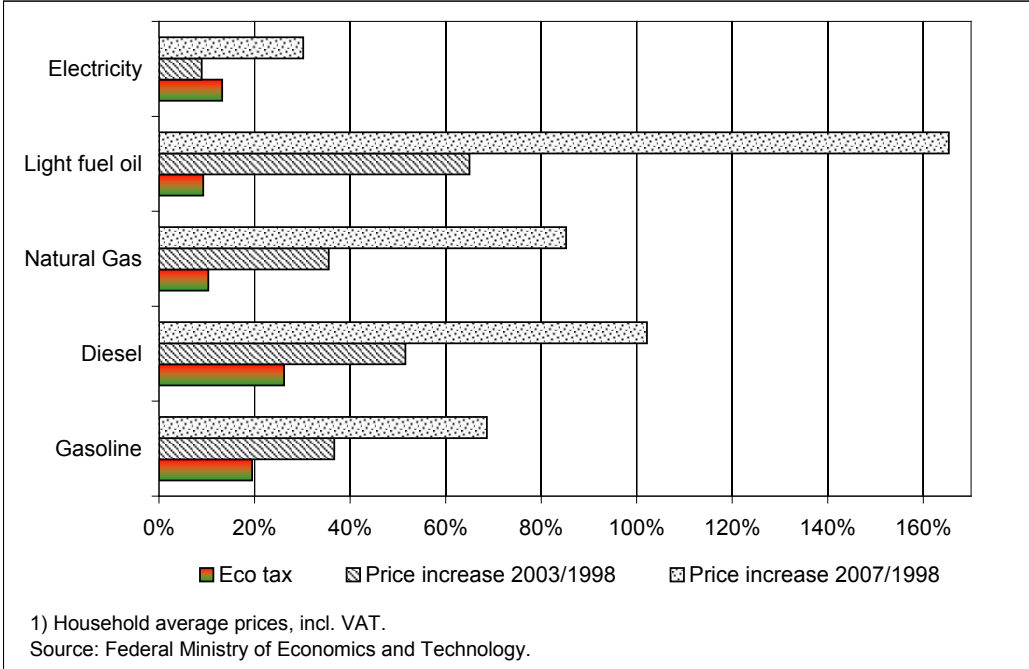
Figure 4.2-1 Energy tax rates, 2006
in Euro per ton CO₂



Actually, eco taxes only account for a minor part of the strong rise in energy prices since 1998 (Figure 4.2-2). For motor fuels, the eco tax burden makes up just half of the price increase by 2003 and only one quarter by 2007. The eco tax portion of gas and heating oil is rather low,

basically due to the much lower taxation level. Merely in the case of electricity the eco tax covers almost 50 percent of the price increase since 1998. By 2003, consumer prices for electricity even decreased due to the market liberalization in 1999.

Figure 4.2-2 Eco tax rates and increase of household energy prices¹⁾
as percent of energy prices 1998



Electricity generated from renewable energies is exempted from the electricity tax if the power is fed into a grid solely supplied with power from such energy sources. For contracting arrangements a corresponding exemption applies. In other cases, electricity generated from renewable energy sources is levied at the same rate as conventional power generation. For technical reasons, no exemption or tax relief is granted in these cases. However, a small part of the eco tax revenue is used for programs promoting renewable energies (see below, Table 4.2-2).

Several derogations were anchored in the ecological tax reform. The most important and contentious regulation is the broad reduction of eco taxes for the goods and materials sectors (i.e., manufacturing industry, energy/water, mining and quarrying, construction) and for agriculture, forestry and fishing in order to maintain competitiveness of these industries. These provisions have been reformed in 2003.

- A general tax reduction was introduced for the goods and materials sectors and for agriculture. The reduced tax rates amount to 20 percent of the regular tax rate until 2002, and 60 percent from 2003 onwards.

- Businesses in the goods and materials sectors benefit from an additional tax cap (“Spitzenausgleich“). Firms could apply for the refund of eco taxes that exceed the savings in public pension contributions associated with the ecological tax reform. Up to 2002, the tax burden exceeding the reduction of pension contributions by more than 20 percent was refunded. Since 2003, 95 percent of the entire excess tax is reimbursed.

Chapter 4.3 analyzes in detail the effects of these special provisions and the reform of 2003.

To prevent social hardship, electricity used to operate electric night storage heating was taxed at only 60 percent of the regular rate (50 percent until 2002), this rebate expired in 2006.

Taxable fuels used for electric power generation are exempted from the eco tax, i.e., the increased tax rates on fuels. Further provisions in the course of the ecological tax reform address environmentally-friendly and energy-saving technologies. The tax rate for the public railway transportation was reduced by 50 percent (38 percent since 2004). In addition, the local public transport system paid only half the rate of increase in fuel taxation (62 percent since 2004). Taxation of bio-fuel, natural gas and liquid gas used for transport purposes was strongly reduced compared to gasoline and diesel. Additional special provisions applied for efficient power stations with combined heat-power generation and for highly efficient gas-steam power stations. Existing exemptions from energy taxation have been retained unchanged, e.g., for non-energy use of fuels, specific combustion processes in production, for friction losses in energy conversion, and for fuels used for business aircraft and navigation.

The 2006 energy tax reform repealed the existing taxation of natural gas and fuels as input in electric power generation, according to the European Union’s Directive on energy taxation. The general eco tax reduction for the goods and materials sectors and agriculture to 60 percent of the regular rate has been enlarged to the entire energy tax, whereas the tax cap still applies to the eco tax portion only but is enlarged to agriculture businesses. Moreover, several enumerated energy-intensive production processes are completely exempted from energy taxation.⁶⁸ At the same time, the definition of the taxable “use as heating fuel” was enlarged according to the European regulations on energy taxation.

The additional revenue from the eco taxes has been recycled in the economy mainly by reducing the contributions to the public pension system (Table 4.2-2). In Germany, most of the

⁶⁸ These are several mineralogical processes such as manufacture of glass and glass products, ceramic goods, bricks, cement, lime, plaster, asphalt, fertilizer, electrolytic and metallurgical processes, processes of chemical reduction, dual use of energy products, thermal waste and exhaust treatment.

employees are obliged to insure in the public pension system. The contributions are raised proportionally to the payroll up to an earnings ceiling of roughly double the average wage (Euro 5.100 per month in 2003, West Germany), financed by employers and employees, both paying half of the contribution rate. The contribution rate was 20.3 percent in 1998. Together with the other public social security systems for unemployment and health care the overall contribution rate amounts to 42.0 percent of the payroll. This was considered to be an important impediment to create more employment in Germany, in particular for low paid jobs.

The additional revenue from the eco taxes is estimated at Euro 18.7 billion in 2003 (Table 4.2-2), which amounts to 0.9 percent of GDP. From these funds, Euro 16.1 billion (0.7 percent of GDP) were transferred to the statutory pension system. This allows a pension rate reduction by 1.7 percent compared to a situation without tax reform, thus relieving employers and employees liable to pension contributions. Besides, pensioners benefit from the ecological tax reform. According to the pension adjustment mechanism regulated by law, a reduction in pension contribution rates triggers a one year-delayed increase in pension income. Simulations show an effect of about 1.14 percent increase in pension income since 2003 compared to a reference scenario without the reform (Buslei, 2008). Further impacts on tax revenue and public budgets with respect to the economic effects of the tax reform are not taken into account in Table 4.2-2.

Table 4.2-2 Fiscal effects of the ecological tax reform, impact on public pension contribution rate and pension adjustment

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Revenue of eco taxes and use of funds from the federal budget in billion Euro									
Revenue of increased energy taxes	4,3	8,8	11,8	14,3	18,7	18,1	17,8	17,4	17,8	17,9
Binding use of funds, federal budget	4,6	8,5	11,4	13,9	16,6	16,5	16,4	16,1	16,2	16,0
Transfer to the public pension system	4,5	8,4	11,2	13,7	16,1	16,0	15,9	15,5	15,6	15,4
Transfer to basic pension schemes	-	-	-	-	0,4	0,4	0,4	0,4	0,4	0,4
Program renewable energy	0,1	0,1	0,2	0,2	0,1	0,1	0,1	0,2	0,2	0,2
Balance	-0,3	0,3	0,4	0,4	2,1	1,6	1,4	1,3	1,6	1,9
	Calculative reduction in public pension contribution rate ¹⁾ in percentage points									
Change in public pension contribution rate	-0,6	-1,0	-1,3	-1,5	-1,7	-1,7	-1,7	-1,7	-1,7	-1,7
	Calculative increase in pension value ¹⁾ in percent									
Change in pension adjustment	0,00	0,00	+0,62	+0,81	+1,14	+1,14	+1,14	+1,14	+1,14	+1,14
1) Own estimation. Assumed stability as of 2005. Sources: Federal Ministry of Finance, August 2006; own calculations.										

In the years following 2003, the eco tax revenue declined markedly. This results essentially from the strong increased fuel prices and from the relative rise in diesel fuel consumption.

Over the next years, a slight increase of eco tax revenue is expected since the tax exemption for bio fuels is reduced step-by-step.

4.2.2 Macroeconomic Impact and Incentives for Structural Change

In 2001, DIW Berlin in cooperation with other researchers carried out a first systematic impact analysis of the ecological tax reform in Germany realized since 1999 (Bach et al., 2001, 2002, 2003). The study was commissioned by the German Federal Ministry of Finance and addressed the applicable law since 2000, i.e., the entirely enacted step-by-step increase in tax rates up to 2003. With respect to the special provisions for the goods and materials sectors, the former regime has been considered. An update study of 2005 took into account the 2003 reform (Kohlhaas, 2005a, Bach, 2005b, 2007, Kohlhaas and Bach, 2007). The analysis focuses on the consequences for economic growth, the labor market, energy consumption and CO₂ emissions, and the effects on income distribution.

Models applied

The macro-sectoral effects are examined by applying two macro models for Germany, an econometric input-output model and a recursive-dynamic computable general equilibrium (CGE) model. The PANTA RHEI multi-sector econometric simulation and forecast model was provided by Bernd Meyer, GWS Osnabrück. It covers 58 industry branches in accordance with the national input-output system (Meyer and Ewerhart, 1998). The LEAN simulation model of Heinz Welsch, Oldenburg University, is a two-region empirical general equilibrium model for Germany and the rest of the European Union with a particular emphasis on the representation of the energy markets (Welsch and Hoster, 1995). Both models allow for “involuntary” unemployment and assume collective wage setting that mainly depends on macroeconomic productivity and inflation.

Macroeconometric models and CGE models span the range of methodological tools usually applied in empirical policy modeling. The main difference between these two general approaches is the emphasis placed on empirical tracking economic performance and theoretical micro foundation. Hence, they might diverge considerably in their results. The joint use of these approaches in this study reflects some effort to enhance the credibility of the analysis. A difference more specific to the two models actually used is that PANTA RHEI has substantial flexibility in the way in which cost changes influence supply prices, whereas LEAN transforms cost changes directly into supply price changes. As a result, the two models differ in their predictions concerning the structural changes induced by the environmental fiscal re-

form. The macroeconomic results, conversely, show a considerable similarity across the two models.

The two macro-sectoral models do not capture the personal income distribution. Because the distributive implications of the environmental fiscal reform were heavily debated most of the time, the study links the macroeconomic analysis to a micro-simulation analysis of the household sector. The then deployed Potsdam microsimulation model of Christhart Bork, Potsdam University, was based on detailed household data in order to determine the reform's effect on personal income distribution (Bork, 2000). This analysis was recently renewed and extended by DIW Berlin, using micro data from the Income and Consumption Survey of 2003, i.e., using data from that year when the step-by-step increase of tax rates was completed. Chapter 4.4 presents the latter study in detail.

The quantitative analysis was carried out by comparing a reference scenario, which describes the economy in the absence of the ecological tax reform, with the policy scenario of the tax reform. Key exogenous variables that shape the economic development in both scenarios are the world energy prices and the exchange rate. In our core simulations, the price for crude oil was kept fixed at 20 USD/bbl (*sic!*) and the USD/Euro exchange rate at 1.12. Some sensitivity analyses were made in order to check the robustness of the findings and to estimate the effect of different assumptions and analytical methods on the results, above all, with respect to energy prices. Up to the end of the nineties, energy and resources prices have been rather low for more than a decade. When we carried out the study in the years 2000/2001 the discussion was how long the then moderate price increase would last. At the same time, the US-Dollar was rather strong. As an alternative we used a scenario with "higher" energy prices (30 USD/bbl,) and a stronger Dollar (0.89 USD/Euro). This reflects the situation of the year 2000. In the following sections we report only the results of the latter scenario referring to the "higher" energy prices. An update study carried out in 2005 with LEAN took into account the much stronger increase in energy prices up to this year (Kohlhaas, 2005a, Kohlhaas and Bach, 2007). The prices of other energy sources have been estimated in relation to the crude oil price. Furthermore, different assumptions on wage-setting behavior have been simulated (see below).

In order to model the ecological tax reform it was necessary to determine the effective tax rates for the various industrial sectors. With respect to the differentiation of tax rates by energy source and sector of use, and the variety of exemptions and special provisions in the goods and materials sectors, a detailed group simulation modeling has been carried out by DIW Berlin in order to capture the most detailed available information on energy intensities and the

distribution of firm size by industries. This analysis has been renewed and enlarged in a further study (Bach, 2005b, 2007, Kohlhaas and Bach, 2007). The results are reported in detail in Chapter 4.3.

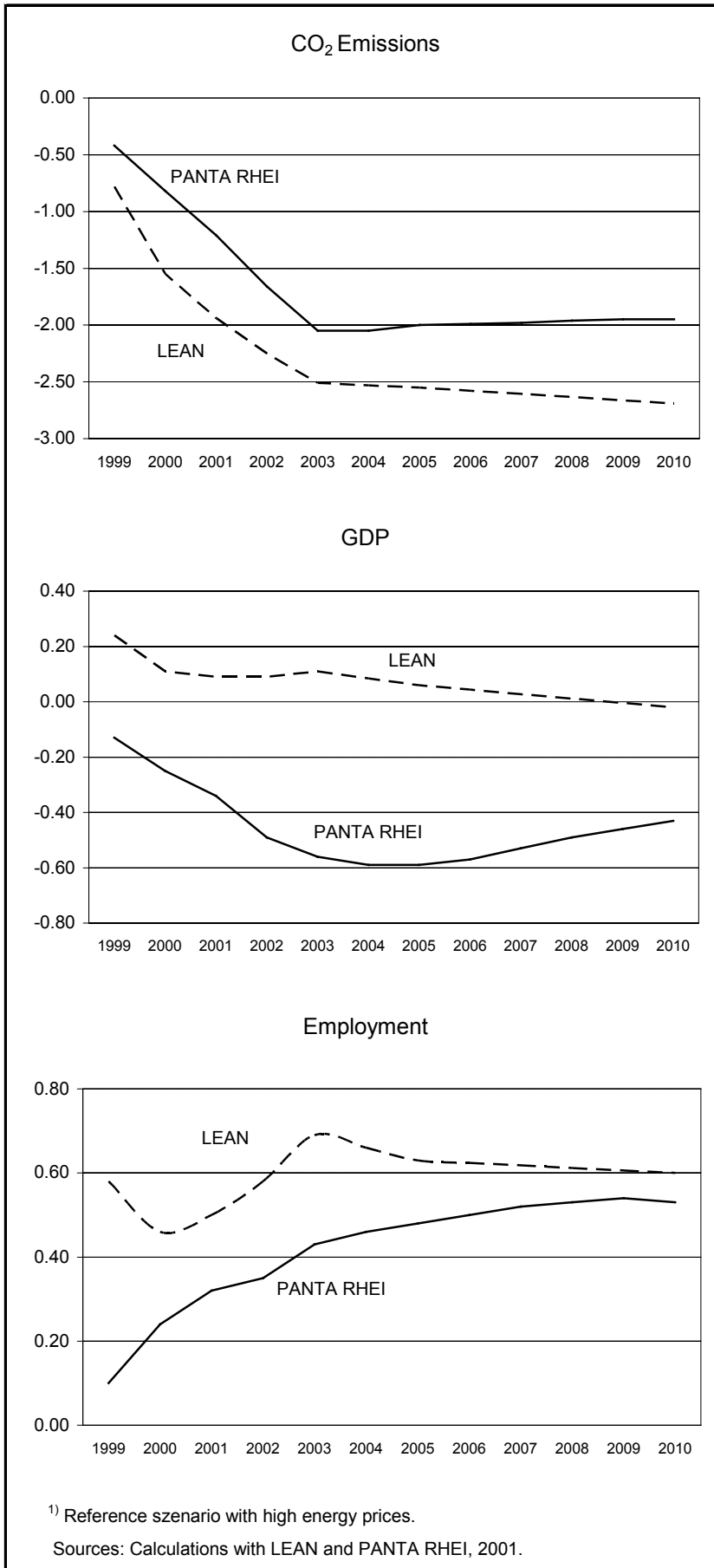
The binding use of funds from the ecological tax reform in favor of the public pension system has also been taken into account in calculating the effective tax rates. It was expected to have a significant influence on labor market, employment and the distribution and use of income. Modeling the first round effects, the reduction in pension contribution is split equally among employers and employees according to the legal regulations. This implies, *ceteris paribus*, lower labor costs for the former and higher disposable income for the latter. Pensioners also benefit from the reform by higher pensions.

Though the step-by-step introduction of the ecological tax reform ended in 2003, the macroeconomic simulations were extended until 2010. For the period 2004-2010 we assumed that the tax rates and social security contributions of 2003 continue to be valid. This is actually the case up to now. Further reforms implemented in the meantime, such as the reform of exemptions and special provisions in 2003 and the energy tax reform of 2006, involve only minor effects on the overall tax burden and thus are not expected to have a remarkable impact on macroeconomic performance. However, the strong increase in energy prices might have dampened energy consumption significantly. These effects were partly captured in an update study carried out in 2005 with LEAN (Kohlhaas, 2005a). The introduction of the European Union Emission Trading Scheme as of 2005 was neglected in the simulations. With the phasing-in trading period until 2008 and the economic crisis 2008-09 this scheme should have had only very little impact on the overall CO₂ emissions in Germany up to 2010.

Slight moderation in CO₂ emissions

The results of the 2001 simulation study show an initial reduction of German CO₂ emissions by 0.4-0.8 percent relative to the reference scenario (Figure 4.2-3). In the medium term the reduction amounts to 2.0-2.5 percent. This corresponds to around 20 million tons per year. However, the strongly increased energy prices might have reduced this effect in the meantime.

Figure 4.2-3 Macroeconomic effects of the ecological tax reform in Germany
 Difference from reference scenario¹⁾ in percent



Negligible impact on economic growth

With respect to GDP, the predicted initial change ranges from -0.2 to +0.2 percent, whereas the effect by 2010 is between -0.4 and zero percent (Figure 4.2-3). The initial increase in GDP predicted by LEAN is based on both demand and supply side effects. On the demand side, energy saving equipment and insulation measures are substituted for energy. In Germany, energy is imported to a considerable extent. This implies a shift in demand from imports to domestic output. On the supply side, the increase in domestic output is achieved by substituting labor for energy to a small extent. This rise in labor input more than offsets the negative output effect of reduced energy input in the pertinent industries. PANTA RHEI predicts somewhat stronger negative output effects over the first years, thus leading to a slight negative impact on economic growth.

Slight rise in employment

With respect to employment both models find a slight increase, more pronounced in LEAN than in PANTA RHEI (Figure 4.2-3). This mirrors the difference between the two models in terms of predicted effects on energy consumption and emissions. The source of both differences is the somewhat greater flexibility of LEAN with respect to energy-labor substitution. As it will become clear in the next paragraph, this is not so much related to differences in the production technologies within each sector. Rather, it reflects differences in the degree of induced structural change between industries, which differ in their labor/energy ratio. The predicted employment effects in the long run are between 0.5 and 0.6 percent. In absolute terms this implies that the environmental fiscal reform could lead to the creation of 200,000 additional jobs by 2010.

An important assumption shaping the results relates to the way in which wage formation is modeled. In our core simulations we assume that the induced increase in employment does not trigger higher wage claims. If, instead, it is assumed that unions or employees react to employment growth by increasing their wage demands, this could significantly dampen economic growth and neutralize the positive employment effects. At the same time, this would enhance the damping effect on energy consumption and CO₂ emissions.

This result highlights a common difficulty of empirically based policy modeling, namely that the way in which important markets, actors and interest groups respond to policy reform may be difficult to capture by statistical methods. On the other hand, it reveals the importance of social consensus for mitigating the adjustment process of broader fiscal reforms. The em-

ployment findings show that the ecological tax reform can ease the situation on the labor market. However, the overall effect on employment is rather marginal compared to the high structural unemployment in Germany, which in fact has increased remarkably during the macroeconomic stagnation of the years 2001-05.

Sectoral effects reveal differences in modeling price setting and factor substitution

Table 4.2-3 shows the reform's effects on output and employment in Germany by 2003, differentiated by broadly defined sectors of production. While PANTA RHEI predicts a decrease in output for all sectors, the simulations with LEAN indicate an increase in the construction and service sectors. However, also by PANTA RHEI the construction sector fares comparatively well in comparison with all other sectors. The reason for this is that industry benefits from increased demand for insulation measures, furthermore, it is relatively labor-intensive and hence benefits from reduced social security contributions. Another common and rather straightforward effect in both models is that the energy industries experience the biggest losses. However, the loss predicted by PANTA RHEI is larger than that predicted by LEAN. This is an immediate consequence of the fact that the simulated reduction in overall economic activity is larger in the former model than in the latter.

Table 4.2-3 Effects of the ecological tax reform in Germany by economic sectors, 2003
Difference from reference scenario¹⁾ in percent

Economic sector	PANTA RHEI		LEAN	
	Output	Employment	Output	Employment
Agriculture	- 1.13	+ 0.89	- 0.31	+ 0.12
Energy sector	- 2.36	- 0.50	- 1.89	- 1.43
Basic/chemical goods	- 0.31	+ 0.51	- 0.50	- 0.15
Investment goods	- 0.35	+ 0.39	- 0.34	+ 0.06
Consumer goods	- 0.59	+ 0.47	- 0.21	+ 0.20
Construction	- 0.08	+ 1.27	+ 0.31	+ 0.84
Transport	- 0.28	- 0.16	- 0.04	+ 0.63
Services	- 0.43	+ 0.49	+ 0.26	+ 1.28
Public services	- 0.92	+ 0.59	+ 0.25	+ 0.83

1) Scenario with high energy prices.
Sources: Calculations with LEAN and PANTA RHEI, 2001.

In addition to the difference in the average effect on output, the two models also differ with respect to their distribution across sectors. A case in point is the basic materials and chemicals industry, which according to LEAN shows the second largest reduction in output, whereas the PANTA RHEI model predicts a rather moderate output decline. The opposite pattern emerges

to the sector consumer goods, which experiences a relatively small decline according to LEAN and a larger decline by PANTA RHEI.

To understand these differences, one should note that the effects on the sectoral output are the result of two influences, of which one is treated differently in the two models. On the demand side, domestically oriented industries (such as consumer goods or services) benefit from higher available income due to lower social security contributions for employees and increased employment, whereas export-oriented industries (such as basic materials and chemicals) are lacking this income effect. This demand-side relationship is captured in both models. On the supply side, the basic materials and chemicals industry has a very high energy/labor ratio and therefore experiences a cost increase as a result of the change in relative factor costs arising from the ecological tax reform. The opposite applies to the construction and service sector. Other industries fall in between these extremes.

These cost changes have different implications for the two models. In the LEAN model they translate directly into price changes, because perfect competition is assumed. In PANTA RHEI, imperfect competition entails that producers in export-oriented industries have more flexibility in targeting their prices towards international price levels. This applies especially to basic materials and chemicals, implying that this industry succeeds in limiting its output decline in spite of increasing costs.

The overall result of these different modeling strategies concerning price setting behavior is that LEAN predicts more structural change in favor of the less energy-intensive, more labor-intensive, and more domestically oriented industries than PANTA RHEI. The greater intersectoral flexibility, in turn, explains why the LEAN model tends to produce more favorable GDP effects than the PANTA RHEI model.

In contrast to the effects on sectoral output, most sectoral employment effects are positive in PANTHA RHEI (except for the energy industries), because the substitution effect (labor for energy) dominates the output effect. In LEAN, in contrast, the output decline predicted for 'basic materials and chemicals' is so strong as to dominate the substitution effect, leading to a decrease in employment in this industry.

Thus, it can be concluded that the different approaches to pricing pursued in the two models imply different degrees of structural change. The LEAN model incorporates greater potential for structural change in favor of the less energy-intensive, more labor-intensive industries incorporated in the LEAN model compared to the PANTA RHEI model. This is the key to understanding why the former model predicts more CO₂ reduction, more favorable employ-

ment effects and less unfavorable GDP effects than the latter. However, as shown above, the differences with respect to these macro indicators are not very pronounced.

Update study 2005 found no significant different results

An update study carried out in 2005 with LEAN (Kohlhaas, 2005a, Kohlhaas and Bach, 2007) took into account the increased energy prices and the reformed special provisions for the goods and materials sectors. Moreover, more recent statistics on national accounts as well as energy consumption, production, and employment across industries have been used for calibration.

The results show a slightly lower reduction in CO₂ emissions by approximately 0.2 percentage points over the first years of the reform up to 2003. In the following years, the simulation shows a somewhat higher impact on CO₂ reduction compared to the former results. The reform of the special provisions for the goods and materials sectors, on the one hand, increase incentives to energy saving for many firms as the general tax reduction was lowered to 40 percent. On the other hand, the eligibility for the tax cap has been enlarged, thus strongly increasing the number of firms with such rebates. According to the simulation results, the former effect dominates the latter with respect to energy consumption and CO₂ emissions (see the detailed analysis in Chapter 4.3).

The differences with respect to the impact on economic growth and employment are rather low and might also be flawed to a minor extend by the data update. In any case, the growth effect of the reform might be somewhat higher compared to the initial simulation as the higher energy prices already carried out a greater reduction in energy consumption captured in the reference scenario. Thus, the impact of the reform is somewhat lower.

4.2.3 Summary and Conclusions

To sum up, the ecological tax reform in Germany injects the remarkable amount of about Euro 18 billion per year to the treasury since 2003, which makes up 0.9 percent of GDP. These funds are largely used for subsidizing the public pension system in order to reduce the contribution rate. In terms of government finance the ecological tax reform was a considerable success. There can be no talk of an erosion of the tax base, as it has been often feared in the general discussion during the nineties, with respect to the ecological effectiveness of the reform that will level down energy consumption. Our results show a rather slight impact on energy consumption and CO₂ emissions as well as on macroeconomic performance and structural change. Despite the differences between the two macro-sectoral modeling tools de-

ployed, both models show that Germany's ecological tax reform helps to reduce CO₂ emissions without having a substantial adverse effect on overall economic growth. It could have a slightly positive effect on employment via the reductions in pension contributions.

The effects on the sectoral structure of the economy are more ambiguous in terms of the environmental rationale of the reform. In general, it is to be expected that shifting the tax burden from labor to energy will induce structural change in favor of the less energy-intensive sectors. However, the German ecological tax reform contains a variety of exemptions and special provisions to the advantage of energy-intensive industries, which dilute this effect. Therefore, the structural change due to this reform may not be expected to be a tremendous one. These implications are discussed in detail in the following Chapter 4.3.

From a modeling point of view, the extent of induced structural change depends on the extent to which higher costs in energy-intensive industries are absorbed by lower profits, rather than leading to higher prices. This is the main point in which the two macro-sectoral models differ. In the LEAN model cost changes translate directly into price changes. In PANTA RHEI, producers in export-oriented industries have more flexibility in targeting their prices towards international price levels. This implies that in the latter model some of the energy-intensive, export-oriented industries can limit their output decline in spite of increasing costs. The overall result of these different modeling strategies is that PANTA RHEI predicts less structural change in favor of the less energy-intensive, more labor-intensive, and more domestically oriented industries than LEAN. The greater inter-sectoral flexibility implicit in the LEAN model also explains why this model tends to produce somewhat more favorable emission and employment effects and less unfavorable GDP effects than the PANTA RHEI model. However, the differences with respect to these macro indicators are not very pronounced.

Another question is how the massive increase in energy prices over the last years would affect the macroeconomic impact of the ecological tax reform. As the price increase of primary energy sources exceeds the price impact of the eco taxes to a considerable extent, the performance of energy consumption and CO₂ emissions might be lower than it has been expected some years ago. Hence, the ecological impact of the ecological tax reform might be smaller. The same might be true with respect to growth, employment, and structural change. In contrast to the oil shocks in the mid-seventies, the remarkable rise in energy prices over the last years did not harm so much the world economy nor did it downsize the recovery of the German economy 2006 to mid-2008. However, energy tax revenues declined. In particular the motor fuel taxes, which make up the lions share of revenue, decreased by 10 percent com-

pared to 2003. This implies less money for the government to spend for reducing other taxes or balancing the budget.

4.3 Impact on the Business Sector

Abstract: We analyze the first-round effective tax rates of the ecological tax reform by industries, using the most detailed information available on energy consumption, energy costs, labor costs and social security contributions for the year 2002. According to the simulations, the special provisions granted to agriculture and the goods and materials sectors avoid higher tax burdens on the energy-intensive production. However, they widely reduce the marginal tax rates and thus the incentives to energy saving. Though the reform of special provisions 2003 increased the overall tax burden of the energy-intensive industry, the enlarged eligibility for tax rebates neutralizes the ecologic incentives.

4.3.1 Introduction

In the update study 2005, we carried out a thorough analysis of the first-round effective tax burden of the ecological tax reform across industries. Moreover, we assessed the 2003 reform of special provisions granted to agriculture and the goods and materials sectors (Bach, 2005b, 2007, Kohlhaas, 2005a, Kohlhaas and Bach, 2007). We use the most detailed available information on energy consumption, energy costs, labor costs and social security contributions for the year 2002 in order to capture the different provisions. Former modeling strategies developed in our previous evaluation study (Bach et al., 2001) have been improved and enlarged. Using the CGE model LEAN (see Section 4.2.2, above), the effects on energy use, CO₂ emissions, economic growth, and employment were quantified.

There has been little evidence on the tax burdens and the effects of special provisions to energy-intensive industries. Hillebrand (1999) ran similar simulations for Germany on the first-round effects of the former regulations applied until 2002, without taking into account effects on energy consumption and emissions as well as on production output and employment. Simulation studies for other countries dealing with this issues (see, e.g., the survey of Andersen et al., 2001, on studies of the Scandinavian experiences, Böhringer and Rutherford, 2002 or Kouvaritakis et al., 2005) do not explicitly model the effects of special provisions within the industrial sectors nor discuss the impact of alternative regulations.

According to our simulation results, the revision of the special provisions did neither affect the economy nor the environment substantially. In particular, it did not contribute considerably to a reduction of CO₂ emissions. The increase of the marginal tax rates in combination with the cap on the tax burden has an ambiguous effect on total emissions.

4.3.2 The 2003 Reform of Special Provisions

In order to meet concerns about negative effects on the competitiveness of German industries, special provisions were made. Up to 2002, the following provisions were in force:

- The goods and materials sectors (i.e., manufacturing industry, energy/water, mining and quarrying, construction sector) and agriculture (including forestry and fishing) paid only 20 percent of the regular eco tax if their energy consumption except motor fuels exceeded a certain threshold of Euro 512.50 tax liability per enterprise per year, both for electricity and for heating fuels. Motor fuels were not rebated, they are taxed at the full rate in any case. Small enterprises with energy consumption below the threshold, the service sectors (wholesale and retail trade, private road transport, and service companies), public institutions, and households also pay the full tax rate on electricity and all fuels.
- Moreover, firms of the goods and materials sectors are eligible for an additional tax cap (“Spitzenausgleich“). Up to 2002, eco tax payments, which exceeded the savings in public pension contributions by more than 20 percent were refunded.

From the beginning of 2003, this system was revised:

- The reduced rates now amount to 60 percent rather than 20 percent of the eco tax.
- Only 95 percent of the tax payments exceeding the (simple) savings of pension contributions will be refunded.

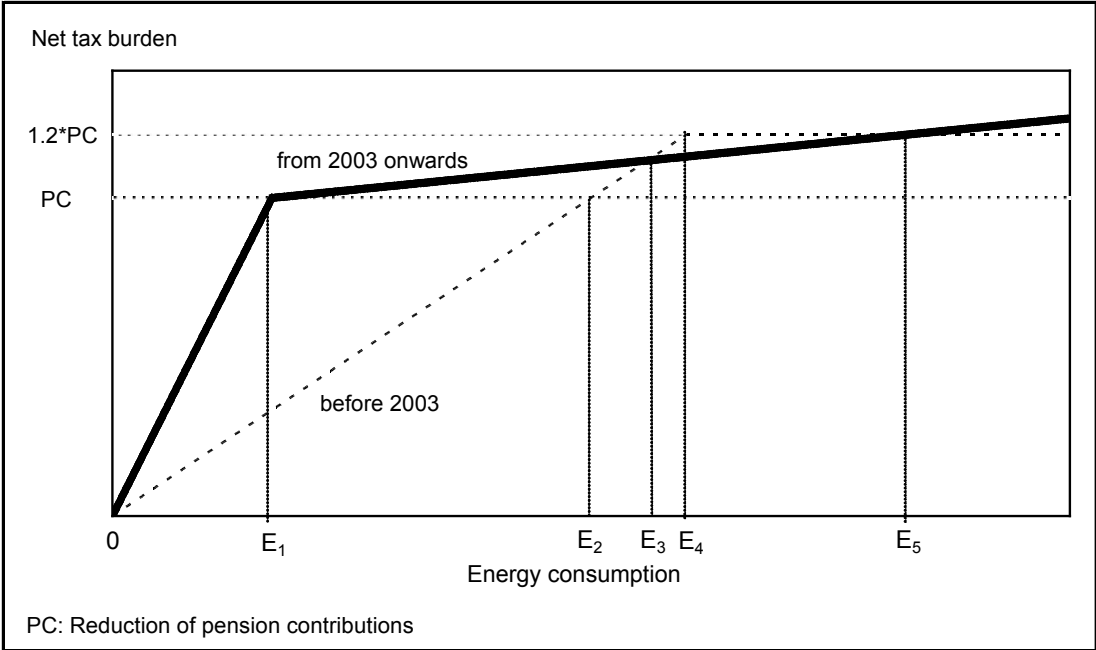
With these changes, the German government intended to spread the burden of the eco taxes more evenly and improve their ecological effectiveness. It expressed the opinion that four years after the introduction of the ecological tax reform, the incentive to use energy more efficiently could be increased without impairing the international competitiveness of energy-intensive industries (Deutscher Bundestag, 2002).

However, in a statement for a hearing of the federal parliament’s tax committee, DIW Berlin (2002) expressed doubts that this reform would really achieve these targets. Figure 4.3-1 shows the stylized tax schedules of an enterprise with a given reduction of pension contributions (PC) for different quantities of energy consumption before and after the reform beyond the fully taxed thresholds. The level of the curves in Figure 4.3-1 represents the net tax burden (net of tax rebates). The slopes of the curves represent the marginal tax burden, i.e., the tax increase associated with higher energy consumption.

The overall tax burden is higher in the new tax schedule in all segments except between E_3 and E_5 . The slope is steeper between 0 and E_1 (60 percent as compared to 20 percent) as well

as above E_4 (3 percent as compared to 0 percent). Between E_1 and E_4 the marginal tax rate and thus the incentive to economize on energy is lower than previously.

Figure 4.3-1: Net tax burden before and after 2003



The net effect is ambiguous. Obviously, it depends on the number of firms concerned falling into these different segments, their energy consumption and pension contributions. Data about this and the firm’s sensitivity to price changes are necessary to estimate the net effect. There was no such an empirical assessment when the new law was passed in December 2002. In the following section, we discuss the data used to model the ecological tax reform in Germany and calculate the average effective tax rates for each sector of the economy.

4.3.3 Modeling Effective Tax Rates

To sum up, the tax rebates granted to goods and materials sectors and agriculture entail that the effective (average and marginal) tax rates for electricity and heating fuels will differ between enterprises of the same industry sector due to difference in size, employment, payroll and the composition of output:

- Small firms below the minimum threshold bear the full burden of the eco taxes.
- Companies with higher energy consumption are favored by the general reduction of the eco taxes, which implies marginal rates of 20 percent (up to 2002) and 60 percent respectively (2003 onwards).
- Firms in the goods and materials sectors (not in agriculture) eligible for the tax cap face a marginal tax rate of 0 percent (up to 2002) respectively 3 percent (2003 onwards).

Therefore, calculations of the (average) marginal tax rate and average tax rate for industry branches have to take into account accurately the distribution of these characteristics. Ideally, micro data from those entities should be available. Unfortunately, this was not possible at this time. In view of the differentiation of effective tax rates by energy sources and field of application, and the variety of exemptions, threshold values and special clauses, we used the most detailed available information on energy and labor intensities and the distribution of firm size in order to approximate the average effective tax rates. When we carried out the study, the most recent data available was for the year 2002. There is some information loss compared to micro data, however, but it is not as substantial as the detailed information breakdown maps most of the relevant tax bases.

We took detailed information on energy consumption from the monthly production surveys for manufacturing and mining. Data on energy costs, payroll, and employers social security contributions is available from the surveys on cost structure. Since these statistics do not include firms or establishments with less than 20 employees, estimations based on small firm surveys according to methods used in national accounts statistics were applied in order to fill this gap. The main exemptions from energy taxation are taken into account for the calculations, in particular for non-energy use of fuels, specific combustion processes in production, for friction losses in energy conversion, for fuels used for electric power generation, and for combined heat-power generation.

With respect to energy consumption of the service sector, of the public sector, and of households, as well as for motor fuels in general, the effective tax burden does not differ across the consumer's individual characteristics. Since the tax schedule is completely linear in these cases macroeconomic statistics are sufficient for calculating the eco tax burden of this sector. We use data from the national accounts, the input-output statistics, environmental-economic accounting (EEA) system, and the energy accounting system.

Based on the thoroughly edited 2002 data, we built up a group simulation model that calculates the provisions of the energy tax law for representative firms of each sector, disaggregated by firm size. Basically, we outline the first round effects of the reform. In default of suitable data, behavioral responses of firms and further repercussions of the reform must be disregarded at this place. Therefore, we are not able to trace the tax shifting impact of the reform in detail. However, the data sources used for simulation comes from 2002 statistics. As far as the ecological tax reform has triggered such effects up to this year, these effects are yet included in the data. Moreover, a general equilibrium analysis with LEAN was followed up. For this

purpose, we aggregate the detailed results by industries to the smaller number of sectors only represented in the CGE model (see below, Section 4.3.5).

4.3.4 Results on Tax Burden and Effective Tax Rates in 2003

Based on the 2002 data base, we simulate the impact of the ecological tax reform on tax revenue and tax burden across industries for the law 2003. In this year, the step-by-step increase in tax rates was completely enacted and the special provisions for agriculture and the goods and materials sectors have been reformed essentially.

Fiscal impact and net tax burden by industries and households

According to the results on fiscal impact (Table 4.3-1) 55 percent of the additional tax revenue stems from the increased motor fuel tax, consisting of 30 percent from gasoline and 25 percent from diesel fuel. The electricity tax makes up 31 percent of the extra revenue, the increased taxes on natural gas and heating oil have a share of 11 percent and 3 percent respectively. The electricity tax and in particular the tax on diesel fuel mainly fall on businesses, whereas the tax increase on natural gas and heating oil predominantly hit households. From the increased tax revenue of Euro 18.7 billion, 13.5 billion were returned to business and households via reduced pension contributions. Euro 2.6 billion were spent to increase pension income. As a result, the entire business sector pays extra Euro 2.5 billion, on balance. For households as a whole, increased energy taxes and compensations via pension contributions balance each other exactly.

Agriculture and the goods and materials sectors face a higher tax burden of Euro 3.0 billion, that comes from the electricity tax by 44 percent and from diesel fuel taxation by 32 percent. The reduction in employer's pension contributions amounts to Euro 2.4 billion. On balance, the reform levies agriculture and the goods and materials sectors with Euro 0.7 billion. We found a significant net burden, measured in relation to gross production value, especially in the following industries: agriculture, mining and quarrying, most of the primary industries, such as basic metals, chemicals, pulp and paper, foodstuffs, as well as textiles, recycling, and the construction industry. Most of the less energy-intensive industries of machinery and equipment or consumer goods are better off, in contrast. Approximately, one third of gross value added and of employment in agriculture and the goods and materials sectors fall upon industries that are relieved by the reform.

Table 4.3-1 Fiscal impact of the ecological tax reform by economic activities and consumption of households, 2003

No. NACE / ISIC Rev.3	Economic activity	Increase in energy taxes					Reduction of pension contribut.	Balance: Net burden	Balance as perc. of gross product. value	
		Electricity tax ¹⁾	Natural gas tax ²⁾	Heating oil tax ³⁾	Motor fuel tax ⁴⁾					Total revenue
					Gasoline	Diesel				
in million Euro										
01-45	Agriculture, goods and materials sectors	1 336.9	430.9	67.5	239.0	957.5	3 031.7	2 358.4	+ 673.3	+ 0.03
01-05	Agriculture, forestry and fishing	75.2	10.2	9.1	17.6	327.0	439.1	39.1	+ 400.0	+ 0.85
10-14	Mining and quarrying	25.6	7.4	1.2	0.9	9.8	44.9	37.7	+ 7.1	+ 0.05
10,11,12	Mining of coal etc, crude oil and natural gas	19.2	3.3	0.2	0.5	5.4	28.6	28.6	- 0.0	- 0.00
13.14	Mining of metal ores, other mining and quarrying	6.4	4.1	1.0	0.4	4.4	16.3	9.2	+ 7.1	+ 0.11
15-37	Manufacturing	1 106.2	401.3	44.5	142.9	309.2	2 004.1	1 853.3	+ 150.8	+ 0.01
15	Food products and beverages	111.5	74.6	21.6	8.3	57.7	273.8	137.3	+ 136.5	+ 0.08
16	Tobacco products	2.1	1.0	0.1	0.3	1.2	4.7	3.9	+ 0.7	+ 0.00
17	Textiles	19.9	10.4	1.0	2.0	3.9	37.3	26.5	+ 10.8	+ 0.06
18	Wearing apparel, dressing and dyeing of fur	3.4	0.8	0.3	1.4	2.0	7.8	12.4	- 4.6	- 0.04
19	Leather and leather products	2.3	0.4	0.2	0.4	0.8	4.1	4.8	- 0.7	- 0.02
20	Wood and wood products	28.4	5.5	0.9	3.5	14.9	53.1	31.4	+ 21.7	+ 0.08
21	Pulp, paper and paper products	36.7	20.2	0.6	2.8	7.3	67.6	40.7	+ 27.0	+ 0.08
22	Publishing, printing, reproduction of record. media	51.5	11.8	0.5	24.2	19.9	108.0	79.2	+ 28.8	+ 0.05
23	Coke, refined petroleum, nuclear fuel	9.2	4.6	0.2	0.3	1.2	15.4	9.4	+ 6.0	+ 0.01
24	Chemicals, chemical products	105.0	76.6	2.1	5.8	15.8	205.4	150.9	+ 54.5	+ 0.04
25	Rubber and plastic products	56.6	15.4	1.8	2.8	5.4	82.0	86.6	- 4.6	- 0.01
26	Other non-metallic mineral products	45.1	37.6	1.2	2.7	21.7	108.3	65.6	+ 42.7	+ 0.10
27	Basic metals	66.2	42.7	0.5	6.1	16.3	131.9	74.2	+ 57.7	+ 0.09
28	Fabricated metal products	111.1	29.3	3.3	12.6	22.0	178.3	165.1	+ 13.2	+ 0.01
29	Machinery and equipment n.e.c.	123.9	18.0	4.5	22.6	31.2	200.3	318.8	- 118.5	- 0.07
30	Office machinery and computers	17.8	2.7	0.3	1.5	2.9	25.3	19.8	+ 5.5	+ 0.02
31	Electrical machinery and apparatus n.e.c.	68.9	7.9	1.9	8.8	18.1	105.6	128.7	- 23.1	- 0.03
32	Radio, television and communication equipment	23.9	1.7	0.2	3.3	7.2	36.3	44.6	- 8.3	- 0.02
33	Medical and precision instruments, watches, clocks	26.6	3.2	0.6	3.3	4.6	38.3	72.5	- 34.2	- 0.08
34	Motor vehicles, trailers	145.2	25.7	1.2	20.4	23.7	216.2	280.0	- 63.7	- 0.02
35	Other transport equipment	18.3	4.0	0.3	2.8	1.8	27.4	42.8	- 15.5	- 0.05
36	Furniture, manufacturing n.e.c.	30.0	6.5	1.0	4.2	13.8	55.5	55.1	+ 0.4	+ 0.00
37	Recycling	2.3	0.6	0.1	2.7	15.8	21.5	3.1	+ 18.4	+ 0.46
40,41	Electricity, gas and water supply	45.6	7.1	6.3	4.9	21.3	85.1	80.7	+ 4.4	+ 0.00
40.1	Production and distribution of electricity ⁵⁾	33.0	2.3	5.5	3.3	16.4	60.6	60.6	+ 0.0	+ 0.00
40.2	Manufacture of gas, distribution of gaseous fuels ⁵⁾	3.4	4.2	0.1	1.0	2.4	11.0	6.4	+ 4.7	+ 0.01
40.3	Steam and hot water supply ⁵⁾	1.8	0.1	0.3	0.2	0.9	3.3	3.8	- 0.5	- 0.01
41	Collection, purification and distribution of water	7.4	0.5	0.3	0.4	1.5	10.2	9.9	+ 0.3	+ 0.00
45	Construction	84.3	4.9	6.4	72.6	290.2	458.5	347.6	+ 110.9	+ 0.07
45.1,45.2	Site preparation, building	53.9	3.1	4.0	41.0	183.2	285.2	230.6	+ 54.7	+ 0.05
45.3-45.5	Building installation and other construction	30.4	1.8	2.3	31.7	107.1	173.2	117.0	+ 56.2	+ 0.11
50-95	Service sectors	1 980.5	389.6	117.9	732.1	3 037.0	6 257.1	4 409.6	+ 1 847.5	+ 0.09
50-55	Trade, hotels and restaurants	614.4	131.0	34.2	206.4	451.8	1 437.8	1 049.2	+ 388.6	+ 0.10
50	Sale, maintenance and repair of motor vehicles etc.	100.0	13.5	3.1	5.1	92.1	213.8	160.9	+ 52.9	+ 0.10
51	Wholesale trade, except of motor vehicles	144.7	27.2	8.1	26.6	232.1	438.7	342.7	+ 96.0	+ 0.07
52	Retail trade, except of motor vehicles, repair	238.1	56.9	14.6	161.2	116.1	586.9	405.7	+ 181.3	+ 0.13
55	Hotels and restaurants	131.6	33.5	8.5	13.5	11.4	198.5	140.0	+ 58.5	+ 0.11
60-64	Transport, storage and communication	285.0	12.0	5.5	34.0	1 362.3	1 698.7	443.8	+ 1 254.9	+ 0.52
60	Land transport, transport via pipelines	178.4	4.4	2.5	12.0	686.0	883.2	203.4	+ 679.9	+ 1.10
61	Water transport	0.3	0.0	0.0	0.2	1.7	2.2	4.3	- 2.1	- 0.02
62	Air transport	0.4	0.0	0.0	5.5	0.4	6.3	11.9	- 5.5	- 0.03
63	Supporting transport activities, travel agencies	39.0	1.9	0.9	13.1	624.5	679.4	112.9	+ 566.6	+ 0.85
64	Post and telecommunications	67.0	5.6	2.0	3.1	49.8	127.6	111.5	+ 16.1	+ 0.02
65-74	Financial intermed., real estate and business activities	274.7	61.7	16.6	223.6	631.0	1 207.6	1 080.5	+ 127.1	+ 0.01
65	Financial intermeditation, except insurance	52.6	10.9	3.4	4.6	2.9	74.4	176.7	- 102.3	- 0.10
66	Insurance, except social security	25.0	7.8	1.9	3.5	1.5	39.7	57.0	- 17.3	- 0.03
67	Activities auxiliary to financial intermeditation	9.2	1.7	0.1	3.4	1.1	15.7	25.5	- 9.9	- 0.04
70	Real estate activities	78.9	1.7	1.6	9.9	26.4	118.5	75.5	+ 43.1	+ 0.01
71	Renting of machinery & equipment without operator	7.9	0.7	0.5	14.8	117.6	141.4	15.7	+ 125.7	+ 0.29
72	Computer and related activities	11.8	3.5	0.8	22.6	64.6	103.4	93.7	+ 9.6	+ 0.02
73	Research and development	23.4	3.9	1.8	7.6	40.9	77.6	31.0	+ 46.6	+ 0.29
74	Other business activities	65.8	31.4	6.4	157.3	376.1	637.0	605.3	+ 31.6	+ 0.01
75-95	Public and personal service activities	806.4	185.0	61.6	268.1	591.8	1 912.9	1 836.1	+ 76.8	+ 0.01
75	Public administration, social security	346.9	69.3	21.1	27.4	70.9	535.6	546.6	- 11.0	- 0.01
80	Education	106.7	41.0	7.7	127.5	77.3	360.2	435.6	- 75.5	- 0.08
85	Health and social work	244.6	56.0	24.2	32.1	60.5	417.4	555.0	- 137.6	- 0.07
90	Sewage and refuse disposal, sanitation etc.	6.7	1.3	0.2	1.8	19.7	29.7	31.5	- 1.8	- 0.01
91	Activities of membership organization n.e.c.	15.1	6.5	3.2	3.0	3.3	31.2	111.5	- 80.3	- 0.36
92	Recreational, cultural and sporting activities	33.8	10.4	3.5	52.4	264.2	364.3	115.1	+ 249.1	+ 0.38
93	Other services activities	52.6	0.4	1.8	23.8	95.9	174.6	34.5	+ 140.1	+ 0.40
95	Private household with employed persons	0.0	0.0	0.0	0.0	0.0	0.0	6.3	- 6.3	- 0.24
01-95	Economic activities, total	3 317.4	820.5	185.4	971.1	3 994.5	9 288.8	6 768.1	+ 2 520.8	+ 0.06
	Consumption of private households	2 440.8	1 150.4	417.3	4 614.6	761.4	9 384.6	9 379.1	+ 5.5	-
	Total economy	5 758.2	1 971.0	602.6	5 585.7	4 755.9	18 673.4	16 147.2	+ 2 526.2	-

1) Standard rate 20.5 Euro/MWh, reduced rate 12.3 Euro/MWh (agriculture, goods and materials sectors).- 2) Increased standard rate by 3.66 Euro/MWh, reduced by 2.196 Euro/MWh (agriculture, goods and materials sectors).- 3) Increased standard rate by 20.45 Euro/1000 l, reduced by 12.27 Euro/1000 l (agriculture, goods and materials sectors).- 4) Increased standard rate by 153.5 Euro/1000 l.- 5) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).
Sources: Federal Statistical Office Germany (Destatis), own calculations.

The ecological tax reform charges the service sector with Euro 1.8 billion. This revenue mainly comes from the transportation and trade sectors. Some other smaller industries also face a higher net burden, such as renting and leasing of equipment or culture and sports. Reductions of the net tax burden could be observed in financial intermediation, business related services, and public services. About 40 percent of all employees in the service sectors working in industries that are relieved by the reform.

These results represent, admittedly, simply the first-round “formal” incidence of the tax reform. Firms might shift the increased tax burden forward to demanders via higher prices or backward to suppliers via lower input costs. The reduced pension contributions enhance employment, since both the employees realize more net income and the employers benefit from lower labor costs. However, nominal wages might increase stronger, be it that employees or unions try to make full use of the reduction in employer’s share in pension contributions or claim for compensation to higher energy prices. Certainly, all these effects depend on the elasticities of demand and supply at the particular markets. In the case of non traded products or highly-specific products, firms or employees usually have a higher degree in price setting opportunities. Analysis using general equilibrium models or other macroeconomic models capturing the industrial structure might give an impression of the potential impact of the second and third round effects (see Bach et al., 2001, and the summary of the main results in Section 4.2.2, above). In the shorter run, business cycle might also have an influence.

However, the overall effects on the level of single industries show a rather low impact of the reform with respect to production value or value added (Table 4.3-2). In this table we also present data on the energy costs in relation the gross production value. These numbers are a matter of interest with respect to the European Energy Tax Directive. According to Article 17(1)(a) of this regulation, differentiated tax reductions on energy products used for heating purposes or electricity must be confined to “energy-intensive business” since 2007. This is defined as business entities having energy costs amounting to at least 3.0 percent of the production value or paying national energy tax amounting to at least 0.5 percent of the added value. Energy costs significantly exceeding 3 percent of gross production value can be found in parts of mining and quarrying and some of the primary industries. Likewise, high energy costs also play a role in foodstuff and textile industry, and recycling. The construction industry has more moderate energy costs. Most of the industries of investment and consumer goods have a share of energy costs of less than 1 percent of production value. For the service sector there are no broad-based statistics available on cost structures. An eco tax burden (except of increased motor fuels) of more than or near 0.5 percent of “added value”, which could be best

approximated by the net value added measured at market prices, is achieved in agriculture, mining and quarrying, foodstuff and textile industry, most of the primary industries, office machinery and computer industry, hotels and restaurants, and land transportation.

The general retention of the tax cap for all firms in agriculture and the goods and materials sectors since 2007 is based on Article 17(1)(b) of the Energy Tax Directive, which allows tax reductions provided that the beneficiaries are subject to agreements, as far as they lead to the achievement of environmental protection objectives or to improvements in energy efficiency. The beneficiaries of the tax cap are subject to the climate protection agreement (“Klimaschutzvereinbarung”). This agreement was concluded between the German government and the German industry in 2000 in order to reduce the specific greenhouse gas emissions of German industry by 35 percent in 2012 compared to 1990 levels. The implementation of the agreement is subject to independent monitoring.

Low incentives for energy-saving due to special provisions

The effective tax rates involved in the tax reform are of high relevance for the incentives to energy-saving as well as for further output or income effects. It is clear that the effective tax rates in the favored sectors are much lower than the regular tax rates that are charged to the service sectors and households (Table 4.3-3). In particular, the marginal tax rates, which are relevant for energy-saving behavior, are rather low in the mining and quarrying sector or in the energy-intensive basic industries. Nearly all of the medium- and large-scaled firms of these sectors are eligible for a tax cap. Correspondingly, their tax rate is solely 3 percent of the standard eco tax rate at the margin. Higher effective tax rates apply to the less energy-intensive industries of investment or consumer goods, in particular if they are dominated by small and medium-sized firms, e.g., wearing apparel, leather and leather products or office machinery and computers (see also below, Table 4.3-4). The more so this is the case in agriculture and construction industry, which have many firms that do not exceed the minimum threshold for the eligibility of the tax reduction. Thus, effective tax rates are at highest in those firms and sectors.

Table 4.3-2 Energy costs and tax burden of the ecological tax reform in relation to production value and value added by economic activities, 2003

No. NACE / ISIC Rev.3	Economic activity	Energy costs as perc. of gross production value	Increase in energy taxes excluding motor fuel taxes as percent of				Net burden of the ecological tax reform including reduced pension contributions as percent of			
			gross production value	gross value added	net value added at		gross production value	gross value added	net value added at	
					market prices	input costs			market prices	input costs
01-45	Agriculture, goods and materials sectors	5.1	0.09	0.31	0.37	0.37	+ 0.03	+ 0.11	+ 0.13	+ 0.14
01-05	Agriculture, forestry and fishing	1.9	0.20	0.43	0.66	0.60	+ 0.85	+ 1.81	+ 2.78	+ 2.53
10-14	Mining and quarrying	4.4	0.22	0.69	0.98	0.48	+ 0.05	+ 0.14	+ 0.20	+ 0.10
10,11,12	Mining of coal etc, crude oil and natural gas	2.7	0.26	1.14	2.23	0.49	- 0.00	- 0.00	- 0.00	- 0.00
13,14	Mining of metal ores, other mining and quarrying	6.6	0.18	0.39	0.46	0.48	+ 0.11	+ 0.24	+ 0.29	+ 0.30
15-37	Manufacturing	1.4	0.10	0.36	0.41	0.42	+ 0.01	+ 0.03	+ 0.04	+ 0.04
15	Food products and beverages	1.8	0.13	0.53	0.64	0.65	+ 0.08	+ 0.35	+ 0.42	+ 0.43
16	Tobacco products	0.3	0.02	0.16	0.18	0.20	+ 0.00	+ 0.04	+ 0.04	+ 0.05
17	Textiles	2.4	0.19	0.60	0.76	0.77	+ 0.06	+ 0.21	+ 0.26	+ 0.27
18	Wearing apparel, dressing and dyeing of fur	0.4	0.04	0.16	0.17	0.18	- 0.04	- 0.16	- 0.18	- 0.18
19	Leather and leather products	0.7	0.07	0.29	0.34	0.35	- 0.02	- 0.07	- 0.08	- 0.08
20	Wood and wood products	1.8	0.13	0.46	0.52	0.53	+ 0.08	+ 0.29	+ 0.33	+ 0.33
21	Pulp, paper and paper products	4.0	0.16	0.55	0.67	0.69	+ 0.08	+ 0.26	+ 0.31	+ 0.32
22	Publishing, printing, reproduction of record. media	0.7	0.11	0.29	0.35	0.35	+ 0.05	+ 0.13	+ 0.16	+ 0.16
23	Coke, refined petroleum, nuclear fuel	0.4	0.01	0.29	0.37	0.38	+ 0.01	+ 0.12	+ 0.16	+ 0.16
24	Chemicals, chemical products	2.9	0.13	0.42	0.50	0.51	+ 0.04	+ 0.12	+ 0.15	+ 0.15
25	Rubber and plastic products	1.6	0.12	0.34	0.38	0.39	- 0.01	- 0.02	- 0.02	- 0.02
26	Other non-metallic mineral products	4.4	0.20	0.58	0.73	0.74	+ 0.10	+ 0.30	+ 0.37	+ 0.38
27	Basic metals	5.8	0.17	0.63	0.76	0.77	+ 0.09	+ 0.33	+ 0.40	+ 0.40
28	Fabricated metal products	1.2	0.14	0.37	0.41	0.42	+ 0.01	+ 0.03	+ 0.04	+ 0.04
29	Machinery and equipment n.e.c.	0.7	0.08	0.22	0.24	0.24	- 0.07	- 0.18	- 0.19	- 0.20
30	Office machinery and computers	0.4	0.08	0.64	0.83	0.84	+ 0.02	+ 0.17	+ 0.22	+ 0.22
31	Electrical machinery and apparatus n.e.c.	0.7	0.09	0.27	0.30	0.30	- 0.03	- 0.08	- 0.09	- 0.09
32	Radio, television and communication equipment	0.5	0.06	0.28	0.35	0.36	- 0.02	- 0.09	- 0.11	- 0.11
33	Medical and precision instruments, watches, clocks	0.5	0.07	0.18	0.20	0.20	- 0.08	- 0.20	- 0.22	- 0.23
34	Motor vehicles, trailers	0.6	0.06	0.30	0.35	0.36	- 0.02	- 0.11	- 0.13	- 0.13
35	Other transport equipment	0.6	0.08	0.24	0.27	0.27	- 0.05	- 0.16	- 0.18	- 0.18
36	Furniture, manufacturing n.e.c.	0.9	0.11	0.36	0.42	0.42	+ 0.00	+ 0.00	+ 0.00	+ 0.00
37	Recycling	2.1	0.08	0.23	0.26	0.26	+ 0.46	+ 1.42	+ 1.58	+ 1.59
40,41	Electricity, gas and water supply	49.6	0.04	0.17	0.25	0.26	+ 0.00	+ 0.01	+ 0.02	+ 0.02
40.1	Production and distribution of electricity ¹⁾	41.4	0.04	0.17	0.27	0.28	+ 0.00	+ 0.00	+ 0.00	+ 0.00
40.2	Manufacture of gas, distribution of gaseous fuels ¹⁾	80.6	0.02	0.16	0.23	0.24	+ 0.01	+ 0.10	+ 0.14	+ 0.15
40.3	Steam and hot water supply ¹⁾	23.7	0.04	0.15	0.20	0.21	- 0.01	- 0.03	- 0.05	- 0.05
41	Collection, purification and distribution of water	11.3	0.10	0.14	0.20	0.21	+ 0.00	+ 0.00	+ 0.01	+ 0.01
45	Construction	1.4	0.06	0.11	0.11	0.11	+ 0.07	+ 0.12	+ 0.13	+ 0.13
45.1,45.2	Site preparation, building	1.6	0.06	0.10	0.11	0.11	+ 0.05	+ 0.09	+ 0.10	+ 0.10
45.3-45.5	Building installation and other construction	1.0	0.07	0.12	0.12	0.12	+ 0.11	+ 0.19	+ 0.20	+ 0.20
50-95	Service sectors	.	0.12	0.18	0.22	0.22	+ 0.09	+ 0.13	+ 0.16	+ 0.16
50-55	Trade, hotels and restaurants	.	0.20	0.33	0.36	0.38	+ 0.10	+ 0.17	+ 0.18	+ 0.19
50	Sale, maintenance and repair of motor vehicles etc.	.	0.21	0.34	0.37	0.38	+ 0.10	+ 0.16	+ 0.17	+ 0.17
51	Wholesale trade, except of motor vehicles	.	0.13	0.21	0.22	0.24	+ 0.07	+ 0.11	+ 0.12	+ 0.13
52	Retail trade, except of motor vehicles, repair	.	0.22	0.35	0.38	0.39	+ 0.13	+ 0.20	+ 0.22	+ 0.23
55	Hotels and restaurants	.	0.31	0.73	0.82	0.83	+ 0.11	+ 0.25	+ 0.28	+ 0.28
60-64	Transport, storage and communication	.	0.12	0.25	0.33	0.34	+ 0.52	+ 1.04	+ 1.39	+ 1.39
60	Land transport, transport via pipelines	.	0.30	0.58	0.82	0.79	+ 1.10	+ 2.11	+ 3.00	+ 2.91
61	Water transport	.	0.00	0.01	0.01	0.01	- 0.02	- 0.05	- 0.10	- 0.11
62	Air transport	.	0.00	0.00	0.01	0.01	- 0.03	- 0.06	- 0.07	- 0.07
63	Supporting transport activities, travel agencies	.	0.06	0.18	0.24	0.25	+ 0.85	+ 2.47	+ 3.22	+ 3.35
64	Post and telecommunications	.	0.09	0.15	0.19	0.19	+ 0.02	+ 0.03	+ 0.04	+ 0.04
65-74	Financial intermed., real estate and business activities	.	0.04	0.06	0.08	0.08	+ 0.01	+ 0.02	+ 0.03	+ 0.03
65	Financial intermediation, except insurance	.	0.07	0.13	0.15	0.15	- 0.10	- 0.20	- 0.22	- 0.23
66	Insurance, except social security	.	0.06	0.26	0.31	0.35	- 0.03	- 0.13	- 0.16	- 0.17
67	Activities auxiliary to financial intermediation	.	0.05	0.09	0.09	0.09	- 0.04	- 0.08	- 0.08	- 0.08
70	Real estate activities	.	0.03	0.03	0.05	0.05	+ 0.01	+ 0.02	+ 0.02	+ 0.03
71	Renting of machinery & equipment without operator	.	0.02	0.03	0.06	0.06	+ 0.29	+ 0.40	+ 0.80	+ 0.81
72	Computer and related activities	.	0.03	0.04	0.05	0.05	+ 0.02	+ 0.03	+ 0.03	+ 0.03
73	Research and development	.	0.18	0.39	0.47	0.44	+ 0.29	+ 0.62	+ 0.75	+ 0.71
74	Other business activities	.	0.04	0.05	0.06	0.06	+ 0.01	+ 0.02	+ 0.02	+ 0.02
75-95	Public and personal service activities	.	0.17	0.25	0.28	0.28	+ 0.01	+ 0.02	+ 0.02	+ 0.02
75	Public administration, social security	.	0.26	0.37	0.44	0.44	- 0.01	- 0.01	- 0.01	- 0.01
80	Education	.	0.16	0.19	0.21	0.21	- 0.08	- 0.09	- 0.10	- 0.10
85	Health and social work	.	0.18	0.25	0.29	0.27	- 0.07	- 0.11	- 0.12	- 0.12
90	Sewage and refuse disposal, sanitation etc.	.	0.03	0.07	0.14	0.13	- 0.01	- 0.01	- 0.03	- 0.03
91	Activities of membership organization n.e.c.	.	0.11	0.15	0.16	0.16	- 0.36	- 0.49	- 0.51	- 0.50
92	Recreational, cultural and sporting activities	.	0.07	0.12	0.15	0.15	+ 0.38	+ 0.63	+ 0.79	+ 0.77
93	Other services activities	.	0.16	0.20	0.21	0.21	+ 0.40	+ 0.51	+ 0.53	+ 0.54
95	Private household with employed persons	.	0.00	0.00	0.00	0.00	- 0.24	- 0.24	- 0.24	- 0.24
01-95	Economic activities, total	.	0.11	0.22	0.26	0.27	+ 0.06	+ 0.13	+ 0.15	+ 0.15

1) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).

Sources: Federal Statistical Office Germany (Destatis), own calculations.

Table 4.3-3 Effective Tax Rates of the ecological tax reform in agriculture and the goods and materials sectors by economic activities, 2003

No. NACE / ISIC Rev.3	Economic activity	Effective tax rates of increased energy taxes					
		Electricity tax ¹⁾		Natural gas tax ²⁾		Heating oil tax ³⁾	
		Average tax rate	Marginal tax rate ⁴⁾	Average tax rate	Marginal tax rate ⁴⁾	Average tax rate	Marginal tax rate ⁴⁾
		Euro/MWh		Euro/MWh		Euro/1000 l	
01-45	Agriculture, goods and materials sectors	4.94	2.31	1.71	0.79	12.08	7.85
01-05	Agriculture, forestry and fishing	18.02	17.29	3.32	2.07	12.00	11.03
10-14	Mining and quarrying	2.31	0.65	2.07	1.17	11.23	4.24
10,11,12	Mining of coal etc, crude oil and natural gas	2.13	0.62	2.21	2.20	12.34	12.29
13.14	Mining of metal ores, other mining and quarrying	3.10	0.81	1.97	0.44	10.99	2.48
15-37	Manufacturing	4.60	1.88	1.72	0.77	11.54	5.89
15	Food products and beverages	4.91	1.44	2.01	0.45	11.24	2.50
16	Tobacco products	7.51	0.63	2.21	2.20	12.34	12.28
17	Textiles	5.79	2.18	2.35	2.28	13.10	12.74
18	Wearing apparel, dressing and dyeing of fur	14.55	14.19	2.69	2.45	15.05	13.68
19	Leather and leather products	13.36	11.35	2.59	2.42	14.48	13.50
20	Wood and wood products	5.73	1.96	2.64	2.54	14.75	14.21
21	Pulp, paper and paper products	1.79	0.69	1.64	0.32	9.18	1.78
22	Publishing, printing, reproduction of record. media	11.46	2.71	2.53	2.42	14.16	13.52
23	Coke, refined petroleum, nuclear fuel	1.20	0.62	1.46	0.14	8.18	0.77
24	Chemicals, chemical products	2.03	0.63	1.45	0.16	8.08	0.90
25	Rubber and plastic products	4.43	0.75	2.34	2.23	13.07	12.43
26	Other non-metallic mineral products	3.33	0.89	1.38	0.18	7.71	1.02
27	Basic metals	1.54	0.62	1.04	0.18	5.83	1.02
28	Fabricated metal products	9.81	1.96	2.54	2.32	14.20	12.98
29	Machinery and equipment n.e.c.	12.69	12.52	2.41	2.28	13.49	12.75
30	Office machinery and computers	14.31	13.49	3.19	3.15	17.81	17.60
31	Electrical machinery and apparatus n.e.c.	11.84	7.87	2.34	2.25	13.10	12.56
32	Radio, television and communication equipment	8.62	0.84	2.41	2.26	13.45	12.65
33	Medical and precision instruments, watches, clocks	13.54	13.17	2.74	2.61	15.33	14.60
34	Motor vehicles, trailers	8.12	0.65	2.22	2.21	12.41	12.32
35	Other transport equipment	11.96	8.09	2.26	2.21	12.64	12.37
36	Furniture, manufacturing n.e.c.	13.30	11.75	2.58	2.46	14.42	13.73
37	Recycling	3.91	1.04	2.63	2.38	14.68	13.31
40,41	Electricity, gas and water supply	4.77	0.86	0.64	0.35	11.74	11.34
40.1	Production and distribution of electricity ⁵⁾	5.40	0.64	2.24	2.21	12.54	12.34
40.2	Manufacture of gas, distribution of gaseous fuels ⁵⁾	8.90	0.86	0.42	0.11	2.37	0.61
40.3	Steam and hot water supply ⁵⁾	12.50	11.56	2.34	2.27	13.06	12.70
41	Collection, purification and distribution of water	2.55	0.82	2.74	2.48	15.31	13.88
45	Construction	16.82	16.58	3.48	3.40	19.44	19.00
45.1,45.2	Site preparation, building	16.72	16.45	3.45	3.36	19.27	18.79
45.3-45.5	Building installation and other construction	17.00	16.83	3.53	3.47	19.74	19.39

1) Standard rate 20.5 Euro/MWh, reduced rate 12.3 Euro/MWh.- 2) Increased standard rate by 3.66 Euro/MWh, reduced by 2.196 Euro/MWh.-
3) Increased standard rate by 20.45 Euro/1000 l, reduced by 12.27 Euro/1000 l.- 4) Average of industry, weighted by energy consumption.-
5) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).
Sources: Federal Statistical Office Germany (Destatis), own calculations.

According to our calculations, more than 95 percent of the electricity consumption in agriculture and the goods and materials sectors are taxed at reduced rates, 80 percent of electricity consumption is eligible for the tax cap. In the case of the taxation of natural gas and heating oil, 90 percent of energy consumption is taxed at reduced rates and 50 percent benefits from the tax cap.

Smaller firms are worse off

If we take a look at the net burden of the reform by firm size, the results showing a higher burden for smaller enterprises in most of the industries. This is true both referring on gross production value (Table 4.3-4) and on value added (Table 4.3-5). Due to the tax falling on the basic threshold small firms in many cases pay the standard rate. At the same time they often do not benefit from the reduction in pension contributions as much since they employ fewer employees liable to social security. This explains why effective tax rates are significantly higher in industries characterized by higher shares of small firms. However, the average net burden of the reform is rather low measured in relation to production value or value added in most of the industries.

Table 4.3-4 Net burden of the ecological tax reform in the goods and materials sectors by number of employees and economic activities, 2003 as percent of gross production value
Net burden (+) / relief (-)

No. NACE / ISIC Rev.3	Economic activity	Enterprises with ... to ... employees						Total
		1 - 9	10-19	20-99	100-249	250-499	500 and more	
10,11,12	Mining of coal etc, crude oil and natural gas	+ 0.09	+ 0.07	+ 0.14	- 0.02	+ 0.02	- 0.01	- 0.00
13.14	Mining of metal ores, other mining and quarrying	+ 0.08	+ 0.08	+ 0.15	+ 0.12	+ 0.05	+ 0.12	+ 0.11
15	Food products and beverages	+ 0.23	+ 0.15	+ 0.08	+ 0.06	+ 0.05	+ 0.05	+ 0.08
16	Tobacco products	+ 0.01	+ 0.00	+ 0.04	- 0.00	- 0.01	+ 0.00	+ 0.00
17	Textiles	+ 0.34	+ 0.04	+ 0.02	+ 0.05	+ 0.05	+ 0.01	+ 0.06
18	Wearing apparel, dressing and dyeing of fur	- 0.03	- 0.02	- 0.02	- 0.05	- 0.05	- 0.04	- 0.04
19	Leather and leather products	+ 0.04	+ 0.02	+ 0.02	- 0.01	- 0.04	- 0.03	- 0.02
20	Wood and wood products	+ 0.14	+ 0.05	+ 0.03	+ 0.07	+ 0.09	+ 0.11	+ 0.08
21	Pulp, paper and paper products	+ 0.14	+ 0.04	+ 0.03	+ 0.08	+ 0.08	+ 0.08	+ 0.08
22	Publishing, printing, reproduction of record. media	+ 0.08	+ 0.04	+ 0.04	+ 0.04	+ 0.03	+ 0.06	+ 0.05
23	Coke, refined petroleum, nuclear fuel	+ 0.06	+ 0.02	+ 0.02	+ 0.03	+ 0.01		+ 0.01
24	Chemicals, chemical products	+ 0.08	+ 0.04	+ 0.04	+ 0.03	+ 0.03	+ 0.04	+ 0.04
25	Rubber and plastic products	+ 0.07	+ 0.02	- 0.00	- 0.01	- 0.02	- 0.02	- 0.01
26	Other non-metallic mineral products	+ 0.18	+ 0.08	+ 0.09	+ 0.08	+ 0.10	+ 0.10	+ 0.10
27	Basic metals	+ 0.11	+ 0.05	+ 0.05	+ 0.07	+ 0.07	+ 0.10	+ 0.09
28	Fabricated metal products	+ 0.09	+ 0.03	+ 0.01	- 0.00	- 0.01	- 0.02	+ 0.01
29	Machinery and equipment n.e.c.	+ 0.00	- 0.03	- 0.07	- 0.08	- 0.09	- 0.06	- 0.07
30	Office machinery and computers	+ 0.06	+ 0.06	+ 0.03	- 0.01	- 0.02	- 0.00	+ 0.02
31	Electrical machinery and apparatus n.e.c.	+ 0.03	+ 0.02	- 0.03	- 0.02	- 0.01	- 0.03	- 0.03
32	Radio, television and communication equipment	+ 0.05	+ 0.01	- 0.00	- 0.03	- 0.03	- 0.02	- 0.02
33	Medical and precision instruments, watches, clocks	- 0.03	- 0.04	- 0.11	- 0.10	- 0.10	- 0.08	- 0.08
34	Motor vehicles, trailers	+ 0.05	+ 0.01	- 0.02	- 0.03	- 0.03	- 0.02	- 0.02
35	Other transport equipment	+ 0.04	+ 0.01	- 0.03	- 0.03	- 0.04	- 0.06	- 0.05
36	Furniture, manufacturing n.e.c.	+ 0.08	+ 0.04	+ 0.01		- 0.02		+ 0.00
37	Recycling	+ 0.39	+ 0.43	+ 0.84		+ 0.31		+ 0.46
40.1	Production and distribution of electricity ¹⁾	+ 0.01		+ 0.01	+ 0.01	+ 0.00	- 0.00	+ 0.00
40.2	Manufacture of gas, distribution of gaseous fuels ¹⁾	+ 0.01		+ 0.02	+ 0.01	+ 0.01		+ 0.01
40.3	Steam and hot water supply ¹⁾	+ 0.01			- 0.01			- 0.01
41	Collection, purification and distribution of water	+ 0.03			- 0.01			+ 0.00
45.1,45.2	Site preparation, building	+ 0.19	+ 0.07	+ 0.01	- 0.01	- 0.03	- 0.04	+ 0.05
45.3-45.5	Building installation and other construction	+ 0.15		+ 0.10	+ 0.05	+ 0.03	+ 0.00	+ 0.11

1) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).

Sources: Federal Statistical Office Germany (Destatis), own calculations.

Table 4.3-5 Net burden of the ecological tax reform in the goods and materials sectors by number of employees and economic activities, 2003 as percent of net value added at input costs
Net burden (+) / relief (-)

No. NACE / ISIC Rev.3	Economic activity	Enterprises with ... to ... employees						
		1 - 9	10-19	20-99	100-249	250-499	500 and more	Total
10,11,12	Mining of coal etc, crude oil and natural gas	+ 0.46	+ 0.30	+ 0.75	- 0.05	+ 0.06	- 0.03	- 0.00
13.14	Mining of metal ores, other mining and quarrying	+ 0.75	+ 0.54	+ 0.44	+ 0.37	+ 0.17	+ 0.41	+ 0.43
15	Food products and beverages	+ 0.98	+ 0.60	+ 0.37	+ 0.32	+ 0.27	+ 0.24	+ 0.42
16	Tobacco products	+ 0.50	+ 0.16	+ 0.17	- 0.14	- 0.13	+ 0.06	+ 0.05
17	Textiles	+ 0.72	+ 0.24	+ 0.08	+ 0.19	+ 0.22	+ 0.05	+ 0.22
18	Wearing apparel, dressing and dyeing of fur	- 0.08	- 0.12	- 0.11	- 0.23	- 0.21	- 0.18	- 0.16
19	Leather and leather products	+ 0.18	+ 0.09	+ 0.07	- 0.04	- 0.17	- 0.18	- 0.07
20	Wood and wood products	+ 0.55	+ 0.23	+ 0.11	+ 0.34	+ 0.40	+ 0.43	+ 0.34
21	Pulp, paper and paper products	+ 0.46	+ 0.15	+ 0.11	+ 0.30	+ 0.29	+ 0.37	+ 0.30
22	Publishing, printing, reproduction of record. media	+ 0.40	+ 0.19	+ 0.12	+ 0.13	+ 0.11	+ 0.16	+ 0.17
23	Coke, refined petroleum, nuclear fuel	+ 0.46	+ 0.20	+ 0.12	+ 0.12	+ 0.19		+ 0.19
24	Chemicals, chemical products	+ 0.55	+ 0.26	+ 0.14	+ 0.15	+ 0.16	+ 0.15	+ 0.16
25	Rubber and plastic products	+ 0.40	+ 0.11	- 0.00	- 0.03	- 0.06	- 0.06	- 0.03
26	Other non-metallic mineral products	+ 0.96	+ 0.44	+ 0.31	+ 0.29	+ 0.35	+ 0.31	+ 0.37
27	Basic metals	+ 0.56	+ 0.31	+ 0.20	+ 0.26	+ 0.27	+ 0.50	+ 0.42
28	Fabricated metal products	+ 0.33	+ 0.13	+ 0.02	- 0.01	- 0.02	- 0.05	+ 0.04
29	Machinery and equipment n.e.c.	+ 0.01	- 0.13	- 0.19	- 0.23	- 0.27	- 0.20	- 0.20
30	Office machinery and computers	+ 0.20	+ 0.17	+ 0.09	- 0.05	- 0.07	- 0.02	+ 0.09
31	Electrical machinery and apparatus n.e.c.	+ 0.15	+ 0.08	- 0.08	- 0.06	- 0.05	- 0.12	- 0.09
32	Radio, television and communication equipment	+ 0.30	+ 0.07	- 0.01	- 0.08	- 0.12	- 0.18	- 0.12
33	Medical and precision instruments, watches, clocks	- 0.10	- 0.15	- 0.24	- 0.29	- 0.27	- 0.23	- 0.22
34	Motor vehicles, trailers	+ 0.32	+ 0.10	- 0.08	- 0.12	- 0.11	- 0.15	- 0.14
35	Other transport equipment	+ 0.21	+ 0.05	- 0.11	- 0.11	- 0.14	- 0.19	- 0.18
36	Furniture, manufacturing n.e.c.	+ 0.34	+ 0.17	+ 0.03		- 0.08		+ 0.00
37	Recycling	+ 3.15	+ 3.04	+ 3.92		+ 1.74		+ 2.69
40.1	Production and distribution of electricity ¹⁾	+ 0.08		+ 0.05	+ 0.02	+ 0.00	- 0.01	+ 0.00
40.2	Manufacture of gas, distribution of gaseous fuels ¹⁾	+ 0.13		+ 0.19	+ 0.10	+ 0.13		+ 0.13
40.3	Steam and hot water supply ¹⁾	+ 0.13			- 0.05			- 0.04
41	Collection, purification and distribution of water	+ 0.11			- 0.02			+ 0.01
45.1,45.2	Site preparation, building	+ 0.40	+ 0.15	+ 0.03	- 0.05	- 0.10	- 0.12	+ 0.14
45.3-45.5	Building installation and other construction	+ 0.39		+ 0.25	+ 0.15	+ 0.07	+ 0.01	+ 0.28

1) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).

Sources: Federal Statistical Office Germany (Destatis), own calculations.

Effects of special provisions 2003

According to the calculations for the law 2003 the overall fiscal impact of tax reliefs provided by the ecological tax reform amounts to Euro 5.28 billion. Thereof, Euro 4.65 billion fall on the electricity tax, 0.5 billion on the natural gas tax.

The special provisions for agriculture and the goods and materials sectors, i.e., the general tax reduction to 60 percent of the energy tax increase (except for motor fuels) and the tax cap for energy-intensive firms, account for Euro 4.75 billion revenue losses (Table 4.3-6). As expected, the lion's share of this relief (72 percent) benefits mining and quarrying as well as the basic industries. For these industries the tax relief has a significant effect in relation to production value or value added. That means that competitiveness or profitability of firms within these industries could be noticeably affected if the tax reliefs were not in place.

Table 4.3-6 Tax relief of special provisions in agriculture and the goods and materials sectors by economic activities, 2003

No. NACE / ISIC Rev.3	Economic activity	Electricity tax ¹⁾	Natural gas tax ²⁾	Heating oil tax ³⁾	Total	Total as percent of	
		in million Euro				gross production value	net value added at input costs
01-45	Agriculture, goods and materials sectors	4 208.6	494.0	46.8	4 749.4	+ 0.25	+ 0.95
01-05	Agriculture, forestry and fishing	10.4	1.0	6.4	17.8	+ 0.04	+ 0.11
10-14	Mining and quarrying	201.2	5.7	1.0	207.9	+ 1.37	+ 2.94
10,11,12	Mining of coal etc, crude oil and natural gas	165.5	2.2	0.2	167.8	+ 1.91	+ 3.60
13.14	Mining of metal ores, other mining and quarrying	35.7	3.5	0.8	40.1	+ 0.62	+ 1.67
15-37	Manufacturing	3 828.3	453.6	34.4	4 316.3	+ 0.27	+ 1.17
15	Food products and beverages	353.6	61.2	17.7	432.5	+ 0.26	+ 1.36
16	Tobacco products	3.5	0.6	0.0	4.2	+ 0.02	+ 0.27
17	Textiles	50.6	5.8	0.5	57.0	+ 0.34	+ 1.41
18	Wearing apparel, dressing and dyeing of fur	1.4	0.3	0.1	1.8	+ 0.01	+ 0.07
19	Leather and leather products	1.2	0.2	0.1	1.5	+ 0.03	+ 0.18
20	Wood and wood products	73.1	2.1	0.3	75.6	+ 0.29	+ 1.16
21	Pulp, paper and paper products	383.5	24.8	0.8	409.1	+ 1.15	+ 4.88
22	Publishing, printing, reproduction of record. media	40.6	5.2	0.2	46.1	+ 0.08	+ 0.26
23	Coke, refined petroleum, nuclear fuel	148.1	6.9	0.2	155.2	+ 0.16	+ 4.20
24	Chemicals, chemical products	953.7	117.4	3.3	1 074.4	+ 0.77	+ 3.00
25	Rubber and plastic products	205.4	8.7	1.0	215.1	+ 0.35	+ 1.14
26	Other non-metallic mineral products	232.7	62.2	2.0	296.8	+ 0.71	+ 2.63
27	Basic metals	818.0	107.1	1.3	926.4	+ 1.45	+ 6.50
28	Fabricated metal products	121.0	12.9	1.5	135.3	+ 0.13	+ 0.39
29	Machinery and equipment n.e.c.	76.3	9.3	2.3	88.0	+ 0.05	+ 0.15
30	Office machinery and computers	7.7	0.4	0.0	8.2	+ 0.03	+ 0.33
31	Electrical machinery and apparatus n.e.c.	50.4	4.4	1.1	55.9	+ 0.06	+ 0.21
32	Radio, television and communication equipment	33.0	0.9	0.1	34.0	+ 0.08	+ 0.47
33	Medical and precision instruments, watches, clocks	13.7	1.1	0.2	15.0	+ 0.03	+ 0.10
34	Motor vehicles, trailers	221.6	16.6	0.8	239.0	+ 0.09	+ 0.49
35	Other transport equipment	13.1	2.5	0.2	15.8	+ 0.06	+ 0.19
36	Furniture, manufacturing n.e.c.	16.2	2.7	0.4	19.4	+ 0.06	+ 0.22
37	Recycling	9.8	0.3	0.0	10.1	+ 0.25	+ 0.87
40,41	Electricity, gas and water supply	150.2	33.4	4.7	188.3	+ 0.13	+ 0.83
40.1	Production and distribution of electricity ⁴⁾	92.2	1.5	3.5	97.2	+ 0.10	+ 0.67
40.2	Manufacture of gas, distribution of gaseous fuels ⁴⁾	4.4	31.7	0.9	37.0	+ 0.09	+ 1.16
40.3	Steam and hot water supply ⁴⁾	1.1	0.1	0.2	1.4	+ 0.03	+ 0.13
41	Collection, purification and distribution of water	52.4	0.2	0.1	52.7	+ 0.65	+ 1.32
45	Construction	18.5	0.3	0.3	19.0	+ 0.01	+ 0.02
45.1,45.2	Site preparation, building	12.2	0.2	0.2	12.6	+ 0.01	+ 0.02
45.3-45.5	Building installation and other construction	6.3	0.1	0.1	6.4	+ 0.01	+ 0.02

1) Standard rate 20.5 Euro/MWh, reduced rate 12.3 Euro/MWh.- 2) Increased standard rate by 3.66 Euro/MWh, reduced by 2.196 Euro/MWh.-
3) Increased standard rate by 20.45 Euro/1000 l, reduced by 12.27 Euro/1000 l.- 4) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).

Sources: Federal Statistical Office Germany (Destatis), own calculations.

One should note that our estimations show the average effect for the entire industry. The presented “two-digit” economic activities are still rather heterogeneous. For instance, the chemical industry includes less energy-intensive branches such as pharmaceuticals or plant protectors as well as the highly energy-consuming production of polymers and other basic chemicals. Machinery, equipment, and automobile industries likewise benefit from the special provisions to a substantial extent, but the tax reliefs are not as high related on production value or value added. This is also the case within the other industries of investment or consumer goods, the energy and water supply, and the construction industry.

4.3.5 Effects of the Reform of Special Provisions in 2003

Flawed incentives for energy-saving

A simulation of the 2003 reform of the special provisions across industries shows that the tax burden and the average tax rates increased in nearly all industries. The tax revenue rose by Euro 630 million. However, in most industries marginal tax rates mounted up much less than the average tax rate (Table 4.3-7). Due to the increase of the reduced tax rates (now 60 percent of the regular tax rates compared to 20 percent before 2003) and a lower threshold, many firms are now eligible for the tax rebate since their additional energy taxes exceed the reduction in social security contributions. According to information from fiscal authorities, the number of firms with tax rebates rose from 1,600 up to 12,000. Taking into account the tax schedules presented in Figure 4.3-1 (see above, Section 4.3.2), this implies that a remarkable part of taxable energy consumption falls into the range from the new threshold eligible for tax rebate (E_1) to the corresponding threshold of the old regime (E_4). It was only in sectors with a low energy-intensity such as wearing apparel, leather and leather products or office machinery that marginal tax rates rose significantly. In these industries the lowering of the general tax reduction presumably dominates the lowering impact of the tax cap, which is the case in the intercept up to E_1 in Figure 4.3-1. Moreover, the marginal tax rates on electricity increased in the very energy-intensive sectors of basic industry and coal mining where the marginal tax rates were naught up to 2002. After the reform, they pay at least 3 percent of the eco tax rates (energy consumption starting in E_4 in Figure 4.3-1). In the case of the taxation of natural gas and heating oil, many firms became newly eligible for the tax cap, leading to lower marginal tax rates in these cases.

Thus, from an ecological perspective, the revision of special provisions seems to fail widely in enhancing incentives on energy-saving in the industrial sector, which is triggered by marginal tax rates. Moreover, the substantial increase in firms eligible for the tax rebate leads to higher administrative and compliance costs of the tax system, since the assessment procedure of the provisions is deemed as rather complex.

Table 4.3-7 Changes in tax revenue and effective tax rates by the reform of special provisions in agriculture and the goods and materials sectors by economic activities, 2003

No. NACE / ISIC Rev.3	Economic activity	Electricity tax ¹⁾			Natural gas tax ²⁾			Heating oil tax ³⁾			Decrease in tax revenue, total
		Decrease in			Decrease in			Decrease in			
		tax revenue	average tax rate	marginal tax rate ⁴⁾	tax revenue	average tax rate	marginal tax rate ⁴⁾	tax revenue	average tax rate	marginal tax rate ⁴⁾	
mill. Euro	Euro/MWh		mill. Euro	Euro/MWh		mill. Euro	Euro/1000 l		mill. Euro		
01-45	Agriculture, goods and materials sectors	412.7	1.53	0.17	189.2	0.75	-0.02	27.5	4.92	1.94	629.4
01-05	Agriculture, forestry and fishing	10.4	2.48	3.21	1.0	0.34	0.49	2.2	2.83	3.28	13.6
10-14	Mining and quarrying	2.1	0.19	0.61	4.3	1.19	0.39	0.6	6.08	-0.24	7.0
10,11,12	Mining of coal etc, crude oil and natural gas	2.0	0.22	0.61	2.2	1.45	1.46	0.2	8.11	8.16	4.3
13.14	Mining of metal ores, other mining and quarrying	0.1	0.05	0.61	2.1	1.01	-0.37	0.5	5.64	-2.07	2.7
15-37	Manufacturing	370.9	1.54	0.11	181.7	0.78	-0.04	20.6	5.33	1.03	573.1
15	Food products and beverages	-0.7	-0.03	-1.01	32.9	0.89	-0.38	9.5	4.95	-2.13	41.7
16	Tobacco products	0.9	3.36	-3.48	0.6	1.45	1.46	0.0	8.11	8.17	1.6
17	Textiles	0.8	0.25	-3.21	5.8	1.31	1.38	0.5	7.35	7.71	7.2
18	Wearing apparel, dressing and dyeing of fur	1.4	5.95	6.31	0.3	0.97	1.21	0.1	5.40	6.77	1.8
19	Leather and leather products	1.2	7.07	5.75	0.2	1.07	1.24	0.1	5.97	6.95	1.5
20	Wood and wood products	1.8	0.37	-1.27	2.1	1.02	1.12	0.3	5.70	6.24	4.3
21	Pulp, paper and paper products	6.9	0.34	0.61	9.9	0.81	-0.46	0.3	4.51	-2.57	17.2
22	Publishing, printing, reproduction of record. media	25.9	5.76	-2.73	5.2	1.13	1.24	0.2	6.29	6.93	31.4
23	Coke, refined petroleum, nuclear fuel	3.5	0.46	0.61	2.3	0.73	-0.47	0.1	4.10	-2.65	5.9
24	Chemicals, chemical products	12.8	0.25	0.61	36.8	0.69	-0.57	1.0	3.87	-3.21	50.6
25	Rubber and plastic products	1.5	0.12	-2.92	8.7	1.32	1.43	1.0	7.38	8.02	11.2
26	Other non-metallic mineral products	0.0	0.00	0.61	13.7	0.50	-0.61	0.4	2.80	-3.41	14.0
27	Basic metals	16.3	0.38	0.61	12.1	0.29	-0.55	0.1	1.65	-3.08	28.5
28	Fabricated metal products	48.1	4.25	-3.25	12.9	1.12	1.34	1.5	6.25	7.47	62.5
29	Machinery and equipment n.e.c.	76.3	7.81	7.98	9.3	1.25	1.38	2.3	6.96	7.70	88.0
30	Office machinery and computers	7.5	5.99	5.80	0.4	0.47	0.51	0.0	2.64	2.85	7.9
31	Electrical machinery and apparatus n.e.c.	42.7	7.33	3.49	4.4	1.32	1.41	1.1	7.35	7.89	48.2
32	Radio, television and communication equipment	11.6	4.19	-3.45	0.9	1.25	1.40	0.1	7.00	7.80	12.6
33	Medical and precision instruments, watches, clocks	13.7	6.96	7.33	1.1	0.92	1.05	0.2	5.12	5.85	15.0
34	Motor vehicles, trailers	70.9	3.96	-3.48	16.6	1.44	1.45	0.8	8.04	8.13	88.3
35	Other transport equipment	11.7	7.60	3.83	2.5	1.40	1.45	0.2	7.81	8.08	14.3
36	Furniture, manufacturing n.e.c.	16.1	7.12	5.94	2.7	1.08	1.20	0.4	6.03	6.72	19.2
37	Recycling	0.0	-0.06	0.46	0.3	1.03	1.28	0.0	5.77	7.14	0.2
40,41	Electricity, gas and water supply	10.9	1.14	-2.07	2.0	0.18	0.26	3.8	7.07	7.35	16.7
40.1	Production and distribution of electricity ⁵⁾	7.6	1.24	-3.48	1.5	1.42	1.45	3.5	7.91	8.11	12.5
40.2	Manufacture of gas, distribution of gaseous fuels ⁵⁾	1.7	4.51	-3.34	0.3	0.03	0.11	0.0	0.17	0.61	2.0
40.3	Steam and hot water supply ⁵⁾	1.1	7.82	7.14	0.1	1.32	1.39	0.2	7.39	7.75	1.4
41	Collection, purification and distribution of water	0.5	0.18	0.61	0.2	0.92	1.18	0.1	5.14	6.57	0.8
45	Construction	18.5	3.68	3.92	0.3	0.18	0.26	0.3	1.01	1.45	19.0
45.1,45.2	Site preparation, building	12.2	3.78	4.05	0.2	0.21	0.30	0.2	1.18	1.66	12.6
45.3-45.5	Building installation and other construction	6.3	3.50	3.67	0.1	0.13	0.19	0.1	0.71	1.06	6.4

1) Standard rate 20.5 Euro/MWh, reduced rate 12.3 Euro/MWh.- 2) Increased standard rate by 3.66 Euro/MWh, reduced by 2.196 Euro/MWh.- 3) Increased standard rate by 20.45 Euro/1000 l, reduced by 12.27 Euro/1000 l.- 4) Average of industry, weighted by energy consumption.- 5) Energy tax burden on taxable energy consumption (less exempted consumption for energy conversion).

Sources: Federal Statistical Office Germany (Destatis), own calculations.

Miniscule macroeconomic effects

The macroeconomic impact of the reform has been assessed by using the CGE model LEAN for the period from 2003 to 2010. Basically, the effects are miniscule (Table 4.3-8). This is not surprising, since the impulse of about Euro 600 million is not very significant at less than 0.03 percent of GDP. It is more important to look at the direction of the changes and the reaction of the economy over time. The effect on GDP and employment is negative in the first years, but positive in later years. The CO₂ reduction is largest in the first year. The gap shrinks later on as the GDP grows faster than in the base run. At the end of the simulated period the reduction of CO₂ emissions amounts to 0.04 percent or about 350,000 (metric) tons of CO₂.

Table 4.3-8 Macroeconomic effects of the reform of special provisions

Difference from reference scenario in percent

	2003	2004	2005	2006	2007	2008	2009	2010
CO ₂ emissions	-0.07	-0.05	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04
Employment	-0.05	-0.03	-0.01	0.02	0.01	0.01	0.01	0.01
GDP	-0.05	-0.03	-0.01	0.02	0.01	0.01	0.01	0.01
Private spending	-0.03	-0.01	0.00	0.02	0.02	0.01	0.01	0.01
Public spending	-0.10	-0.08	-0.07	-0.06	-0.05	-0.05	-0.05	-0.05
Investment	0.03	-0.02	-0.02	-0.02	0.01	0.00	0.00	0.00
Exports	0.05	0.01	-0.05	0.02	-0.03	-0.02	-0.01	-0.02
Imports	0.03	0.07	0.09	0.08	0.08	0.08	0.07	0.07

Source: Calculations with LEAN.

Table 4.3-9 describes the effects on the output of the production sectors. These results figure out the same pattern as the change of GDP: an initial decrease, then a slight increase up to 2007, and finally a slight decrease again.

Table 4.3-9 Output effects of the reform of special provisions by economic activities

Difference from reference scenario in percent

	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	-0.07	0.00	0.01	0.01	0.01	0.00	0.00	-0.01
Energy sector	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
Basic/chemical goods	0.00	0.06	0.08	0.08	0.08	0.07	0.07	0.06
Investment goods	0.03	0.08	0.09	0.11	0.10	0.09	0.09	0.08
Consumer goods	0.04	0.04	0.06	0.07	0.06	0.06	0.06	0.05
Construction	-0.06	-0.04	-0.04	-0.01	-0.02	-0.02	-0.01	-0.02
Transport	-0.03	-0.01	0.00	0.01	0.01	0.01	0.01	0.01
Services	-0.06	-0.04	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
Public Sector	-0.02	-0.04	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01

Source: Calculations with LEAN.

More detailed information about the sectoral effects gives Table 4.3-10. The primary impulse stems from a change in unit energy costs. The reduction of pension contributions is identical in both scenarios. The reform of special provision affects only agriculture and the goods and materials sectors. The other industries do not profit from reduced tax rates or tax rebates. The simulation results reflect the interaction of the primary effect of the change of tax rebates and the induced reduction of net energy prices. Therefore, industries not directly affected by the reform (transport, private and public services) show a reduction of unit energy costs. The effect on producer prices depends on the share of energy in total production costs and the price changes of intermediate goods. The increase in unit energy costs induces a substitution of energy by labor and, in the longer run, by capital. Therefore, the effect on employment is in general somewhat more favorable than the effect on output.

Since reduced tax rates and tax rebates are applied only to electricity, natural gas and heating oil, the modification affects the relative price of hard coal and lignite and thus the energy mix.

This may explain why the emissions of basic materials and chemicals increase even though the output is unchanged and unit energy costs increase.

Table 4.3-10 Other effects of the reform of special provisions by economic activities
Difference from reference scenario in percent

	Unit energy costs	Producer price	Output	Employment	CO ₂ emissions
Agriculture	1.18	0.05	-0.07	0.03	-0.06
Energy sector	-0.30	-0.25	-0.08	-0.13	-0.30
Basic/chemical goods	0.15	0.00	0.00	0.01	0.00
Investment goods	-0.64	-0.81	-0.08	-0.60	0.00
Consumer goods	-0.04	-0.03	0.01	0.04	0.00
Construction	0.06	-0.28	-0.16	-0.45	0.00
Transport	-0.70	-0.24	-0.11	-0.11	0.00
Services	0.42	-0.01	0.00	0.04	0.34
Public Sector	1.32	-0.01	0.03	0.05	-1.13

Source: Calculations with LEAN.

4.3.6 Summary and Conclusions

The ecological tax reform might be a success story in terms of government finance, not harming macroeconomic performance, and even slightly enhancing employment via reduced pension contributions for which the eco tax revenue is recycled for. Tax reductions, in particular the special provisions for agriculture and the goods and materials sectors, prevent any appreciable net tax burden that endangers competitiveness and profitability of single industries. On the other side of the coin, these tax reductions cut down considerably the marginal tax rates, and thus reducing the incentives for energy-saving and the reduction of CO₂ emissions in the favored industries. Therefore, the ecological impact reform is rather ambiguous in this respect.

In 2003, the German government modified the special provisions granted to the energy-intensive industries in the framework of the ecological tax reform. On paper, this reform significantly increased the marginal tax rates: from 20 percent up to 60 percent of the eco tax rate with respect to the general reduction and from 0 percent up to 3 percent if the tax cap applies. Actually, with respect to the overall energy consumption of the favored industries, the additional incentives are thwarted by the enlargement of the tax cap's eligibility. Since the tax cap starts at a much lower level of energy consumption after the reform, the effective marginal tax rates only rose for firms with rather high energy intensity and for firms with lower energy intensity not eligible for the tax cap even after the reform. Moreover, the administration and compliance of the tax cap is regarded as rather expensive, both for excise authorities and for

firms. As the number of firms with tax rebates rose from 1,600 up to 12,000, the administration and compliances costs of the reform might have increased strongly.

According to the European Energy Tax Directive, differentiated tax reductions on energy products used for heating purposes or electricity should be confined to “energy-intensive business” from 2007 onwards, having energy costs amounting to at least 3.0 percent of the production value or paying energy tax amounting to at least 0.5 percent of the added value. Our calculations show that this is in fact the case only in some energy-intensive industries. Instead of that, the general retention of the tax cap for all firms of agriculture and the goods and materials sectors has been notified to, and approved by the European Commission based on the climate protection agreement between the German government and the German industry. Moreover, several energy-intensive production processes have been completely exempted from energy taxation since 2007 (see above, footnote 68).

From the perspective of economic and environmental policy, all the remaining tax reductions are inadequate. Alternative approaches that better align ecologic incentives with the competitiveness and profitability of energy-intensive industries should be considered further on (Kohlhaas and Bach, 2007, for a general discussion see Kohlhaas, 2005b, Bach et al., 1998). The marginal tax rate, which is relevant for ecologic incentives, should be kept at the general level as far as possible. This promotes cost-efficient reduction of CO₂ emissions across the economy. Unwanted income effects for existing energy intensive producers could be compensated via transfers or tax allowances, independent from their current energy use. These rebates might be based either on the former energy consumption or on the “typical” or “best-practice” energy intensity of selected productions processes (see Linscheidt and Truger, 2000). Obviously, such allowances schemes within an eco tax regime are rather similar to the “grandfathering” rules implemented in the European Union Emission Trading Scheme for greenhouse gases, which are scheduled to be strengthened from 2013 onwards⁶⁹. These regulations might be aligned. The general conflict of such reduction schemes is, however: If one tries to confine the relief to highly energy-intensive productions processes the administration and compliance become more intricate. Nonetheless, the political decision-making on the eligibility of such processes is highly prone to lobbying (Anger et al., 2008).

⁶⁹ http://ec.europa.eu/environment/climat/emission/ets_post2012_en.htm

4.4 Impact on the Household Sector

Abstract: We analyze the distributional impact of the ecological tax reform in Germany using household survey micro data on income and expenditure of 2003. The energy taxes increased 1999-2003 show a clear regressive impact relative to disposable income. Families with children face a higher tax burden relative to household income. The reduction of pension contributions and the automatic adjustment of social security transfers widely mitigate this regressive impact. Nevertheless, households with low income or with many children bear a slight increase in tax burden. Refunding the eco tax revenue by an eco bonus would make the reform clearly progressive.

4.4.1 Introduction

Experience shows that public debate and politics pay prior attention to the immediate short-run distributional impact of tax reforms. This is even true if the reform aims at long-run objectives of environmental and economic policy, as it is the case with the ecological tax reform. Environmental charges or eco taxes often fall primarily on basic needs. This is the case with energy taxation, in particular with taxes on heating fuels and electricity. Households with lower income face a higher tax burden relative to their household income compared to better earners. Thus, the real income distribution turns out to be more unequal. This is unpopular and might impair goals of social welfare policy, in particular, if households near or below the poverty line are affected significantly.

The overall distributional impact of an ecological tax reform depends on the use of funds from the eco tax revenue. In the longer run, behavioral responses of firms or households have to be taken into account, too. Using the eco tax revenue for funding environmental programs would increase the ecological effectiveness of the reform. However, this would not moderate undesirable impacts on income distribution. It is the charm of the ecological tax reform that the government recycles the extra revenue to the economy via reducing other taxes. This offsets the additional levies for the economy as a whole. For a single household, the individual balance depends on the incidence of the taxes and expenditures involved. Reductions of the pension contributions, as implemented in Germany's ecological tax reform, unburden employees and some self-employed insured in the public pension system, in proportion to their income liable to pension contributions. The recipients of transfer income from social security are compensated as far as these transfers were adjusted with respect to net wage income, which applies automatically in Germany for public pensions, income replacement benefits from social security, and social assistance benefits. Households without considerable income liable to pension contributions or adjusted transfer income go away empty-handed. These are, in particular, the self-employed, civil servants and civil servant's pensioners, and households

living from capital income or annuity payments from private pension schemes. In order to bridge these gaps in compensation for the increased eco tax burden, or, more generally, to mitigate the regressive impact of the reform on income distribution, an “eco bonus” transfer is discussed, i.e., to refund the extra revenue via lump-sum transfers to the households.

Historically, group simulation models based on detailed tabulations from the Income and Consumption Survey (EVS) of the Federal Statistical Office have been used to analyze the distributional impact of energy taxes or broader concepts of an ecological tax reform in Germany (see, e.g., Nagel, 1993, Müller, Nagel and Petersen, 1996, DIW Berlin and FiFo Köln, 1999: 414 ff.). Since the end of the nineties, the micro data of the EVS became available to scientific research. Microsimulation studies on the ecological tax reform based on the EVS wave of 1993 have been realized by Grub (2000) and Bach et al. (2001: 111). The latter study deployed the Potsdam microsimulation model built up by Bork (2000). Fritzsche et al. (2003) from RWI Essen analyze the distributional impact of the fuel taxation based on EVS wave of 1998, RWI Essen and FiFo Köln (2007) update and extend this study based on the EVS wave of 2003.

In this study we run a comprehensive microsimulation analysis on the distributional impact of the ecological tax reform in Germany, based on the EVS of 2003, which is still the last available wave of the German Income and Consumption Survey. In 2003, the final stage of the step-by-step introduction of the ecological tax reform came into force. Effects of the reform on energy use or employment up to this year are yet included in the data. Beside the increased energy taxes, our microsimulation modeling also captures the compensating use of funds for the reduction of pension contributions and the adjustments of public pensions and some social security transfers. In order to adjust the respective items in the simulation analysis, we use estimations from the Federal Government and own estimations on the impact of the ecological tax reform on the pension contribution rate, on the indexation of public pensions, and on the adjustments of wage replacement benefits.

According to our results, the energy taxes increased over the period 1999-2003 show a clear regressive impact with respect to disposable household income. Families with children face a higher tax burden relative to disposable income compared to other households. The reduction of pension contributions and the automatic adjustment of social security transfers widely mitigate this regressive impact. However, households with low income or with many children bear a slight increase in tax burden. Refunding the eco tax revenue by an eco bonus would make the reform clearly progressive.

4.4.2 Microsimulation Model

We analyze the distributional impact of the ecological tax reform in Germany on households with the consumption tax microsimulation model of DIW Berlin, which is based on the Income and Consumption Survey (EVS) of 2003 (see Bach, 2005c). The EVS is a cross-section household survey, collected every 5 years by the German Statistical Offices (Federal Statistical Office, 2005). The sample includes about 60,000 households, of which a 80 percent random sample is provided to researchers as a scientific use file. The main aim of the survey is to collect accurate information about the economic and social situation of households in Germany by capturing all incomes, other revenues, all expenditures, and the main components of financial and other household wealth. It is the only source of detailed and consistent information about household consumption expenditures and savings in Germany. The EVS does not sample households with a monthly net income of more than Euro 18,000 in 2003. Since this truncation affects about 1.5 percent of the population with the high and very high incomes, our results on the distributional impact of the ecological tax reform are somewhat biased with respect to top incomes. Based on the detailed information on consumption expenditure (132 items) we run a consumption tax microsimulation model that calculates the VAT burden and the energy tax burden for each good taxed, assuming fully shifting of the tax burden to final consumers (Bach, 2005c).

Energy taxation

We use the detailed information of the EVS on expenditure for different fuels and electricity to model the energy tax burden falling on the households' energy consumption, assuming that the energy taxation is fully shifted to the consumers (see the discussion below). The EVS only queries the expenditure for the energy sources. Therefore, one has to estimate the physical quantities of the energy consumption according to which the energy tax is levied (see above, Chapter 4.2.1). We divide the expenditure by average prices taken from price and energy statistics, provided by the German Statistical Offices and the energy industry. Since household prices for gas and electricity are considerably differentiated according to consumption features of households, we take into account such price differentiations across size of household, heating system, and size of the dwelling. The EVS of 2003 reports the expenditure on motor fuels only as total, there is no differentiation between gasoline and diesel. Based on the survey

“mobility in Germany” of 2002,⁷⁰ we estimate the probability of having a diesel car within the household according to socio-demographic characteristics observed in both surveys. We impute this information into the EVS and assign the expenditure on motor fuels proportionally to the household’s cars.

The aggregated quantities of energy consumption estimated by these methods are well compatible with the respective macroeconomic figures from energy statistics, national accounts, and environmental accounting (Arbeitsgemeinschaft Energiebilanzen, 2009, Umweltökonomische Gesamtrechnungen, 2009). We simulate the energy tax burden according to the tax provisions of the year 2003 (see above, Chapter 4.2.1). The then tax rate reduction for electric night storage heating was taken into account.

Pension contributions and social security transfers

The contributions for the public pension scheme and for other schemes of social security are accounted in the EVS for each person in the household, differentiated in compulsory social contributions paid by employers or self-employed and voluntary contributions. Using this information, we calculate the effect of a reduction in pension contributions on the households’ net income.

The EVS reports in detail the different transfer incomes from social security. This applies to pensions from public pension schemes according to different categories, the income replacement benefits from social security, and the social assistance benefits. We use this information to simulate the adjustments of social security transfers triggered off by the ecologic tax reform according to the legal provisions. For the impact on the pension contribution rate and the indexation of public pensions, we use estimations from the Federal Government and own estimations (see Chapter 4.2.1, above). According to the simulations on the statutory pension adjustment mechanism, the funds from the increased energy tax revenue transferred to the public pension scheme lead to reduction of the contribution rate by 1.7 percentage points as of 2003 (0.85 percentage points reduction of the employee’s contribution rate), and a 1.14 percent increase in pension income, both compared to a reference scenario without the reform (see also Buslei, 2008). With respect to the income replacement benefits from the unemployment insurance and the health insurance, we roughly simulate the statutory adjustment schemes, which results in a benefit increase of 1.3 percent on average. For social assistance,

⁷⁰ <http://www.mobilitaet-in-deutschland.de/engl/index.htm>

we adjust the current maintenance benefit according to the pension adjustment, and the housing support by the household's individual increase in heating costs.

Other earned incomes or transfer incomes do not benefit from an automatic adjustment caused by the ecologic tax reform. Self-employed, civil servants and civil servant's pensioners (which have a separate pension scheme in Germany funded by the government and are thus not covered by the public pension system), and households living from capital income or annuity payments from private pension schemes do not benefit from the adjustments of pension rates or social security transfers, unless they are compulsory or voluntary insured in the public pension scheme, or receive supplementary social assistance due to low earned income. Moreover, in order to maintain the incentives for energy saving, there was no adjustment of the general housing benefit, which is granted to households with low income.

Incidence assumptions

We assume that the additional eco taxes are fully passed through to final consumers. Insofar, we describe the income effect of the tax reform based on the income and consumptions structures of the year 2003. In that year, the final stage of the step-by-step introduction of the ecological tax reform became effective (see above, Chapter 4.2.1). Effects of the reform on energy use or employment up to this year are yet included in the data. For the microsimulation analysis, we neglect that the ecological tax reform might have changed the prices of other products than energy sources, in particular energy-intensive goods and services. Due to the special provisions granted to the energy-intensive industries, there are no considerable effects to be expected in this field (see Bach, 2007, and Chapter 4.3, above). Simulation studies show only small price effects with respect to transportation services or single agricultural commodities, which are of rather minor importance to the households' budget (Grub, 2000, Bach et al., 2001, see Chapter 4.2.2, above). Likewise, we ignore further effects of the reform on employment and growth, in particular in the course of the reduced pension contributions. Simulation studies also indicate only minor effects on the household income (Bach et al., 2001, Kohlhaas, 2005a, see Chapter 4.2.2, above). The employment is predicted to increase at about 0.5 percent, which amounts to 200,000 additional jobs. The gross domestic product and the national income remain nearly constant.

Recent information from the EVS wave of 2008 is not available yet. In the following, we present the income effect for the year 2003 and refrain from a complex updating of the income- and consumption information to the present. With the rather slight increase in mass income and with respect to the inflation rate, the real disposable income per household went down

since 2003. Correspondingly, the same is true for real private consumption expenditure. However, the employment rose significantly, and unemployment sunk considerably. The boost in energy prices over the last years should have increased the household expenditure on energy consumption, however, and might have increased efforts in energy saving (see *Arbeitsgemeinschaft Energiebilanzen, 2009, FiFo Köln, 2007*). Insofar, the distributional impact of the increased energy taxes today might be somewhat smaller compared to the results for the year 2003 presented in the following sections.

4.4.3 Regressive Distribution of Eco Taxes

From the additional energy taxes in 2003, somewhat more than half fall on the energy consumption of households (see Chapter 4.3.4, above). On average, this makes up 0.75 percent of the disposable income of all households (Table 4.4-1).⁷¹ By deciles of net equivalent household income⁷², the distributional impact of the eco taxes shows a clear regressive trend relative to disposable income. Households with lower income face a higher tax burden relative to their household income compared to better earners. The poorest 10 percent of households pay more than 1 percent of their disposable income for the increased energy taxes, while the top 10 percent are levied only with 0.5 percent. This regressive impact is steady over all deciles. Thus, the real income distribution turns out to be more unequal. The EVS does not sample households with a very high income (more than Euro 18,000 monthly net income). Moreover, studies show that also in the percentiles down to the 95 percent percentile the EVS does not portray well the income distribution (Becker and Hauser, 2003: 73, Merz, 2001). Insofar, we might underestimate the increase in income inequality triggered off by the ecologic tax reform.

⁷¹ The disposable income is defined as net income (which equals to gross income from all sources, including public and private transfers, less income taxes and social security contributions), plus refunds and returns for outlays or commodities, asset transfers, or other revenues not included in gross household income.

⁷² Net equivalent household income is defined as the household's total net income divided by its "equivalent size", to take account of the size and composition of the household, and is attributed to each household member. The equivalent household size is calculated according to the "modified OECD" equivalence scale, which gives a weight of 1.0 to the first adult, a weight of 0.5 to any other household member aged 14 and more, and a weight of 0.3 to each child below 14.

**Table 4.4-1 Distribution of the increased energy taxes¹⁾, 2003
by income group and energy source**

Deciles net equivalent household income ²⁾	Net equivalent household income ²⁾		Energy taxation on				
	Average income	Highest income	natural gas	light fuel oil	electricity	motor fuels	Total
	Euro per month						
			Increased energy tax burden relative to disposable household income in percentage points				
1 st decile	724	909	0.12	0.06	0.41	0.45	1.05
2 nd decile	1 029	1 136	0.11	0.06	0.33	0.49	0.98
3 rd decile	1 233	1 325	0.11	0.05	0.28	0.50	0.94
4 th decile	1 411	1 497	0.10	0.05	0.27	0.52	0.94
5 th decile	1 586	1 676	0.09	0.05	0.24	0.48	0.86
6 th decile	1 772	1 873	0.10	0.05	0.23	0.48	0.85
7 th decile	1 988	2 116	0.09	0.05	0.21	0.45	0.80
8 th decile	2 282	2 471	0.08	0.04	0.19	0.42	0.73
9 th decile	2 745	3 100	0.07	0.04	0.17	0.37	0.66
10 th decile	4 346	.	0.06	0.03	0.12	0.26	0.47
Total	1 868	.	0.08	0.04	0.21	0.41	0.75
			Increased energy tax burden relative to consumption expenditure in percentage points				
1 st decile	724	909	0.11	0.06	0.38	0.42	0.96
2 nd decile	1 029	1 136	0.12	0.06	0.34	0.52	1.04
3 rd decile	1 233	1 325	0.12	0.06	0.31	0.56	1.05
4 th decile	1 411	1 497	0.11	0.06	0.31	0.60	1.08
5 th decile	1 586	1 676	0.11	0.06	0.29	0.57	1.03
6 th decile	1 772	1 873	0.12	0.06	0.29	0.59	1.06
7 th decile	1 988	2 116	0.11	0.06	0.27	0.58	1.02
8 th decile	2 282	2 471	0.11	0.06	0.26	0.56	0.99
9 th decile	2 745	3 100	0.11	0.06	0.25	0.54	0.95
10 th decile	4 346	.	0.11	0.05	0.21	0.46	0.83
Total	1 868	.	0.11	0.06	0.28	0.54	0.99
1) Energy taxes increased by the ecological tax reform, 1999-2003. Assumption: Increased energy taxes are fully shifted to consumers.- 2) Weighted by the modified OECD equivalence scale. Source: Micro simulation based on the German Income and Consumption Survey (EVS) 2003.							

More than 50 percent of the increased energy taxes falling on households stem from the tax hike on motor fuels (Table 4.4-1). This distribution profile turns out to be slightly progressive over the four bottom deciles. From the median incomes upwards, the distributional impact is regressive as it is the case for the other energy sources. Simulations based on former waves of the EVS from the eighties and nineties showed a markedly stronger progression in the bottom half of the income distribution (Nagel, 1993, Müller, Nagel and Petersen, 1996, DIW Berlin and FiFo Köln, 1999: 414, Grub, 2000: 31, Bach et al., 2001: 111, Fritzsche et al., 2003: 107).

A closer look to the bottom deciles shows that the motorization of the poor people obviously has well advanced. After all, 50 percent of the households in the bottom decile drive a car in 2003 and 38 percent even in the lowest 5 percent.

The electricity tax, which makes up 28 percent of the increase in energy taxes, is steadily regressive in all income deciles. The same applies to the higher energy taxes on gas and fuel oil, however, their revenue and distributional impact is rather low.

The regressive distribution of consumption taxes based on household income of a single year is substantially determined by the households' savings rate. It varies hugely across the income distribution, ranging from -15 percent in the lowest decile to more than +25 percent in the highest income decile. However, in the long-run perspective there might be another distributional impact if, according to the lifecycle income hypothesis, savings are withdrawn for consumption and thus are subject to consumption taxes later in life. The same is true, vice versa, if real estate property of durable household equipment is debt-financed and the household has to "save" money for the amortization later on. Insofar, the current consumption expenditure might be deemed as a better indicator with respect to such implications of life income compared to the current income of a single year (Poterba, 1989, Metcalf, 1994, 1999). Based on consumption expenditure, the increase in energy taxes makes up 1 percent on average (Table 4.4-1, lower panel). The distribution across income deciles is widely proportionally. In the bottom deciles there is a slight progression due to the taxation of motor fuels. In the top deciles the tax burden declines markedly. Since we are mainly interested in the political feasibility of the reform in the shorter run, we focus on the distributional impact referring on disposable income in the following.

Analyzing the distribution of the entire energy tax increase in relation to disposable income across different household and family types figures out that families with children see higher tax burdens compared to singles or couples without children having the same net equivalent income (Table 4.4-2). This effect is plausible since children increase the household's energy consumption, but usually contribute to net household income only by extra transfers or tax allowances. This effect is particular pronounced in the lower income deciles. For the median and upper income deciles the eco tax burden of families with more children declines compared to household with one child. Household economies of scale or tax allowances and child benefits might play a role for this effect.

**Table 4.4-2 Distribution of the increased energy taxes¹⁾, 2003
by income group and household type**

Deciles net equivalent household income ²⁾	Single households	Single parents		Married and unmarried couples				Other households	Households total
		with 1 child	with 2 and more children	without children	with 1 child	with 2 children	with 3 and more children		
Increased energy tax burden relative to disposable household income in percentage points									
1 st decile	0.91	1.01	1.04	1.13	1.19	1.32	1.31	1.20	1.05
2 nd decile	0.80	0.96	0.96	1.04	1.17	1.13	1.19	1.00	0.98
3 rd decile	0.76	0.93	0.97	0.95	1.11	1.08	1.08	0.90	0.94
4 th decile	0.84	0.94	1.13	0.91	1.03	1.00	1.01	0.88	0.94
5 th decile	0.72	0.87	0.92	0.83	0.99	0.94	0.90	0.92	0.86
6 th decile	0.74	0.82	0.83	0.84	0.93	0.89	0.86	0.87	0.85
7 th decile	0.73	0.88	0.74	0.80	0.86	0.80	0.76	0.83	0.80
8 th decile	0.66	0.76	0.78	0.75	0.78	0.73	0.69	0.75	0.73
9 th decile	0.63	0.67	0.68	0.67	0.69	0.64	0.60	0.68	0.66
10 th decile	0.45	0.45	0.36	0.48	0.49	0.46	0.43	0.52	0.47
Total	0.68	0.84	0.88	0.71	0.80	0.79	0.80	0.79	0.75
For information: households in 1 000									
Total	14 051	1 349	652	11 159	4 105	3 806	1 372	1 617	38 111
1) Energy taxes increased by the ecological tax reform, 1999-2003. Assumption: Increased energy taxes are fully shifted to consumers. - 2) Weighted by the modified OECD equivalence scale. Source: Micro simulation based on the German Income and Consumption Survey (EVS) 2003.									

4.4.4 Use of Eco Tax Funds Moderate the Tax Regression

The use of the eco tax revenues for the reduction of pension contributions and the automatic adjustment of social security transfers completely compensates the higher energy tax burden for households in total (Table 4.4-3). Thus, the reform turns out to be revenue-neutral for the household sector as a whole. Across the occupational position of the household's principal earner there are considerable differences, however. Households of employees with higher income are made better off by the reform, or bear only a slight burden on balance. White collar employees with higher income benefit from the lower energy taxes relative to income and the reduction of the pension contribution rate. In particular, the better earners are relieved. Low-income employees pay more on balance. Beside wage income liable to pension contributions, public transfers or lump-sum taxed wages from short-time employment taxed (the so called "minijobs" in Germany) make up a larger share of the households' gross income in these deciles. As already mentioned, we neglect the reduction of the employers' pension contribution and its potential long-run impact on higher employment or higher wages.

**Table 4.4-3 Distribution of the ecological tax reform¹⁾, 2003
by income group and occupational position of the principal earner**

Deciles net equivalent household income ²⁾	Self-employed	Civil servant	White-collar employee	Blue-collar employee	Unemployed	Pensioner	Other non-employed	Households total
	Effect of the ecological tax reform relative to disposable household income in percentage points							
1 st decile	0.67	.	0.19	0.25	0.06	- 0.24	0.68	0.13
2 nd decile	0.52	0.82	0.13	0.16	0.20	- 0.16	0.58	0.10
3 rd decile	0.43	1.13	0.01	0.20	0.26	- 0.19	0.54	0.05
4 th decile	0.44	0.82	0.00	0.12	0.35	- 0.14	0.68	0.05
5 th decile	0.36	0.76	- 0.09	0.05	0.14	- 0.12	0.51	- 0.01
6 th decile	0.45	0.69	- 0.13	0.07	0.14	- 0.04	0.42	0.02
7 th decile	0.28	0.62	- 0.15	- 0.02	0.12	0.00	0.33	0.00
8 th decile	0.33	0.57	- 0.19	- 0.08	0.14	0.13	0.34	0.01
9 th decile	0.25	0.50	- 0.26	- 0.12	0.21	0.19	0.53	0.00
10 th decile	0.12	0.38	- 0.25	- 0.10	0.13	0.24	0.51	0.00
Total	0.24	0.51	- 0.17	0.05	0.15	0.01	0.59	0.02
	For information: households in 1 000							
Total	2 155	1 660	11 391	6 411	2 025	12 793	1 677	38 111
<p>1) Energy taxes increased by the ecological tax reform, 1999-2003. Assumption: Increased energy taxes are fully shifted to consumers. Reduction of the employee's social pension contributions by 0.85 percentage points, adjustment of public pensions and social security transfers.- 2) Weighted by the modified OECD equivalence scale. Source: Micro simulation based on the German Income and Consumption Survey (EVS) 2003.</p>								

The ecological tax reform puts only a slight burden on pensioners or unemployed, taking into account the adjustment of social security transfers. The unemployed with the low and medium incomes are made worse off by the reform, whereas pensioners of these income groups profit slightly from the reform. Only few households of self-employed benefit from the reduction of pension contributions as they are compulsory or voluntary insured in the public pension scheme. Moreover, households of civil servants and civil servant's pensioners do not get a appreciable compensation for the higher energy taxes. Obviously, pension contributions or public pensions do not play an important role for their household income.

The cumulative effect of the ecological tax reform across household and family types shows that a higher tax burden remains for families with more children (Table 4.4-4). This is plausible since neither the reductions of pension contributions nor the adjustment of transfers account for children, which applies only to social assistance transfers.

All in all, our simulations reveal a slight regressive distribution of the ecological tax reform. The reduction of the pension contributions and the automatic adjustment of social security transfers considerably moderate the progressive impact of the increased energy taxes, howev-

er. Only at the bottom of the income distribution and for families with more children the reform puts a noticeable weight on households.

**Table 4.4-4 Distribution of the ecological tax reform¹⁾, 2003
by income group and household type**

Deciles net equivalent household income ²⁾	Single households	Single parents		Married and unmarried couples			Other households	Households total	
		with 1 child	with 2 and more children	without children	with 1 child	with 2 children			with 3 and more children
Effect of the ecological tax reform relative to disposable household income in percentage points									
1 st decile	- 0.02	0.20	0.35	0.16	0.27	0.28	0.48	0.38	0.13
2 nd decile	- 0.16	0.21	0.28	0.13	0.25	0.31	0.50	0.15	0.10
3 rd decile	- 0.22	0.10	0.25	0.01	0.25	0.27	0.39	0.00	0.05
4 th decile	- 0.17	0.11	0.48	- 0.04	0.15	0.23	0.32	- 0.04	0.05
5 th decile	- 0.27	0.04	0.31	- 0.08	0.15	0.17	0.25	- 0.02	- 0.01
6 th decile	- 0.22	0.00	0.21	- 0.04	0.10	0.18	0.23	0.04	0.02
7 th decile	- 0.15	0.16	0.29	- 0.06	0.05	0.12	0.18	- 0.05	0.00
8 th decile	- 0.11	0.14	0.35	- 0.03	0.03	0.10	0.16	0.02	0.01
9 th decile	- 0.05	0.10	0.22	- 0.03	0.03	0.05	0.14	0.03	0.00
10 th decile	0.02	0.15	0.17	- 0.03	0.03	0.03	0.13	0.01	0.00
Total	- 0.11	0.13	0.29	- 0.03	0.08	0.13	0.24	0.03	0.02
For information: households in 1 000									
Total	14 051	1 349	652	11 159	4 105	3 806	1 372	1 617	38 111
1) Energy taxes increased by the ecological tax reform, 1999-2003. Assumption: Increased energy taxes are fully shifted to consumers. Reduction of the employee's social pension contributions by 0.85 percentage points, adjustment of public pensions and social security transfers.- 2) Weighted by the modified OECD equivalence scale. Source: Micro simulation based on the German Income and Consumption Survey (EVS) 2003.									

4.4.5 Eco Bonus Would Make the Reform Progressive

Refunding the eco tax revenue to households by an eco bonus is discussed in Germany since the nineties (Bach et al., 1995: 72, DIW Berlin and FiFo Köln, 1999: 428). The additional revenue from eco taxes is to be passed back to the citizens via lump-sum transfers. The idea is to mitigate the regressive impact of the reform on income distribution, and to avoid that some households do not benefit from any compensation if they pay no taxes reduced or do not receive transfers increased. At last, the idea of the eco bonus was sponsored by groups within the German Green Party (AG Ökobonus, 2008). As a basic alternative, the eco bonus could be done by equal per capita transfers. Conceivably, there might be differentiations by age, income, or other socio-demographic characteristics. The incentives for energy saving are fully maintained if the eco bonus is granted independent from the household's individual energy consumption. However, wage income would not benefit from the tax reform as it is now the

case with the reduction of pension contributions. Thus, the positive impact on employment and wage income should be expected to be much smaller or even negative with an eco bonus.

In order to point out the maximum progressive impact on income distribution, we simulate a scenario of an eco bonus with a uniform per capita rate. Dividing the eco tax revenue falling on households in 2003 by all resident citizens would lead to an amount of Euro 10.15 per capita and month. Clearly, such a uniform lump-sum transfer becomes noticeable in relation to lower incomes, whereas it does not count so much for households with higher income (Table 4.4-5). Correspondingly, the cumulative effect of the ecological tax reform would be progressive in terms of disposable income. The real income of households in the first decile would increase by 0.7 percent, for median incomes the increased energy taxes and compensations balance each other widely, whereas households above the median income would go off with a low net burden.

**Table 4.4-5 Distribution of the ecological tax reform¹⁾, 2003
with revenue-neutral compensation by an eco bonus equal per capita
by income group and household type**

Deciles net equivalent household income ²⁾	Single households	Single parents		Married and unmarried couples				Other households	Households total
		with 1 child	with 2 and more children	without children	with 1 child	with 2 children	with 3 and more children		
Effect of the ecological tax reform relative to disposable household income in percentage points									
1 st decile	- 0.49	- 0.90	- 1.28	- 0.66	- 0.90	- 1.20	- 1.20	- 0.86	- 0.71
2 nd decile	- 0.18	- 0.47	- 0.78	- 0.23	- 0.32	- 0.58	- 0.70	- 0.49	- 0.35
3 rd decile	- 0.05	- 0.22	- 0.43	- 0.13	- 0.16	- 0.36	- 0.50	- 0.34	- 0.20
4 th decile	0.13	- 0.06	- 0.08	- 0.03	- 0.09	- 0.24	- 0.40	- 0.21	- 0.08
5 th decile	0.08	- 0.04	- 0.13	- 0.01	0.01	- 0.20	- 0.32	- 0.07	- 0.05
6 th decile	0.16	0.02	- 0.11	0.09	0.04	- 0.13	- 0.24	- 0.02	0.02
7 th decile	0.23	0.17	- 0.10	0.13	0.07	- 0.11	- 0.23	0.06	0.06
8 th decile	0.23	0.15	0.03	0.17	0.09	- 0.05	- 0.18	0.08	0.09
9 th decile	0.27	0.17	0.07	0.18	0.11	- 0.01	- 0.11	0.11	0.14
10 th decile	0.23	0.14	- 0.02	0.18	0.11	0.01	- 0.05	0.14	0.15
Total	0.09	- 0.17	- 0.38	0.09	0.02	- 0.14	- 0.29	- 0.04	0.00
For information: households in 1 000									
Total	14 051	1 349	652	11 159	4 105	3 806	1 372	1 617	38 111
1) Energy taxes increased by the ecological tax reform, 1999-2003. Assumption: Increased energy taxes are fully shifted to consumers. Eco bonus: Lump-sum transfer of Euro 10.15 per household member and month.- 2) Weighted by the modified OECD equivalence scale. Source: Micro simulation based on the German Income and Consumption Survey (EVS) 2003.									

Moreover, the net burden of the existing ecological tax reform on families with children would result in the opposite with an eco bonus equal per capita. It suggests itself that families with many children would considerably benefit from the reform, even those with higher in-

come. Correspondingly, couples and singles without children would bear a larger share of the reform's net burden.

4.4.6 Summary and Conclusions

We present a comprehensive microsimulation analysis on the distributional impact of the ecological tax reform in Germany, based on the Income and Consumption Survey (EVS) of 2003. We show that the energy taxes increased over the years 1999-2003 have a clear regressive impact relative to disposable income, i.e., households with lower income bear a higher tax burden relative to high-income households. The poorest 10 percent of households pay more than 1 percent of their disposable income for the increased energy taxes, while the top 10 percent are levied only with 0.5 percent. This regressive impact is steady over all deciles. Compared to simulations based on former waves of the EVS from the eighties and nineties, the regressive impact of energy taxes is more pronounced in 2003. The main reason is that the progressivity of motor fuel taxes in the bottom half of the income distribution has declined. Even poor people below the poverty line often drive cars nowadays. In total, more than 50 percent of the increased energy taxes falling on households stem from the tax hike on motor fuels. Based on consumption expenditure, the distribution of the increased energy taxes across income deciles is widely proportionally. Families with children face a higher tax burden relative to household income compared to households without children having the same net equivalent income, in particular in the bottom of the income distribution.

The use of the eco tax revenues for the reduction of pension contributions and the automatic adjustment of social security transfers completely compensates the higher energy tax burden for households in total. The regressive distribution of the increased energy taxes is widely mitigated by this use of funds. However, a slight regressive impact of the ecological tax reform remains, in particular for households with low income or with many children. Employees with higher income are made better off by the reform due to the reduction in pension contributions.

The increased tax burden for low-income households seems not to be dramatic, but unpopular and a problem for households near or below the poverty line. Refunding the eco tax revenue to the households via an eco bonus with a uniform per capita rate would make the ecological tax reform clearly progressive in terms of disposable income. However, wage income would not benefit from the tax reform in this case. Thus, the positive impact on employment and wage income should be expected to be much smaller or even negative with an eco bonus. One might combine the alternatives in using the eco tax funds, or pay the eco bonus only to low-

income households respectively. Anyway, specific benefits that directly compensate the increased energy costs should be avoided, since they reduce the incentives for energy saving. This is the case with social assistance and the general housing benefit.

After all, the increased energy taxes only account for a minor part of the strong rise in energy prices since 1998. Notably in 2007 and 2008, the energy prices hiked up to record levels. The analysis on energy taxes presented in this study gives an impression on the distributional impact of such price changes (see also FiFo Köln, 2007). In the public debate, compensations especially to low-income households were claimed.

Not only eco taxes or rising energy and commodity prices cause higher energy costs for firms and households. Similar fiscal and distributional impacts might be triggered off by other regulations of environmental and energy policy that increase energy prices, for instance, price surcharges for the promotion of renewable energies and energy-saving technologies, emission trading schemes, or other regulatory instruments that restrict energy supply. Eco taxes or nongratis emission permits might skim potential economic rents resulting from these regulations. The extra revenue could be used for compensations to firms and households via reduced taxes and contributions or increased transfers. If the energy industry captures such windfall profits, the government participates only by increased business taxes.

5 Summary and Conclusions

Summary

This professorial dissertation thesis collects several empirical studies on tax distribution and tax reform in Germany. The studies reflect the main topics of my research work over the last 10 years at the Public Economics Department of DIW Berlin.

Chapter 2 deals with two studies on effective income taxation, based on representative micro data sets from tax statistics.

Chapter 2.1 presents a study on the effective income taxation at the individual level, in particular with respect to the top incomes (Bach, Corneo and Steiner, 2008). The analysis is based on an integrated micro data file of the income tax statistics and the Socio-Economic Panel (SOEP), which captures the entire income distribution, from the bottom to the very top. Regarding the latter, the data set includes all taxpayers in the top percentile of the gross income distribution. We show that tax base erosion, i.e., the gap between taxable and gross income, is substantial and varies significantly by level and source of income. Despite substantial tax base erosion and significant reductions of top statutory marginal tax rates, the German personal income tax has remained effectively progressive. The distribution of the tax burden is highly concentrated and the German economic elite is still taxed relatively heavily, even though the effective tax rate for this group has significantly declined. Finally, we show that the personal income tax substantially contributes to reduce the concentration of income in Germany, where the lion's share of this redistributive effect is contributed by the top 1 percent of taxpayers.

The study of Chapter 2.2 discusses the effective income taxation of functional income sources, such as labor income, business and capital income, etc. (Bach and Buslei, 2009a). Using income tax micro data and microsimulation models, we allocate the individual income tax liability to the respective income sources, according to different apportionment schemes accounting for losses. Aggregating over the taxpayer population yields the tax shares falling on the several income sources. Including the business taxes levied on corporate income, we calculate implicit tax rates based on the corresponding macroeconomic income aggregates from the national accounts statistics. We find that the choice of the apportionment scheme markedly affects the tax shares of income sources and the implicit tax rates, in particular those of capital income. Income types without significant losses such as labor income or transfer incomes show higher tax shares and implicit tax rates if we account for losses. The opposite is

true for capital income, in particular for income from renting and leasing, since losses from these incomes have been dominating during the last decades in Germany.

Chapter 3 presents two studies on business taxation, based on representative micro data sets from tax statistics and the microsimulation model BizTax.

Chapter 3.1 provides a microsimulation study on fundamental reform options for the German local business tax (Fossen and Bach, 2008). Based on theory and an international comparison, we derive general concepts of local business taxation. Using the BizTax model, we quantify several tax reform options compared to the status quo with respect to the first round effects on revenue and its distribution across firms and regions. We find that today's high concentration of local business tax revenues on corporations with high profits decreases if the tax base is broadened by integrating more taxpayers and by including more elements of value added. The reform scenarios with a broader tax base distribute the local business tax revenue per capita more equally across regional categories, especially by reducing the high concentration of revenues on cores of agglomeration in western Germany. Revenues from local business taxation in rural areas and in East Germany increase.

The study presented in Chapter 3.2 discusses the macroeconomic performance of business taxation against the background of corporate income. We calculate comprehensive measures of the entire business taxation revenue and the tax base accrued in a tax year. A comparison of the tax base reported in tax statistics with the macroeconomic corporate income from national accounts gives hints to considerable tax base erosion. The high weight of reported tax losses underlines this result. The average implicit tax rate on corporate income was around 20 percent since 2001, and thus falling considerably short of statutory tax rates and effective tax rates discussed in the literature. For lack of detailed accounting data it is hard to give precise reasons for the presumptive tax base erosion. Presumably, the opportunities to create hidden reserves, tax-saving strategies of small and medium-sized firms with respect to hidden private expenses, and lax tax enforcement could explain a considerable part of the tax base erosion. International tax avoidance might also be a cause.

Chapter 4 deals with several assessment studies on the ecological tax reform implemented in Germany as of 1999. Chapter 4.1 describes the scientific, ideological, and political background of the ecological tax reform.

Together with other researchers, we ran a first systematic impact analysis commissioned by the German Federal Ministry of Finance (Bach et al., 2001, 2002, 2003). Chapter 4.2 presents the main findings of this study on macroeconomic performance and structural change. We

employed two macroeconomic models, an econometric input-output model and a recursive-dynamic computable general equilibrium (CGE) model. Both models show that Germany's ecological tax reform helps to reduce energy consumption and CO₂ emissions without having a substantial adverse effect on overall economic growth. It could have a slightly positive effect on employment. Exemptions and special provisions for energy-intensive industries widely reduce the incentives to a more pronounced structural change towards less energy-intensive production.

In Chapter 4.3, the reform's impact on the business sector and the effects of special provisions granted to agriculture and the goods and materials sectors are outlined (Bach, 2005c, 2007, Kohlhaas and Bach, 2007). According to the simulations, the special provisions avoid higher tax burdens on the energy-intensive production. However, they widely reduce the marginal tax rates and thus the incentives to energy saving. Though the reform of special provisions 2003 increased the overall tax burden of the energy-intensive industry, the enlarged eligibility for tax rebates neutralizes the ecologic incentives.

Findings on the distributional effects for the household sector are presented in Chapter 4.4. Based on the Income and Consumption Survey of 2003, we carried out a comprehensive micro simulation analysis of the ecological tax reform. The increased energy taxes show a clear regressive impact relative to disposable income. Families with children face a higher tax burden relative to household income. The reduction of pension contributions and the automatic adjustment of social security transfers widely mitigate this regressive impact. Households with low income or with many children nevertheless bear a slight increase in tax burden. Refunding the eco tax revenue by an eco bonus would make the reform clearly progressive.

Further conclusions

The studies presented in this professorial dissertation are strongly oriented to applied economics and policy advice, using microsimulation analysis tools. Most of the research projects in which they have been developed were immediately directed to actors of economic policy. The projects were commissioned by governmental bodies such as the Federal Ministry of Finance and the Federal Environmental Agency, and the results were communicated to the public by the media.

With respect to the scopes of microsimulation modeling and microeconomic studies in the field of tax policy evaluation, substantial advances have been realized over the last decade. Representative micro data sets became accessible from the tax statistics as well as from sever-

al surveys of the statistical offices and other public authorities, such as the Bundesbank, the Federal Employment Agency, or the Statutory Pension Insurance. The broad information provided by the micro databases allows for detailed analysis. Group simulation models based on tabulations from the statistics, for instance in the field of German business taxation, were replaced by microsimulation modeling. Advanced microeconomic models and evaluation strategies have been utilized for the impact analysis of tax reforms. The micro data from tax assessment provide new findings on the income distribution at the very upper bound, since household surveys do not well portray the top income strata.

However, some reservations should be noted with respect to the practical accessibility and usability of the data sets. Due to the restrictive data protection provisions in Germany, scientific use files are only available for the personal income tax statistics and for surveys related to households and persons, since anonymization procedures are not so restrictive for these data. However, the data anonymization often impedes micro analysis mentioned above if relevant characteristics are deleted or streamlined. Generally, business surveys are harder to make anonymous. Thus, many interesting data sets are only available on-site at workplaces within the research data centers, or via remote execution of prepared source code. The former is costly to organize, in particular if the researcher is not located close to a research data center, and the latter makes a thorough data editing rather difficult. Insofar, a broader access to sensible micro data is still at the agenda.

Most of the studies presented here deal with microsimulation strategies and analysis of the first-round distributional and fiscal impacts. The studies describe the immediate impact of taxation and tax reform in the shorter run, on which policymakers and the public are mainly interested on. However, further economic effects of tax reforms have to be taken into account in the longer run. Detailed data sets, in particular micro data, allow for empirical analysis of the behavioral responses of the taxpayers. Such evidence can be used to simulate second and third-round effects of tax policy. Estimations on corporate tax base elasticities and on financial leverage have been carried out in our project on business taxation, analyzing the tax reform of 2001 and based on several waves of the corporate income tax statistics (Dwenger and Steiner, 2008, 2009). A bulk of empirical research has been carried out over the last years, analyzing several other decisions of the firms, regarding location, investment, portfolio allocation, or choices of legal form. Several studies for Germany have been made in this field using micro data from the foreign direct investment stock statistics of the Bundesbank (see, e.g., Weichenrieder, 2009, Buettner and Wamser, 2009). Moreover, databases of financial statements such as DAFNE and Hoppenstedt (for Germany), or AMADEUS (for Europe) and

ORBIS (worldwide) are used for the research (see, e.g., Egger et al., 2008, Dwenger, 2009). However, these databases do not capture tax-specific items. Moreover, they are not representative for the entire business sector in Germany. Thus, one can not generalize the findings on behavioral response without further ado. Therefore, detailed accounting information should be collected from the firms' tax assessment, which is not available in Germany up to now.

Reliable elasticities on the firms' decision making can be used to simulate second and third-round effects of tax reforms. Moreover, this could shed more light on the effective incidence of corporate taxation, which is still a kind of terra incognita in public finance (see Gentry, 2007). However, more complex interactions with capital and labor markets, commodity markets, other taxes and transfers, public expenditure, and foreign trade are hard to model in a general equilibrium setting, taking into account the broader information from the micro analysis. The complexity of such models is rising strongly progressive with the number of agents. Therefore, computable modeling approaches in these fields are confined to a small number of representative agents (see, e.g., Radulescu, 2007, Stimmelmayer, 2007). However, evidence from microsimulation or microeconomic analysis can be used as input to such macroeconomic models, and, vice versa, the results from these models can be given back to the micro analysis. We used such a kind of micro-macro linkage for the evaluation study on the ecological tax reform in Germany.

Bibliography

- AG Ökobonus - Bettina Herlitzius, Gerhard Schick (2008): Ökobonus – neues Instrument für Klimaschutz und ökologische Gerechtigkeit. Diskussionsvorlage für den Länderrat am 5. April 2008. Bündnis 90/Die Grünen.
http://www.gruene.de/cms/default/dokbin/226/226560.diskussionspapier_zum_oekobonus.pdf
- Andersen, Mikael Skou, Niels Dengsøe, Anders Branth Pedersen (2001): An Evaluation of the Impact of Green Taxes in the Nordic Countries. TemaNord 2000:561. Kopenhagen.
<http://www.norden.org/pub/ebook/2001-566.pdf>
- Anger, Niels, Christoph Böhringer, Andreas Lange (2008): The political economy of environmental tax differentiation: theory and empirical evidence. Universität Oldenburg, Wirtschaftswissenschaftliche Diskussionspapiere: Reihe V, Volkswirtschaftliche Reihe, 306.
- Arbeitsgemeinschaft Energiebilanzen e.V. (2009): Auswertungstabellen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2008. Berechnungen auf Basis des Wirkungsgradansatzes. Stand: September 2009. <http://www.ag-energiebilanzen.de/viewpage.php?idpage=139>
- Atkinson, Antony B., Thomas Piketty (eds.) (2007): Top Incomes Over the Twentieth Century. Oxford: Oxford University Press.
- Bach, Stefan (2005a): Fundamental Reform of Income Tax: In How Far Can the Assessment Basis Be Broadened and Tax Law Simplified? DIW Berlin Weekly Report No. 32/2005.
http://www.diw.de/documents/publikationen/73/diw_01.c.43769.de/diw_wr_2005-32.pdf. Deutsche Fassung: Grundlegende Reform der Einkommensbesteuerung: Inwieweit kann die Bemessungsgrundlage verbreitert und das Steuerrecht vereinfacht werden? Wochenbericht des DIW Berlin Nr. 36/2005. http://www.diw.de/documents/publikationen/73/diw_01.c.43556.de/05-36-2.pdf
- Bach, Stefan (2005b): Be- und Entlastungswirkungen der ökologischen Steuerreform nach Produktionsbereichen. Band I des Endberichts für das Vorhaben: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation“. Forschungsprojekt im Auftrag des Umweltbundesamtes. FuE-Vorhaben Förderkennzeichen 204 41 194. August 2005.
<http://www.umweltdaten.de/publikationen/fpdf-l/2960.pdf>
- Bach, Stefan (2005c): Mehrwertsteuerbelastung der privaten Haushalte. Dokumentation des Mehrwertsteuer-Moduls des Konsumsteuer-Mikrosimulationsmodells des DIW Berlin auf Grundlage der Einkommens- und Verbrauchsstichprobe. DIW Berlin Data Documentation 10.
http://www.diw.de/documents/publikationen/73/diw_01.c.43845.de/diw_datadoc_2005-010.pdf
- Bach, Stefan (2007): Belastungswirkungen der ökologischen Steuerreform in den Produktionsbereichen: Steuervergünstigungen reduzieren ökologische Anreize. Zeitschrift für Umweltpolitik & Umweltrecht 30, 53-78.
- Bach, Stefan, Michael Kohlhaas, Volker Meinhardt, Barbara Praetorius, Hans Wessels, Rudolf Zwiener (1995): Wirtschaftliche Auswirkungen einer ökologischen Steuerreform. DIW-Sonderheft Nr. 153. Berlin: Duncker & Humblot. Executive summary in English: Ecological tax reform even if Germany has to go it alone. DIW Economic Bulletin, 7/1994.
<http://www.springerlink.com/content/p442rq1173422286/fulltext.pdf>
- Bach, Stefan, Michael Kohlhaas, Barbara Praetorius, Bernhard Seidel, Rudolf Zwiener (1998): Sonderregelungen zur Vermeidung von unerwünschten Wettbewerbsnachteilen bei energieintensiven Produktionsbereichen im Rahmen einer Energiebesteuerung mit Kompensation. DIW-Sonderheft Nr. 163. Berlin: Duncker & Humblot. Executive summary in English: The Use of Tax Allowances to Reduce Competitive Disadvantages Resulting from Ecological Tax Reform. DIW Economic Bulletin, 7/1997. <http://www.springerlink.com/content/e245467426571581/fulltext.pdf>

- Bach, Stefan, Christhart Bork, Michael Kohlhaas, Bernd Meyer, Barbara Praetorius, Heinz Welsch (2001): Die ökologische Steuerreform in Deutschland. Eine modellgestützte Analyse ihrer Wirkungen auf Wirtschaft und Umwelt. Unter Mitarbeit von Viola Ehrenheim und Katja Schumacher. Berlin, Heidelberg: Physica. http://books.google.de/books?id=2S-q6rjlvSgC&printsec=frontcover&dq=%C3%96kologische+Steuerreform&sig=NA-AjeK_HIV7NIIvHSVzK_c9Ks#PPP1.M1
- Bach, Stefan, Dieter Vesper (2002): Finanz- und Investitionskrise der Gemeinden erzwingt grundlegende Reform der Kommunalfinanzen. Wochenbericht des DIW Berlin 31. http://www.diw.de/documents/publikationen/73/diw_01.c.92409.de/02-31.pdf
- Bach, Stefan, Michael Kohlhaas, Bernd Meyer, Barbara Praetorius, Heinz Welsch (2002): The effects of environmental fiscal reform in Germany: A simulation study. Energy Policy 30, 803-811.
- Bach, Stefan, Michael Kohlhaas, Bernd Meyer, Barbara Praetorius, Heinz Welsch (2003): Auswirkungen und Perspektiven der Ökologischen Steuerreform in Deutschland: Eine modellgestützte Analyse. Perspektiven der Wirtschaftspolitik 4, 223-238.
- Bach, Stefan, Hermann Buslei (2003): Fiskalische Wirkungen einer Reform der Ehegattenbesteuerung. Wochenbericht des DIW Nr. 22/2003. http://www.diw.de/documents/publikationen/73/diw_01.c.40450.de/03-22.pdf
- Bach, Stefan, Hermann Buslei, Dagmar Svindland, Hans J. Baumgartner, Juliane Flach, Dieter Teichmann (2003): Untersuchung zu den Wirkungen der gegenwärtigen Ehegattenbesteuerung auf Grundlage von fortgeschriebenen Einzeldaten der Einkommensteuerstatistik. Materialien des DIW Berlin Nr. 27. http://www.diw.de/documents/publikationen/73/diw_01.c.40444.de/diw_rn03-05-27.pdf
- Bach, Stefan, Peter Haan, Hans-Joachim Rudolph, Viktor Steiner (2004): Reformkonzepte zur Einkommens- und Ertragsbesteuerung: Erhebliche Aufkommens- und Verteilungswirkungen, aber relativ geringe Effekte auf das Arbeitsangebot. Wochenbericht des DIW Berlin Nr. 16/2004. http://www.diw.de/documents/publikationen/73/diw_01.c.41622.de/04-16.pdf
- Bach, Stefan, Hermann Buslei, Hans-Joachim Rudolph, Erika Schulz, Dagmar Svindland (2004): Aufkommens- und Belastungswirkungen der Lohn- und Einkommensteuer 2003 bis 2005. Simulationsrechnungen auf Grundlage von fortgeschriebenen Einzeldaten der Einkommensteuerstatistik mit dem Lohn- und Einkommenssteuersimulationsmodell des DIW Berlin. Materialien des DIW Berlin Nr. 38. http://www.diw.de/documents/publikationen/73/diw_01.c.41633.de/diw_rn04-04-38.pdf
- Bach, Stefan, Giacomo Corneo, Viktor Steiner (2005): Top Incomes and Top Taxes in Germany. DIW Berlin Discussion Paper 532, Berlin. http://www.diw.de/documents/publikationen/73/diw_01.c.43871.de/dp532.pdf
- Bach, Stefan, Nadja Dwenger (2007): Unternehmensbesteuerung: Trotz hoher Steuersätze mäßiges Aufkommen. Wochenbericht des DIW Berlin Nr. 5/2007. http://www.diw.de/documents/publikationen/73/diw_01.c.55734.de/07-5-1.pdf
- Bach, Stefan, Viktor Steiner (2007): Steuerreformpläne im empirischen Vergleich. In: Markus Zwick, Joachim Merz u.a. (ed.): MITAX - Mikroanalysen und Steuerpolitik: Beiträge zur wissenschaftlichen Konferenz am 6. und 7. Oktober 2005 in Lüneburg. Statistik und Wissenschaft, Band 7. Wiesbaden: Statistisches Bundesamt Wiesbaden, 54-83. <https://www-ec.destatis.de/csp/shop/sfg/bpm.html.cms.cBroker.cls?cmspath=struktur.vollanzeige.csp&ID=1020984>
- Bach, Stefan, Giacomo Corneo, Viktor Steiner (2007): The Entire Distribution of Market Income in Germany, 1992-2001. CEPR Policy Insight No. 4. June 2007. <http://www.cepr.org/pubs/PolicyInsights/PolicyInsight4.pdf>
- Bach, Stefan, Hermann Buslei, Nadja Dwenger (2007a): Unternehmensteuerreform 2008: Positives Signal auf Kosten der Steuersystematik. Wochenbericht des DIW Berlin 74, 293-301. http://www.diw.de/documents/publikationen/73/diw_01.c.57328.de/07-18-1.pdf

- Bach, Stefan, Hermann Buslei, Nadja Dwenger, Frank Fossen (2007b): Aufkommens- und Verteilungseffekte der Unternehmensteuerreform 2008: Eine Analyse mit dem Unternehmensteuer-Mikrosimulationsmodell BizTax. Vierteljahrshefte zur Wirtschaftsforschung 76, 74-85.
http://www.diw.de/documents/publikationen/73/diw_01.c.60126.de/diw_vjh_07-2-6.pdf
- Bach, Stefan, Hermann Buslei, Nadja Dwenger, Frank Fossen (2008a): Dokumentation des Mikrosimulationsmodells BizTax zur Unternehmensbesteuerung in Deutschland. DIW Berlin Data Documentation 29.
http://www.diw.de/documents/publikationen/73/diw_01.c.79803.de/diw_datadoc_2008-029.pdf
- Bach, Stefan, Hermann Buslei, Nadja Dwenger, Frank Fossen, Viktor Steiner (2008b): Verbesserung der steuerstatistischen Informationssysteme zur Folgenabschätzung und Evaluierung steuerpolitischer Maßnahmen im Bereich der Unternehmensbesteuerung. DIW Berlin: Politikberatung kompakt 43. Berlin 2008.
http://www.diw.de/documents/publikationen/73/diw_01.c.83602.de/diwkompakt_2008-043.pdf
- Bach, Stefan, Giacomo Corneo, Viktor Steiner (2008): Effective Taxation of Top Incomes in Germany, 1992-2002. DIW Berlin Discussion Papers 767.
http://www.diw.de/documents/publikationen/73/diw_01.c.79344.de/dp767.pdf
- Bach, Stefan, Giacomo Corneo, Viktor Steiner (2009): From Bottom to Top: The Entire Income Distribution in Germany, 1992-2003. Review of Income and Wealth 55, 331-359.
- Bach, Stefan, Hermann Buslei (2009a): The Impact of Losses on Income Tax Revenue and Implicit Tax Rates of Different Income Sources. Evidence from Microsimulation Using Tax Statistics for Germany. DIW Berlin Discussion Paper 950.
http://www.diw.de/documents/publikationen/73/diw_01.c.343857.de/dp950.pdf
- Bach, Stefan, Hermann Buslei (2009b): Empirische Analysen zur Zinsschranke auf Grundlage von Handelsbilanzdaten. DIW Berlin Research Notes 30.
http://www.diw.de/documents/publikationen/73/diw_01.c.96142.de/rn30.pdf. Kurzfassung: Zinsschranke trifft vor allem Großunternehmen. Wochenbericht des DIW Berlin Nr. 17/2009.
http://www.diw.de/documents/publikationen/73/diw_01.c.97201.de/09-17-3.pdf
- Bach, Stefan, Michael Broer, Frank Fossen (2010): Sollen Freiberufler und Landwirte Gewerbesteuer zahlen? Steuersystematische Überlegungen und empirische Wirkungsanalysen. Jahrbuch für Regionalwissenschaft 30, 71-90.
- Baldwin, Richard, Paul Krugman (2002): Agglomeration, Integration and Tax Harmonization. NBER Working Paper W9290. National Bureau of Economic Research.
- Baldwin, Richard, Rikard Forslid, Philippe Martin, Gianmarco Ottaviano, Frederic Robert-Nicoud (2003): Economic Geography and Public Policy. Princeton: Princeton University Press.
- Becker, Irene, Richard Hauser (2003): Anatomie der Einkommensverteilung. Ergebnisse der Einkommens und Verbrauchsstichprobe 1969-1998. Berlin: Sigma.
- Becker, Johannes, Clemens Fuest (2004): A Backward-Looking Measure of the Effective Marginal Tax Burden on Investment. CESifo Working Paper No. 1342.
http://www.ifo.de/pls/guestci/download/CESifo%20Working%20Papers%202004/CESifo%20Working%20Papers%20November%202004/cesifo1_wp1342.pdf
- Becker, Johannes, Clemens Fuest (2006): Ist Deutschland Hoch- oder Niedrigsteuerland? Der Versuch einer Synthese. Perspektiven der Wirtschaftspolitik 7, 35-42.
- Bernd Jonas (2009): Das Volumen von Steuersubstratverlagerungen in Outbound-Fällen. In: W. Spindler et al. (eds.): Steuerzentrierte Rechtsberatung. Festschrift für Harald Schaumburg zum 65. Geburtstag. Köln: Schmidt, S. 793-812.
- Beuermann, Christiane, Tilman Santarius (2006): Ecological tax reform in Germany: Handling two hot potatoes at the same time. Energy Policy 34, 917-929.
- Binswanger, Hans Christoph, Werner Geissberger, Theo Ginsburg (1978): Der NAWU-Report: Wege aus der Wohlstandsfalle. Strategien gegen Arbeitslosigkeit und Umweltzerstörung. Fischer. Frankfurt am Main: S. Fischer.

- Binswanger, Hans-Christoph, Heinz Frisch, Hans G. Nutzinger et al.. (eds.) (1983): Arbeit ohne Umweltzerstörung. Strategien für eine neue Wirtschaftspolitik. Frankfurt am Main: S. Fischer.
- Bird, Richard M. (1999): Rethinking Tax Assignment: The Need for Better Subnational Taxes. IMF Working Paper WP/99/165. <http://www.imf.org/external/pubs/ft/wp/1999/wp99165.pdf>
- BMF – Bundesministerium der Finanzen (2004): Zur Eignung der Steuereinnahmen von Lohnsteuer und veranlagter Einkommensteuer für Analysen der Steuerlastverteilung. Monatsbericht des BMF, Oktober 2004. http://www.bundesfinanzministerium.de/nr_324/DE/BMF_Startseite/Service/Downloads/Abt_I/27137_0.templateId=raw.property=publicationFile.pdf
- Böhringer, Christoph, Thomas F. Rutherford (2002): In Search for a Rationale for Differentiated Environmental Taxes. ZEW Discussion Paper No. 02-30. Zentrum für Europäische Wirtschaftsforschung. <ftp://ftp.zew.de/pub/zew-docs/dp/dp0230.pdf>
- Bork, Christhart (2000): Steuern, Transfers und private Haushalte. Eine mikroanalytische Simulationsstudie der Aufkommens- und Verteilungswirkungen. Frankfurt am Main et al.: Lang.
- Bovenberg, Ary Lans (1999): Green Tax Reforms and the Double Dividend: an Updated Reader's Guide. International Tax and Public Finance 6, 421-443. <http://www.springerlink.com/content/qk37243t05622042/>
- Buettner, Thiess, Georg Wamser (2009): Internal Debt and Multinationals' Profit Shifting - Empirical Evidence from Firm-Level Panel Data. Oxford University Centre for Business Taxation, Working Papers 0918. http://www.sbs.ox.ac.uk/centres/tax/Documents/working_papers/WP0918.pdf
- Buettner, Thiess, Michael Overesch, Ulrich Schreiber, Georg Wamser (2008): The impact of thin-capitalization rules on multinationals' financing and investment decisions. Deutsche Bundesbank Discussion Paper Series 1: Economic Studies. No 03/2008. <http://www.bundesbank.de/download/volkswirtschaft/dkp/2008/200803dkp.pdf>
- Bundesbank (2004): Ratios from financial statements of German enterprises 2000 to 2002. Special Statistical Publication 6. http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2000_2002.en.pdf
- Bundesbank (2005): Ratios from financial statements of German enterprises 2002 to 2003. Special Statistical Publication 6. http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2002_2003.en.pdf
- Bundesbank (2006): Extrapolated results from financial statements of German enterprises 1994 to 2003. Special Statistical Publication 5. http://www.bundesbank.de/download/statistik/stat_sonder/statso5_1994_2003.en.pdf
- Bundesbank (2007): Ratios from financial statements of German enterprises 2003 to 2004. Special Statistical Publication 6. http://www.bundesbank.de/download/statistik/stat_sonder/statso6_2003_2004.en.pdf
- Bundesrechnungshof (2006): Probleme beim Vollzug der Steuergesetze. Empfehlungen des Präsidenten des Bundesrechnungshofes als Bundesbeauftragter für Wirtschaftlichkeit in der Verwaltung zur Verbesserung des Vollzuges der Steuergesetze in Deutschland. Schriftenreihe des Bundesbeauftragten für Wirtschaftlichkeit in der Verwaltung Band 13. Stuttgart: Kohlhammer. <http://books.google.de/books?id=Y3P4I2yYhbUC&printsec=frontcover#v=onepage&q=&f=false>
- Bundesvereinigung der kommunalen Spitzenverbände (2003): Vorschlag für eine modernisierte Gewerbesteuer. <http://www.staedtetag.de/imperia/md/content/pressedien/2003/11.pdf>
- Burkhauser, Richard V., Takashi Oshio, Ludmila Rovba (2007): How the Distribution of After-Tax Income Changed Over the 1990s Business Cycle: A Comparison of the United States, Great Britain, Germany and Japan. Michigan Retirement Research Center Working Paper 145. <http://www.mrrc.isr.umich.edu/publications/Papers/pdf/wp145.pdf>
- Buslei, Hermann (2008): Wirkungen der ökologischen Steuerreform auf den Beitragssatz der Gesetzlichen Rentenversicherung (GRV) und die Rentenanpassung. Mimeo, DIW Berlin.

- Buslei, Hermann, Viktor Steiner (1999): Beschäftigungseffekte von Lohnsubventionen im Niedriglohnbereich. Baden-Baden: Nomos.
- Clark, W. Steven (2002): Using micro-data to assess average effective tax rates. CESifo Venice Summer Institute 2002. Workshop on "Measuring the Tax Burden on Capital and Labour". http://www.cesifo-group.de/DocCIDL/cesifo_wp966.pdf
- Corneo, Giacomo (2005): The Rise and Likely Fall of the German Income Tax, 1958-2005. CESifo Economic Studies 51, 159-186.
- De Laet, Jean-Pierre, Florian Wöhlbier (2008): Tax burden by economic function. A comparison for the EU Member States. MPRA Munich Personal RePEc Archive. http://mpra.ub.uni-muenchen.de/14761/1/MPRA_paper_14761.pdf
- Dell, Fabien (2005): Top Income in Germany and Switzerland over the Twentieth Century. Journal of the European Economic Association 3, 1-10.
- Deutsche Bundesbank (2006): Extrapolated results from financial statements of German enterprises 1994 to 2003. Special Statistical Publication 5. http://www.bundesbank.de/download/statistik/stat_sonder/statso5_1994_2003.en.pdf
- Deutsche Bundesbank (2009a): Balance of payments statistics. December 2009. <http://www.bundesbank.de/download/volkswirtschaft/zahlungsbilanzstatistik/2009/balanceofpayments122009.pdf>
- Deutsche Bundesbank (2009b): Foreign direct investment stock statistics. Special Statistical Publication 10. http://www.bundesbank.de/download/statistik/stat_sonder/statso10_en.pdf
- Deutscher Bundestag (2002): Entwurf eines Gesetzes zur Fortentwicklung der ökologischen Steuerreform. 5.11.2002. Deutscher Bundestag, Drucksache 15/21. <http://dip21.bundestag.de/dip21/btd/15/000/1500021.pdf>
- Deutscher Bundestag (2007): Entwurf eines Unternehmensteuerreformgesetzes 2008. Gesetzentwurf der Fraktionen der CDU/CSU und SPD. 27.03.2007. Deutscher Bundestag, Drucksache 16/4841. <http://dipbt.bundestag.de/dip21/btd/16/048/1604841.pdf>
- Devereux, Michael P., Christina Elschner, Dieter Endres, Jost H. Heckemeyer, Michael Overesch, Ulrich Schreiber, Christoph Spengel (2008): Effective levels of company taxation within an enlarged EU. Report prepared for the European Commission, TAXUD/2005/DE/3 10. http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/economic_studies/effective_levels_report.pdf
- Devereux, Michael P., Rachel Griffith (1999): The taxation of discrete investment choices (Revision 2). Institute for Fiscal Studies, Working Paper Series No. W98/16. <http://www.ifs.org.uk/wps/wp9816.pdf>
- Devereux, Michael P., Rachel Griffith (2003): Evaluating tax policy for location decisions. International Tax and Public Finance 10, 107-126.
- Devereux, Michael P., Rachel Griffith, Alexander Klemm (2002): Corporate Income Tax Reforms and International Tax Competition. Economic Policy 17, 451-495.
- Devereux, Michael P., Rachel Griffith, Alexander Klemm (2004): Why has the UK corporation tax raised so much revenue? Fiscal Studies 25, 367-388. <http://www.ifs.org.uk/wps/wp0404.pdf>
- DIW Berlin (Deutsches Institut für Wirtschaftsforschung Berlin) (2002): Stellungnahme zum Entwurf eines Gesetzes zur Fortentwicklung der ökologischen Steuerreform vom 5.11.2002 anlässlich der Anhörung des Finanzausschusses des Deutschen Bundestages am 12. November 2002. Prepared by Stefan Bach and Michael Kohlhaas. Berlin, 11 November 2002. http://www.diw-berlin.de/documents/dokumentenarchiv/17/41829/hearing_oekstreform4.pdf

- DIW Berlin, FiFo Köln (Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln) (1999): Anforderungen an und Anknüpfungspunkte für eine Reform des Steuersystems unter ökologischen Aspekten. Forschungsbericht des Umweltbundesamtes 296 14 175. UBA FB 99-024/1. Berichte des Umweltbundesamtes 99.3. Berlin: Erich Schmidt Verlag. Kurzfassung: Stefan Bach, Michael Kohlhaas, Bodo Linscheidt, Bernhard Seidel, Achim Truger: Ökologische Steuerreform. Wie die Steuerpolitik Umwelt und Marktwirtschaft versöhnen kann. Berlin: Erich Schmidt Verlag, 1999
- Döring, Thomas, Lars P. Feld (2005): Reform der Gewerbesteuer: Wie es Euch gefällt? – Eine Nachlese. Perspektiven der Wirtschaftspolitik 6, 207-232.
- Dunning, John H., Sarianna M. Lundan (2008): Multinational Enterprises and the Global Economy. Cheltenham: Edward Elgar. http://books.google.de/books?id=xIk3fF2z5KcC&source=gbs_navlinks_s
- Dwenger, Nadja (2008): Tax Loss Offset Restrictions - Last Resort for the Treasury? An Empirical Evaluation of Tax Loss Offset Restrictions Based on Micro Data. DIW Berlin Discussion Papers 764. <http://www.diw.de/documents/publikationen/73/79199/dp764.pdf>
- Dwenger, Nadja (2009): Corporate taxation and investment: Explaining investment dynamics with firm-level panel data. DIW Discussion Paper 924. http://www.diw.de/documents/publikationen/73/diw_01.c.341687.de/dp924.pdf
- Dwenger, Nadja, Viktor Steiner (2008): Effective Profit Taxation and the Elasticity of the Corporate Income Tax Base: Evidence from German Corporate Tax Return Data. DIW Discussion Paper 829. http://www.diw.de/documents/publikationen/73/diw_01.c.89661.de/dp829.pdf
- Dwenger, Nadja, Viktor Steiner (2009): Financial Leverage and Corporate Taxation: Evidence from German Corporate Tax Return Data. DIW Discussion Paper 855. http://www.diw.de/documents/publikationen/73/diw_01.c.94405.de/dp855.pdf
- Egger, Peter, Simon Loretz, Michael Pfaffermayr, Hannes Winner (2008): Firm-specific Forward-looking Effective Tax Rates. Oxford University Centre for Business Taxation, Working Paper 08/11. <http://users.ox.ac.uk/~mast1732/RePEc/pdf/WP0811.pdf>
- Elschner, Christina, Werner Vanborren (2009): Corporate Effective Tax Rates in an Enlarged European Union. Taxation Papers 14, Directorate General Taxation and Customs Union, European Commission. http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_14_en.pdf
- European Commission (2001): Company Taxation in the Internal Market. Commission staff working paper, COM(2001)582 final. Brussels, 23.10.2001, SEC(2001) 1681. http://ec.europa.eu/taxation_customs/resources/documents/company_tax_study_en.pdf
- European Commission (2007): Taxes in Europe Database. http://ec.europa.eu/taxation_customs/taxation/gen_info/info_docs/tax_inventory/index_en.htm
- European Commission (2009): Taxation trends in the European Union. Data for the EU Member States and Norway. 2009 edition. Luxembourg. http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_structures/2009/2009_full_text_en.pdf
- Federal Ministry of Economics and Technology (2007): Projektion der gesamtwirtschaftlichen Entwicklung in Deutschland bis 2011. Teil III: Mittelfristige Projektion. Monatsbericht 07-2007 BMWi. http://www.bmwi.de/BMWi/Redaktion/PDF/P-R/projektion-monatsbericht-juli-2007_property=pdf.bereich=bmwi.sprache=de.rwb=true.pdf
- Federal Ministry of Finance (2002): An ABC of Taxes in Germany. 2002 edition. http://english.benefitax.com/fileadmin/projekt_allgemein/teilnehmer_12921/PDF/An_ABC_of_taxes_in_Germany_BMF.pdf
- Federal Office for Building and Regional Planning (2007): Siedlungsstrukturelle Gebietstypen. http://www.bbr.bund.de/cln_015/nn_103086/BBSR/DE/Raumbeobachtung/Werkzeuge/Raumabgrenzung/en/SiedlungsstrukturelleGebietstypen/gebietstypen.html

- Federal Statistical Office (2001): Lohn- und Einkommensteuer 2001 - Statistik über die Personengesellschaften/Gemeinschaften. <http://www-ec.destatis.de>
- Federal Statistical Office (2001-2007): Fachserie 18: Volkswirtschaftliche Gesamtrechnungen. <http://www-ec.destatis.de>
- Federal Statistical Office (2005): Wirtschaftsrechnungen. Einkommens- und Verbrauchsstichprobe - Aufgabe, Methode und Durchführung der EVS2003. Fachserie 15, Heft 7. Wiesbaden. <https://www-ec.destatis.de/csp/shop/sfg/bpm.html.cms.cBroker.cls?cmspath=struktur,vollanzeige.csp&ID=1017774>
- Federal Statistical Office (2009): National Accounts. Gross Domestic Product in Germany in accordance with ESA 1995. Methods and Sources. Version following the major revision 2005. Subject-matter series 18, series S. 22. Wiesbaden. <https://www-ec.destatis.de/csp/shop/sfg/bpm.html.cms.cBroker.cls?cmspath=struktur,vollanzeige.csp&ID=1023848>
- Federation of German Industries (BDI), German Chemical Industry Association (VCI) (eds.) (2001): Verfassungskonforme Reform der Gewerbesteuer – Konzept einer kommunalen Einkommen- und Gewinnsteuer. Köln: div Deutscher Instituts-Verlag. http://www.bdi.eu/download_content/SteuernUndFinanzpolitik/12_BDI_VCI-Studie_Gewerbesteuerreform.pdf
- Feenberg, Daniel, James Poterba (2000): The Income and Tax Share of Very High-Income Households, 1960-1995. American Economic Review Papers and Proceedings 90, 264-270.
- FiFo Köln - Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln (2007): Auswirkungen stark steigender Preise für Öl und Gas auf Verbraucherinnen und Verbraucher in NRW. Kurzstudie im Auftrag der Enquêtekommision zu den Auswirkungen längerfristig stark steigender Preise von Öl- und Gasimporten auf die Wirtschaft und die Verbraucherinnen und Verbraucher in Nordrhein-Westfalen des Landtags Nordrhein-Westfalen. April 2007. http://www.wiso.uni-koeln.de/finanzfors/pdf/Endbericht_Enquete_P165.pdf
- FÖS (Förderverein Ökologische Steuerreform, ed.) (1997): Innovationen anstoßen, Wettbewerbsfähigkeit fördern, Arbeitsplätze schaffen. Der neue Weg zu einer Ökologischen Steuerreform. Hamburg.
- Fossen, Frank, Stefan Bach (2008): Reforming the German Local Business Tax. Lessons from an International Comparison and a Microsimulation Analysis. FinanzArchiv / Public Finance Analysis 64, 245-272.
- Fritzsche, Bernd, Rainer Kambeck, Hans Dietrich von Loeffelholz u.a. (2003): Empirische Analyse der effektiven Inzidenz des deutschen Steuersystems. Untersuchungen des Rheinisch-Westfälischen Instituts für Wirtschaftsforschung 42. Essen.
- Fuest, Clemens, Bernd Huber (2003): Lösungsmöglichkeiten und Probleme bei der Gewerbesteuerreform. Wirtschaftsdienst 83, 560-565.
- Gentry, William M. (2007): A Review of the Evidence on the Incidence of the Corporate Income Tax. Office of Tax Analysis, US Department of the Treasury. OTA Paper 101. <http://www.ustreas.gov/offices/tax-policy/library/ota101.pdf>
- German Council of Economic Advisors (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung) (2001): Für Stetigkeit – gegen Aktionismus. Jahresgutachten 2001/2002, Wiesbaden. http://www.sachverstaendigenrat-wirtschaft.de/download/gutachten/01_ges.pdf
- German Council of Economic Advisors (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung) (2003): Staatsfinanzen konsolidieren – Steuersystem reformieren. Jahresgutachten 2003/2004, Wiesbaden. http://www.sachverstaendigenrat-wirtschaft.de/download/gutachten/03_ges.pdf

- German Council of Economic Advisors (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung) (2006): Reform der Einkommens- und Unternehmensbesteuerung durch die Duale Einkommensteuer. Expertise im Auftrag der Bundesminister der Finanzen und für Wirtschaft und Arbeit vom 23. Februar 2005. Wiesbaden. http://www.sachverstaendigenrat-wirtschaft.de/download/publikationen/dit_gesamt.pdf
- Gordon, Roger H., John D. Wilson (1986): An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment. *Econometrica* 54, 1357-1373.
- Görres, Anselm, Ernst Ulrich v. Weizsäcker, Henner Ehringhaus (1994): Der Weg zur ökologischen Steuerreform. Weniger Umweltbelastung und mehr Beschäftigung. Das Memorandum des Fördervereins Ökologische Steuerreform. München: Olzog.
- Gorter, Joeri, Ruud A. de Mooij (2001): Capital Income Taxation in Europe: Trends and Trade-Offs. CPB Special Publications 30. Centraal Planbureau - Netherlands Bureau for Economic Policy Analysis, Den Haag. <http://www.cpb.nl/eng/pub/cpbreeksen/bijzonder/30/bijz30.pdf>
- Görzig, Bernd Claudius Schmidt-Faber (2001): Gewinnaussagen von Bundesbank und Volkswirtschaftlicher Gesamtrechnung im Vergleich. Sonderhefte Deutsches Institut für Wirtschaftsforschung 171. Berlin: Duncker & Humblot.
- Grub, Martin (2000): Verteilungswirkungen der ökologischen Steuerreform auf private Haushalte: Eine empirische Analyse. In: Vierteljahrshefte zur Wirtschaftsforschung 69, 17-37. http://www.diw.de/documents/publikationen/73/38718/v_00_1_2.383195.pdf
- Haan, Peter, Viktor Steiner (2005): Distributional Effects of the German Tax Reform 2000 - A Behavioral Microsimulation Analysis. *Schmollers Jahrbuch – Journal of Applied Social Science Studies* 125, 39-49.
- Hackmann, Johannes (1979): Die Besteuerung des Lebenseinkommens. Ein Vergleich von Besteuerungsverfahren, Tübingen: Mohr (Siebeck).
- Haisken-DeNew, John P., Joachim R. Frick (2005): DTC Desktop Companion to the German Socio-Economic Panel (SOEP). Version 8.0 - Dec 2005, Updated to Wave 21 (U). http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.38951.de/dtc.409713.pdf
- Heckemeyer, Jost H., Christoph Spengel (2008): Ausmaß der Gewinnverlagerung multinationaler Unternehmen – empirische Evidenz und Implikationen für die deutsche Steuerpolitik. *Perspektiven der Wirtschaftspolitik* 9, 37-61.
- Hillebrand, Bernhard (1999): Sektorale Wirkungen der Energiesteuerreform 1999. RWI-Papiere, Nr. 58. Rheinisch-Westfälisches Institut für Wirtschaftsforschung, September 1999. http://www.rwi-es-sen.de/pls/portal30/docs/FOLDER/PUBLIKATIONEN/RWI_PAPIERE/RWI_PAPIER58/PAP058.PDF
- IBFD - International Bureau of Fiscal Documentation (2007): European Tax Handbook. Amsterdam: IBFD Publications.
- IFS London - Institute for Fiscal Studies (2005): Corporate tax rate data. <http://www.ifs.org.uk/data/internationaltaxdata.zip>
- Jacob, Martin, Rainer Niemann, Martin Weiss (2008): The Rich Demystified: A Reply to Bach, Corneo, and Steiner (2008). CESifo Working Paper No. 2478. http://www.cesifo-group.de/~DocCIDL/cesifo1_wp2478.pdf
- Jacobs, Otto H., Christoph Spengel (1999): The Effective Average Tax Burden in the European Union and the USA: A Computer-based Calculation and Comparison with the model of the European Tax Analyzer, ZEW Discussion Paper No. 99-54. <ftp://ftp.zew.de/pub/zew-docs/dp/dp5499.pdf>
- Jacobs, Otto H., Christoph Spengel (2002): Effective Tax Burden in Europe. ZEW Economic Studies 15. Heidelberg: Physica.
- Jarass, Lorenz, Gustav M. Obermaier (2003): Von der Gewerbesteuer zur Kommunalen Betriebssteuer. *Wirtschaftsdienst* 83, 157-163.

- Junkernheinrich, Martin (2003): Reform des Gemeindefinanzsystems: Mission Impossible? Vierteljahrshefte zur Wirtschaftsforschung 72, 423-443.
http://www.diw.de/documents/publikationen/73/42025/v_03_3_7.pdf
- Kassella, Thomas, Uwe Hochmuth (1989): Ein synthetisches Mikrodatenfile des Haushaltssektors für steuerpolitische Simulationen. Sonderforschungsbereich 3: Mikroanalytische Grundlagen der Gesellschaftspolitik, J. W. Goethe-Univ. Frankfurt und Univ. Mannheim. Arbeitspapier Nr. 299.
- King, Mervyn A., Don Fullerton (1984): The Taxation of Income from Capital. Chicago and London: University of Chicago Press.
- Kohlhaas, Michael (2005a): Gesamtwirtschaftliche Effekte der ökologischen Steuerreform. Band II des Endberichts für das Vorhaben: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation“. Forschungsprojekt im Auftrag des Umweltbundesamts. FuE-Vorhaben Förderkennzeichen 204 41 194. August 2005.
<http://www.umweltdaten.de/publikationen/fpdf-l/2961.pdf>
- Kohlhaas, Michael (2005b): Energy taxation and competitiveness – Special provisions for business in Germany’s environmental tax reform. In: Critical Issues in International Environmental Taxation: International and Comparative Perspectives, ed. by Hope Ashiabor et al., Vol 2. Richmond: Richmond Law & Tax.
- Kohlhaas, Michael, Stefan Bach (2007): The effect of special provisions in the framework of energy taxes on environmental effectiveness: the case of Germany. In: Kurt Deketelaere (ed.): Critical issues in environmental taxation, Vol. 4. Oxford Univ. Press, 359-376.
- Kouvaritakis, Nikos, Nikos Stroblos and Leonidas Paroussos (ICCS-NTUA), Tamas Revesz and Erno Zalai (CPAS-CUB University), Denise Van Regemorter (CES-KULeuven) (2005): Impacts of energy taxation in the enlarged European Union. Evaluation with GEM-E3 Europe. Study for the European Commission DG TAXUD.TAXUD/2003/DE/308. Final Report. 11.7.2005.
http://europa.eu.int/comm/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/economic_studies/energy_tax_study.pdf
- Krebs, Carsten, Danyel T. Reiche, Martin Rocholl (1998): Die Ökologische Steuerreform. Was sie ist, wie sie funktioniert, was sie uns bringt. Ed. by Deutscher Naturschutzring (DNR), Naturschutzbund (NABU), and Bund für Umwelt und Naturschutz Deutschland (BUND). Berlin, Basel, Boston: Birkhäuser.
- Lang, Oliver, Karl-Heinz Nöhrbaß, Konrad Stahl (1997): On Income Tax Avoidance: The Case of Germany. Journal of Public Economics 66, 327-347.
- Lietz, Christine, Daniela Mantovani (2007): A Short Introduction to EUROMOD: An integrated European tax-benefit model. In: O. Bargain (ed.): Microsimulation in Action: Policy Analysis in Europe using EUROMOD. Research in Labor Economics. Amsterdam: Elsevier, 1-26.
- Linscheidt, Bodo, Achim Truger (2000): Energiebesteuerung und Sonderregelungen für die Industrie: Ein Konzept prozessspezifischer Freibeträge. Zeitschrift für angewandte Umweltforschung 13, 50-65.
- Luh, Thomas (1996): Verbesserung der statistischen Erfassung der Unternehmensgewinne zur Berechnung des Bruttosozialprodukts von der Einkommenseite. Band 3 der Schriftenreihe Spektrum der Bundesstatistik. Stuttgart.
- Maiterth, Ralf (2003): Die Gewerbesteuer als ungerechtfertigte ‘Großbetriebssteuer’? – Eine empirische Analyse. Schmollers Jahrbuch – Journal of Applied Social Science Studies 123, 545-562.
- Maiterth, Ralf, Markus Zwick (2006): A Local Income and Corporation Tax as an Alternative to the German Local Business Tax. Jahrbücher für Nationalökonomie und Statistik 226, 285-307.
- Mendoza, Enrique G., Assaf Razin, Linda L. Tesar (1994): Effective Tax Rates in Macroeconomics. Cross-country Estimates of Tax Rates on Factor Incomes and Consumption. Journal of Monetary Economics 34, 297-323.

- Mennel, Annemarie, Jutta Foerster (eds.) (2006): Steuern in Europa, Amerika und Asien. 61st edition. Herne: nwb.
- Merz, Joachim (2001): Was fehlt in der EVS? Eine Verknüpfung mit der Einkommensteuerstatistik für die Verteilungsanalyse hoher Einkommen. In: Irene Becker, Notburga Ott, Gabriele Rolf (eds.): Soziale Sicherung in einer dynamischen Gesellschaft. Festschrift für Richard Hauser zum 65. Geburtstag. Frankfurt/M. et al.: Campus, 278-300.
- Metcalf, Gilbert E. (1994): Life Cycle versus Annual Perspectives of the Incidence of the Value Added Tax. In: J. M. Poterba (Ed.), Tax Policy and the Economy, Vol. 8. Cambridge, Mass.: MIT Press, 45-64.
- Metcalf, Gilbert E. (1999): A distributional analysis of green tax reforms. National Tax Journal 52, 655-681.
[http://ntj.tax.org/wwwtax%5Cnjrec.nsf/F57602350346C55985256AFC007F1BF7/\\$FILE/v52n4655.pdf](http://ntj.tax.org/wwwtax%5Cnjrec.nsf/F57602350346C55985256AFC007F1BF7/$FILE/v52n4655.pdf)
- Meyer, Bernd, Georg Ewerhart (1998): Multisectoral Policy Modelling for Environmental Analysis. In: Environmental Accounting in Theory and Practice, ed. by Kimio Uno and Peter Bartelmus. Kluwer, 395-406.
- Müller, Klaus, Thomas Nagel, Hans-Georg Petersen (1996): Ökosteuerreform und Senkung der direkten Abgaben: Zu einer Neugestaltung des deutschen Steuer- und Transfersystems. Finanzwissenschaftliche Diskussionsbeiträge Nr. 8. <http://lsfiwi.wiso.uni-potsdam.de/publikationen/diskuss/pdf/paper08.pdf>
- Nagel, Thomas (1993): Allokative und distributive Effekte einer umweltgerechten Umgestaltung des deutschen Steuersystems. Frankfurt/M. et al.: Campus.
- OECD (1990): The Personal Income Tax Base: A Comparative Study. Paris: OECD.
- OECD (1991): Taxing Profits in a Global Economy. Domestic and International Issues. Paris: OECD.
- OECD (2001): Tax Ratios – A Critical Survey. Paris: OECD.
- OECD (2005): Measuring Globalisation. OECD Economic Globalisation Indicators 2005. Paris: OECD.
- OECD (2006): Revenue Statistics 1965-2005 - 2006 Edition. Paris: OECD.
- OECD (2007): Taxing Wages 2005/2006: 2006 Edition. Paris: OECD.
http://www.oecd.org/document/17/0,3343,en_2649_34533_38148433_1_1_1_1,00.html
- OECD (2009): Revenue Statistics 1965-2008. Paris: OECD.
- OECD Tax Database (2009): <http://www.oecd.org/ctp/taxdatabase>
- Office for National Statistics UK (200): UK ESA95 Gross National Income Inventory of Methods.
http://www.statistics.gov.uk/downloads/theme_economy/Final_ESA95_Inventory.pdf
- Olson, Mancur (1969): The Principle of 'Fiscal Equivalence': The Division of Responsibilities among Different Levels of Government. Papers and Proceedings of the Eighty-first Annual Meeting of the American Economic Association. American Economic Review 59, 479-487.
- Parisi, Valentino (2003): A Cross Country Simulation Exercise Using the DIECOFIS Corporate Tax Model. European Commission IST Programme DIECOFIS, Work Package no. 7, Deliverable no. 7.2. http://petra1.istat.it/diecofis/App/Finals/del7.2_it_uk_site.doc
- Petersen, Hans-Georg, Antje Fischer, Juliane Flach (2005): Wirkungen der Einfachsteuer auf die Steuerbelastung von Haushalten und Unternehmen. Perspektiven der Wirtschaftspolitik 6, 71-94.
- Piketty, Thomas, Emmanuel Saez (2003): Income Inequality in the United States, 1913-1998. Quarterly Journal of Economics 118, 1-39.

- Piotrowska, Joanna, Werner Vanborren (2008): The corporate income tax rate-revenue paradox: Evidence in the EU. Taxation Papers 12, Directorate General Taxation and Customs Union, European Commission.
http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_12_en.pdf
- Plachta, Robert Christopher (2008): Schuldenfalle Finanzausgleich. Theoretische und empirische Analyse der deutschen Finanzverfassung. Dissertation, Wirtschafts- und Sozialwissenschaftliche Fakultät der Universität zu Köln. 2008. <http://kups.ub.uni-koeln.de/volltexte/2009/2584/pdf/Plachta-Dissertation.pdf>
- Poterba, James M. (1989): Lifetime Incidence and the Distributional Burden of Excise Taxes. American Economic Review 79, 325-330.
- Quinke, Hermann (2001): Erneuerung der Stichprobe des ESt-Modells des Bundesministeriums der Finanzen auf Basis der Lohn- und Einkommensteuerstatistik 1995. Fraunhofer-Institut für Angewandte Informationstechnik FIT, Sankt Augustin. Unveröffentlichter Projektbericht April 2001.
- Radulescu, Doina Maria (2007): CGE Models and Capital Income Tax Reforms: The Case of a Dual Income Tax for Germany. Heidelberg: Springer.
- Ramb, Fred, Alfons J. Weichenrieder (2004): Taxes and the Financial Structure of German Inward FDI. Review of World Economics (Weltwirtschaftliches Archiv) 141, 670-692.
- Reidenbach, Michael (2006): Zur Auswahl von Gemeindetypen für die Regionalisierung der Berechnungen zur Unternehmenssteuerreform. Unpublished manuscript, German Institute of Urban Affairs (Difu).
- Rosanne Altshuler, Alan J. Auerbach, Michael Cooper, Matthew Knittel (2008): Understanding U.S. Corporate Tax Losses. NBER Working Paper No. 14405, October 2008.
<http://www.nber.org/papers/w14405>
- Ruding Report (1992): Report of the Committee of Independent Experts on Company Taxation, Luxembourg: Commission of the European Communities.
- RWI Essen, FiFo Köln (Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln) (2007): Der Zusammenhang zwischen Steuerlast und Einkommensverteilung. Forschungsprojekt für das Bundesministerium für Arbeit und Soziales. Endbericht, Dezember 2007. RWI Projektberichte. Essen.
http://www.bmas.de/portal/27422/property=pdf/a367_forschungsprojekt.pdf
- Schaumburg, Harald (2006): Normative Defizite und internationale Verrechnungspreise. Der Konzern 2006, 495-502.
- Scherf, Wolfgang (2002): Ersatz der Gewerbesteuer durch eine anrechenbare Wertschöpfungsteuer. Wirtschaftsdienst 82, 603-608.
- Schlegelmilch, Kai (2005): Insights in Political Processes on the Ecological Tax Reform from a Ministerial Perspective. In: Applied research in environmental economics, ed. by Christoph Böhringer, Andreas Lange. Berlin, Heidelberg: Physica, 299-314.
- Schöb, Ronnie (2005): The double-dividend hypothesis of environmental taxes: a survey. In: The international yearbook of environmental and resource economics. Cheltenham et al.: Elgar, 223-279.
- Schwarze, Johannes (1995): Simulating German Income and Social Security Tax Payments using the GSOEP. Cross-National Studies in Aging Program Project Paper No. 19.
http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.39001.de/p19.409859.pdf
- Slemrod, Joel (1994): On the High-Income Laffer Curve. In: Joel Slemrod (ed.): Tax Progressivity and Income Inequality. Cambridge: Harvard University Press.

- Sørensen, Peter Birch (2004): Measuring Taxes on Capital and Labor: An Overview of Methods and Issues. In: Peter Birch Sørensen: Measuring the tax burden on capital and labor. Cambridge, Ma., London: MIT Press, 1-33.
- Sørensen, Peter Birch (2007): Can Capital Income Taxes Survive? And Should They? CESifo Economic Studies 53, 172-228. <http://cesifo.oxfordjournals.org/cgi/content/abstract/53/2/172>
- Spahn, Paul Bernd, Helmut Kaiser, Thomas M. Kassella (1992): The tax dilemma of married women in Germany. Fiscal studies 13, 22-47.
- Spengel, Christoph (2003): Internationale Unternehmensbesteuerung in der Europäischen Union. Steuerwirkungsanalyse, Empirische Befunde, Reformüberlegungen. Düsseldorf: IDW-Verlag.
- Spengel, Christoph, Christina Elschner, Michael Grünewald, Timo Reister (2007): Einfluss der Unternehmensteuerreform 2008 auf die effektive Steuerbelastung. Vierteljahrshefte zur Wirtschaftsforschung 76, 86-97. http://www.diw.de/documents/publikationen/73/diw_01.c.60125.de/diw_vjh_07-2-7.pdf
- Statistics Netherlands, National Accounts Department (2008): Gross National Income Inventory (ESA 95). <http://www.cbs.nl/NR/rdonlyres/D6900700-8D0A-4E7E-B611-A7906B94A77B/0/2009GROSSNATIONALINCOMEINVENTORYESA95pub.pdf>
- Statistics Sweden (2008): ESA95 GNI Inventory Sweden, Revision 4 – August 2008. http://www.scb.se/statistik/NR/NR0102/ESA95%20GNI%20Inventory_revAug2008.pdf
- Steiner, Viktor, Peter Haan, Katharina Wrohlich, Johannes Geyer (2008): Documentation of the Tax-Benefit Microsimulation Model STSM: Version 2008. DIW Berlin Data Documentation 31. http://www.diw.de/documents/publikationen/73/diw_01.c.83857.de/diw_datadoc_2008-031.pdf
- Stimmelmayer, Michael (2007): Fundamental Capital Income Tax Reforms: Discussion and Simulation Using ifoMOD. Tübingen: Mohr Siebeck.
- Studenski, Paul (1940): Toward a Theory of Business Taxation. Journal of Political Economy 48, 621-654.
- Testa, William A., William H. Oakland (1996): A Benefits Principle Approach to State-Local Business Taxation: Policies for Midwestern Growth and Development. Federal Reserve Bank of Chicago. http://www.chicagofed.org/digital_assets/others/events/1996/designing_state/1996_designing_state_local_fiscal_policy_testa.pdf
- U.S. Department of Commerce, Bureau of Economic Analysis (2009): Concepts and Methods of the U.S. National Income and Product Accounts. October 2009. <http://www.bea.gov/national/pdf/NIPAhandbookch1-4.pdf>
- Umweltgutachten (1974): Der Rat von Sachverständigen für Umweltfragen. Umweltgutachten 1974. Stuttgart: Kohlhammer. Bundestags-Drucksache 7/2802.
- Umweltökonomische Gesamtrechnungen (2009): Umweltnutzung und Wirtschaft - Tabellen zu den Umweltökonomischen Gesamtrechnungen 2009. Teil 2: Kapitel 3 Energie. Wiesbaden. <https://www-ec.destatis.de/csp/shop/sfg/bpm.html.cms.cBroker.cls?cmspath=struktur.vollanzeige.csp&ID=1024830>
- UPI (Umwelt- und Prognose-Institut Heidelberg e.V.) (1988): Öko-Steuern als marktwirtschaftliches Instrument im Umweltschutz – Vorschläge für eine ökologische Steuerreform. UPI-Bericht Nr. 9. Heidelberg.
- Verbist, Gerlinde (2004): Redistributive effect and progressivity of taxes. An International Comparison across the EU using EUROMOD. Institute for Social and Economic Research, University of Essex. EUROMOD Working Papers em 5/04. <http://www.iser.essex.ac.uk/publications/working-papers/euromod/em5-04.pdf>
- Vesper, Dieter (2004): Gemeindefinanzen und Unternehmensbesteuerung. In: Margit Schratzenstaller, Achim Truger (eds.): Perspektiven der Unternehmensbesteuerung. Marburg: Metropolis.

- Vickrey, William (1939): Averaging of Income for Income-Tax Purposes. *Journal of Political Economy* 43, 379-397.
- Wagenhals, Gerhard (1997): A microsimulation approach for tax and social policy recommendations in the Federal Republic of Germany. *Diskussionsbeiträge aus dem Institut für Volkswirtschaftslehre, Universität Hohenheim* 143. Stuttgart: Institut für Volkswirtschaftslehre, Univ. Hohenheim.
- Wagstaff, Adam, Eddy van Doorslaer (2001): What Makes the Personal Income Tax Progressive? A Comparative Analysis for Fifteen OECD Countries. *International Tax and Public Finance* 8, 299-316.
- Wagstaff, Adam, Eddy van Doorslaer, et al. (1999): Redistributive effect, progressivity and differential tax treatment: Personal income taxes in twelve OECD countries. *Journal of Public Economics* 72, 73-98.
- Wamser, Georg, Michael Overesch (2007): Corporate Tax Planning and Thin-Capitalization Rules: Evidence from a Quasi-Experiment. *Applied Economics*, First published on: 13 November 2007 (iFirst). <http://dx.doi.org/10.1080/00036840701704477>
- Weichenrieder, Alfons (2009): Profit shifting in the EU: Evidence from Germany. *International tax and public finance* 16, 281-297.
- Weichenrieder, Alfons J., Helen Windischbauer (2008): Thin-Capitalization Rules and Company Responses. Experience from German Legislation. http://www.cesifo-group.de/~DocCIDL/cesifo1_wp2456.pdf
- Weichenrieder, Alfons J., Martin Ruf (2009): The Taxation of Passive Foreign Investment. Lessons from German Experience. CESifo Working Paper No. 2624. http://www.cesifo-group.de/DocCIDL/cesifo1_wp2624.pdf
- Weizsäcker, Ernst Ulrich v. (1989): *Erdpolitik: Ökologische Realpolitik an der Schwelle zum Jahrhundert der Umwelt*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Weizsäcker, Ernst Ulrich v., Samuel P. Mauch, Rolf Iten, Jochen Jesinghaus (1992): *Ökologische Steuerreform. Europäische Ebene und Fallbeispiel Schweiz*. Chur: Rüegger.
- Welsch, Heinz, Frank Hoster (1995): A General-Equilibrium Analysis of European Carbon/Energy Taxation: Model Structure and Macroeconomic Results. *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 115, 275-303.
- Zimmermann, Horst (2002): *Gewerbesteuerreform – in welche Richtung?* *Wirtschaftsdienst* 82, 465-470.
- Zodrow, George R. (2008): *The Property Tax Incidence Debate and the Mix of State and Local Finance of Local Public Expenditures*. Oxford University Centre for Business Taxation WP 08/01. http://www.sbs.ox.ac.uk/centres/tax/Documents/working_papers/WP0801.pdf
- Zwick, Markus (2001): Individual tax statistics data and their evaluation possibilities for the scientific community. *Schmollers Jahrbuch – Journal of Applied Social Science Studies* 121, 639-648.
- Zwick, Markus (2007): *Alternative Modelle zur Ausgestaltung von Gemeindesteuern: Mikroanalytische Quantifizierung der Einnahme-, der Einkommens- und der Verteilungseffekte*. Dissertation thesis. *Statistik und Wissenschaft, Band 8*. Wiesbaden: Federal Statistical Office.
- Zwick, Markus, Nicole Buschle, Heike Habla, Ralf Maiterth (2003): *Reform der Gemeindefinanzen – die kommunale Einnahmeseite*. *Wirtschaft und Statistik* 7/2003, 633-647. <http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Querschnittsveroeffentlichungen/WirtschaftStatistik/FinanzenSteuern/ReformGemeindefinanzen.property=file.pdf>