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Impact of tax rate cut cum base broadening reforms on heterogeneous firms: Learning from the German tax reform 2008

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Cut Cum Base Broadening Reforms
on Heterogeneous Firms**

Learning from the German Tax Reform 2008

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Non-technical summary

This paper presents a new corporate microsimulation model, ZEW TaxCoMM, which allows for the coherent micro-based analysis (ex ante and ex post) of reform induced revenue implications and the distribution of the tax burden between firms of different characteristics. In this paper, ZEW TaxCoMM is employed to evaluate the consequences of the 2008 German corporate tax reform.

The German corporate tax reform of 2008 has brought about important cuts in corporate tax rates, which were at the same time accompanied by significant changes in the determination of the tax base for both major German corporate taxes - corporate income tax and trade tax. The reform followed the distinct and internationally prevalent pattern of tax rate cut cum base broadening. Hence, the results on the distribution of the tax burden according to firm characteristics stand exemplarily for those reforms which follow a similar pattern. Especially in view of the current economic crisis, questions on the distribution of the tax burden among firms of different characteristics have arisen and still remain at the heart of the academic and political debate in Germany and other countries.

As a result, the ZEW TaxCoMM simulations show that less than 5% of all corporations did *not* benefit from the 2008 German corporate tax reform. The average annual relief as measured by the average decline in the effective tax burden *on cash flows* amounts to 2.8 percentage points for large corporations and to 6 percentage points for small corporations. Clearly, small firms benefited more. As to tax revenues, the reform induced decrease amounts to € 9.8 billion. The decline in tax revenues is more important for the corporate income tax. The trade tax thus gains fiscally in importance.

Furthermore, the simulation illustrates that firms with low profitability, high debt ratio and high capital intensity benefit *least* from the reform. This is a consequence of the reform detaching the tax base from profits by banning the deduction of business expenses. This additionally endangers the existence of firms in times of massive economic downturn. Indeed, policy makers in Germany and other countries reacted by modifying the most harmful regulations which implied the taxation of economic worth instead of profits.

Zusammenfassung

Dieser Beitrag präsentiert ein neues Mikrosimulationsmodell, das ZEW TaxCoMM, welches für auf Mikrodaten basierende Analysen der Auswirkungen von Unternehmenssteuerreformen entwickelt wurde. ZEW TaxCoMM simuliert sowohl die Verteilung der Belastungswirkungen einer Reform als auch ihre steuerlichen Aufkommenswirkungen. In diesem Papier wird ZEW TaxCoMM eingesetzt, um die Auswirkungen der deutschen Unternehmenssteuerreform 2008 zu bewerten.

Die deutsche Unternehmenssteuerreform des Jahres 2008 verbindet eine deutliche Senkung der steuerlichen Tarifbelastung von Unternehmen mit einer Verbreiterung der Bemessungsgrundlagen der Körperschaftsteuer sowie der lokalen Gewerbesteuer. Die Reform folgt damit einem gängigen Muster, dem sog. *tax rate cut cum base broadening*.

Die in diesem Papier ausgewiesenen Reformkonsequenzen in Abhängigkeit struktureller Unternehmensmerkmale stehen daher exemplarisch für Reformen in anderen Ländern, die einem ähnlichen Muster folgen. Insbesondere angesichts der gegenwärtigen wirtschaftlichen Verwerfungen sind Fragen nach einer sinnhaften steuerlichen Belastung heterogener Unternehmen in den Fokus der wissenschaftlichen und politischen Debatte gerückt.

Im Ergebnis zeigen die Simulationen auf Basis des ZEW TaxCoMM, dass weniger als 5% aller Kapitalgesellschaften in Deutschland *nicht* von der Unternehmenssteuerreform 2008 profitiert haben. Die durchschnittliche jährliche Entlastung, gemessen am durchschnittlichen Rückgang der effektiven Steuerbelastung des *Cash Flows*, beträgt 2,8 Prozentpunkte für Großunternehmen und 6 Prozentpunkte für kleine Unternehmen. Kleine Firmen haben damit weitaus deutlicher von der Reform profitiert. Mit Blick auf die Aufkommenswirkungen der Reform ermittelt ZEW TaxCoMM einen reformbedingten Rückgang der Steuereinnahmen in Höhe von 9,8 Milliarden Euro. Der Rückgang der Steuereinnahmen betrifft vor allem die Körperschaftsteuer. Die Gewerbesteuer gewinnt somit fiskalisch an Bedeutung.

Darüber hinaus zeigt die Simulation, dass Unternehmen mit geringer Rentabilität, hohem Schuldenstand oder hoher Kapitalintensität *am wenigsten* von der Reform profitieren. Dies ist eine Folge der reformgetriebenen Abkopplung der steuerlichen Bemessungsgrundlage von den Unternehmensgewinnen. Dies bedeutet eine zusätzliche Gefährdung der Existenz von Unternehmen in Zeiten eines massiven wirtschaftlichen Abschwungs. In der Tat hat die Politik auf diese Fehlentwicklung bereits reagiert. Zahlreiche Regelungen, die mit einer Besteuerung der Unternehmenssubstanz anstelle des Unternehmensgewinns einhergingen, wurden korrigiert.

Impact of Tax Rate Cut Cum Base Broadening Reforms on Heterogeneous Firms – Learning from the German Tax Reform 2008

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Abstract: The German corporate tax reform of 2008 has brought about important cuts in corporate tax rates, which were at the same time accompanied by significant changes in the determination of the tax base for both major German corporate taxes - corporate income tax and trade tax. The reform followed the distinct and internationally prevalent pattern of tax rate cut cum base broadening. Its implications are thus not unique to Germany. Especially in view of the current economic crisis, questions on the distribution of the tax burden among firms of different characteristics have arisen and still remain at the heart of the academic and political debate in Germany and other countries.

In this paper we present a new corporate microsimulation model, ZEW TaxCoMM, which allows for the coherent micro-based analysis of revenue implications of tax reforms and the distribution of tax consequences among heterogeneous firms. The model processes firm-level financial accounting input data and derives the firm specific tax base and tax due endogenously in accordance with the tax code. To smooth out distortions between the sample and the population of German corporations, the sample is extrapolated on the basis of the corporate income tax statistic.

The simulation results show inter alia that the average annual relief as measured by the average decline in the effective tax burden *on cash flow* amounts to 2.8 percentage points for large corporations and to 6 percentage points for small corporations. Furthermore, the results illustrate that firms with low profitability, high debt ratio and high capital intensity benefit least from the reform. As to tax revenues, the reform induced decrease amounts to € 9.8 billion and the trade tax gains fiscally in importance.

JEL Codes: H 25, H 32, K 34, C 8

Keywords: tax reform, microsimulation, tax policy evaluation

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1 Introduction

Economists have a long standing experience in capturing the incentives of taxation on micro-economic decision behavior. Approaches based on the neoclassical investment theory (Hall and Jorgenson (1967), King and Fullerton (1984), Devereux and Griffith (1999)) consistently reveal the distorting effects of taxation, particularly on corporate investment and financing decisions. However, their microeconomic foundation prevents these models from being applicable for purposes other than the identification of tax incentives on rational, i.e. tax minimizing, representative agents. As a consequence, the coherent analysis of implications of tax reforms for tax revenue and the distribution of tax consequences across firms has remained a largely unresolved issue. Still, providing this information to decision makers is required of comprehensive economic tax policy analysis. Otherwise, a thorough ex ante evaluation of existing tax regimes and possible reform scenarios is not feasible. We present a corporate microsimulation model - ZEW TaxCoMM - which closes the identified methodological gap. In its current stage of development, ZEW TaxCoMM is designed particularly to simulate German corporate tax law and corresponding reforms.

The remainder of the paper is organised as follows. In *Section 2*, we highlight the central challenges corporate microsimulation models have to meet. Furthermore, we provide a review of existing models and contrast their fundamental characteristics with the ZEW TaxCoMM approach. *Section 3* provides a brief outline of its basic idea and structure. In *Section 4*, the ZEW TaxCoMM will be employed for evaluating the German corporate tax reform 2008 that constitutes a typical tax rate cut cum base broadening reform with particular restrictions on the deduction of interest expenses. Resorting on a broad sample of heterogeneous firms, ZEW TaxCoMM determines how the tax burden is distributed according to sector and company size and establishes a relation between firm characteristics and the impact of the tax reform. Moreover the reform induced changes in tax revenue are derived. *Section 5* derives policy implications in view of an economic crisis. *Section 6* concludes.

2 Corporate Microsimulation as an Instrument of Tax Policy Analysis

Microsimulation models, by definition, trace or simulate all analytically relevant processes and interdependencies at the lowest level of aggregation, i.e. the single economic agent. Due to their micro-level perspective, these models are able to precisely capture central agent characteristics and their response to (alternative) legal settings (Creedy (2001)). Since microsimulation models do not only rely on one economic agent but process real data on a vast num-

ber of subjects, they are able to broadly and authentically anticipate the consequences of policy reforms (Orcutt et al. (1976)). With special regard to tax reform scenarios, the ex ante assessment of corresponding distributional and revenue implications becomes possible. Indeed, microsimulation models of *households* have already been successfully applied in the evaluation of transfer and benefit policies (see inter alia Fuest et al. (2005), Arntz et al. (2008)).¹ However, up to now, they have been less established for the analysis of the corporate sector (Bardazzi et al. (2004)).

On the one hand, as compared to household data, the availability of quantitative micro information on firms has traditionally been more limited. Especially in Europe, databases with firm-level financial accounting information have emerged only in recent years. The access to comprehensive original tax data is even more restricted. In Germany, official firm-level tax data is available for selected flow variables only. Hence, the duality of financial and tax accounting is one of the major challenges corporate microsimulation has to cope with. While household microsimulation models can directly refer to economic flow data, corporate microsimulation must possibly process a multitude of stock and flow variables from the financial accounting sphere and transform them according to tax accounting provisions. Otherwise, the model might only be able to capture the effect of a change in nominal tax rates, rather than a reform of tax base regulations. Another issue closely linked to the aspect of data availability is the models' capacity to allow for general conclusions with respect to the whole population of corporate firms. If the microsimulation is based on a representative sample, there should not be such a problem. However, particularly samples of firm-level financial accounting data rarely fulfill this criterion. Still, based on detailed aggregate information covering the total population of firms, an appropriate weighting scheme might be constructed even for arbitrary, i.e. non-random, samples. In this case, conclusions referring to the whole population of firms could still be drawn.

On the other hand, a second source of increased complexity is the existence of inter-temporal effects of tax provisions governing the tax base (depreciation, loss offset, etc.) which go beyond the merely one-periodic perspective in the tax assessment of households. Consequently, the time horizon covered by corporate microsimulation should also be multi-periodic in

¹ A comprehensive overview of these household microsimulation models is provided by O'Hare and Gupta (2000) and - with a special focus on Germany - by Wagenhals (2004).

order to consistently trace firm-level developments of fundamental tax base variables over time (dynamic microsimulation).

Defining these sources of conceptual complexity as central requirements of corporate microsimulation models allows categorising existing models relative to the new approach represented by the ZEW TaxCoMM and described in more detail in *Section 3*. In total, three corporate microsimulation models with a specific focus on tax policy evaluation exist (see *Table 1*). Precisely, these are the Italian microsimulation model DIECOFIS, a model provided by the Canadian ministry of finance and BizTax, a microsimulation approach designed to analyse business tax reforms in Germany which has been put forward by the German Institute for Economic Research (DIW). The Italian DIECOFIS² project led to the development of a corporate microsimulation model under the aegis of the Italian statistical office ISTAT (Castellucci et al. (2003), Oropallo and Parisi (2005)). The DIECOFIS microsimulation model is a one-periodic model based on cross-sectional real financial accounting data. The representative dataset (29,196 corporations, reporting year 2000) underlying the DIECOFIS model has been assembled from numerous sources comprising published financial statements and survey data on Italian firms. In order to simulate the corporate tax burden of companies, the given financial accounting data are first transformed into tax data. Subsequently, the firm-specific corporate income is computed in a very detailed way and then multiplied with the statutory corporate income tax rate.

Table 1: Corporate Microsimulation Models in Applied Tax Policy Analysis

		ZEW TaxCoMM	DIW BizTax	DIECOFIS	Canadian Corporate Microsim.
Simulation design	Detailed ascertainment of profits	Yes	No	Yes	Yes
	Dynamic simulation (multi-period)	Yes	No	No	No
Data features	Primary tax data	No	Yes	No	Yes
	Data extrapolation possible	Yes	Yes	Yes	Yes

² Development of a System of Indicators on Competitiveness and Fiscal Impact on Enterprises Performance (DIECOFIS).

The corporate microsimulation approach employed by the Canadian ministry of finance³ complements a macroeconomic model called CEFM.⁴ It is based on a representative dataset covering 18,000 corporations. The micro data is directly assembled from tax returns plus additional information taken from the financial accounts. The CEFM framework does not only serve the purpose of pure policy analysis but is also conceived to fulfill a revenue forecasting function. Therefore, the database is updated or extrapolated to the current period. Moreover, the model is capable of capturing tax base regulations as well as certain inter-temporal effects of tax legislation.

In 2007, the German Institute for Economic Research (DIW) presented a microsimulation model (BizTax) designed particularly to evaluate the German business tax reform 2008 (Bach et al. (2008)). It is based on a representative dataset sampled from official individual local business tax and income tax files for 2001. Individual firm structures and tax bases computed on the basis of the primary data are extrapolated to the year 2008 by means of - inter alia - yearly turnover tax statistics.⁵ Despite the far-reaching data update, BizTax keeps in principle a one-periodic perspective in its analyses. Inter-temporal aspects of taxation hence might not be fully reflected in the computations. Moreover, BizTax does not precisely simulate the definition of the tax base. Instead, changing regulation with respect to the ascertainment of profits thus is taken account of via imposed proportional adjustments of benchmark profits. However, BizTax has been successfully employed for the evaluation of selected issues subject to the business tax reform 2008 (Fossen and Bach (2008)).

The design of the ZEW TaxCoMM has in part been inspired by these existing approaches. However, offering broad analytical capacities within a multi-periodic framework, the new model goes beyond prior approaches and thus closes a gap in the conceptual design of corporate microsimulation models. Precisely, ZEW TaxCoMM is the first microsimulation model which allows for a detailed assessment of all major elements forming the tax bases for profit taxes including e.g. depreciation, thin capitalization rules and loss offset as well as tax regulations concerning different types of provisions.

³ No primary documentation is available for this model. The following précis therefore is based on Ahmet (2006).

⁴ CEFM: Canadian Economic and Fiscal Model.

⁵ The BizTax model may even resort to a long-term projection up to the year 2015 (Bach et al. (2008)).

3 The ZEW TaxCoMM: A new Corporate Microsimulation Approach

ZEW TaxCoMM establishes an explicit linkage between the corporate financial accounting sphere and the tax accounting sphere. The principal data input is taken from the DAFNE database provided by Bureau van Dijk. DAFNE contains detailed financial information of German corporations. Precisely, our microsimulation database covers the years from 2003-2005. We expect that the 2008 reform did not affect business behaviour during this period. The public debate only started at the end of the year 2006. The data excluded from DAFNE thus should not reflect any (anticipated) reform consequences. The microsimulation procedure requires the underlying data panel to be balanced. Hence, only corporations with balance sheets as well as profit and loss accounts for this entire time span are included in the sample.⁶ Finally, the sample encompasses 12,569 companies and 37,707 firm-year observations

Table 2: Number of companies in the sample classified according to economic activity and size

Economic Activity	Small Corporations	Medium-sized Corporations	Large Corporations
Mining and Manufacturing	1,210	730	997
Energy and Water Supply	44	70	377
Construction	1,159	220	90
Trade, Hotels and Restaurants	1,574	620	505
Transportation and Telecommunications	401	140	195
Other Services	2,330	766	1,141
All economic activities	6,718	2,546	3,305
Share of companies in size range	53.45%	20.26%	26.29%

Note: The table shows absolute numbers of corporations considered by ZEW TaxCoMM classified by company size and economic activity. Proportions of company size ranges are displayed in the bottom row. Company size is defined according to annual balance sheet totals. Small corporations display an annual balance sheet total of not more than € 4,015,000. Corporations are classified as medium-sized if the annual balance sheet total ranges between € 4,015,000 and € 16,060,000. The balance sheet total of large corporations exceeds € 16,060,000.

Table 2 illustrates the structure of the sample with regard to size and economic activity. The sample covers small, medium-sized and large corporations operating in six different economic sectors. In order to smooth out structural differences between the microsimulation sample and the population of all corporations in Germany, data and results from the considered sample are extrapolated. For this purpose, we principally proceed along the lines of the method applied by the Deutsche Bundesbank to extrapolate financial accounts data from a sample of German corporations to the total business population. However, while Deutsche Bank resorts to official turnover statistics, the extrapolation here is based on the corporate income tax statistic of 2004 provided by the German Federal Statistical Office (Statistisches Bundesamt

⁶ Non-tax-paying charitable companies are excluded from the dataset.

(2009)).⁷ It provides only moderately aggregated information based on a virtually complete survey of tax declarations from corporations. The statistic *inter alia* reports the number of corporations falling into predefined income ranges and the aggregate gross taxable corporate income earned from corporations within each range. The data are grouped according to economic sectors and according to profit and loss making corporations. Due to its full coverage of corporations and its reference to gross taxable corporate income which is a key output variable in the ZEW TaxCoMM, the corporate income tax statistic is well suited to extrapolate the results from the considered sample. Precisely, we proceed as follows. First, for each economic activity, the corporations in the ZEW TaxCoMM sample are grouped into intervals of gross taxable corporate income corresponding to those defined in the corporate income tax statistic. Second, for each resulting activity-income-class, we calculate the proportion of the class-specific number of sample observations to population observations in that same class, as given by the corporate income tax statistic. Third, sample observations in each activity-income-cluster are weighted by the reciprocal of this proportion.⁸ The weights for extrapolation are determined annually. Thus, firms might switch income classes over the considered years. For each year, however, the sample data is aligned to the total business population as represented by the corporate income tax statistic of 2004. The extrapolation ensures that structural distortions of the sample due to less prominently represented small and medium-sized corporations or underrepresented sectors are offset. Hence ZEW TaxCoMM allows conclusions on the distribution of the tax burden among corporations as well as on revenue implications of tax reforms. *Table 3* illustrates the structure of the extrapolated sample.

⁷ The Federal Statistical Office has provided us with a special evaluation of the corporate income tax statistic. It contains tabulations in much higher detail than those in the standard version.

⁸ The procedure thus implicitly assumes that within each activity-income-class, the ratio between gross corporate taxable income and individual balance sheet or profit and loss account items of firms not included in the sample on average corresponds to that of corporations covered by the dataset.

Table 3: Number of companies in the extrapolated sample classified according to economic activity and size (3-year average)

Economic Activity	Small Corporations	Medium-sized Corporations	Large Corporations
Mining and Manufacturing	84,341	17,580	8,800
Energy and Water Supply	3,829	1,393	2,194
Construction	81,781	6,359	844
Trade, Hotels and Restaurants	150,463	20,103	6,507
Transportation and Telecommunications	24,807	2,212	1,267
Other Services	349,021	32,236	23,112
All economic activities	694,242	79,882	42,723
Share of companies in size range	84.99%	9.78%	5.23%

Note: The table shows absolute numbers of corporations considered by ZEW TaxCoMM after extrapolation on the basis of the corporate income tax statistic of 2004. Proportions of company size ranges are displayed in the bottom row. Company size is defined according to annual balance sheet totals. Small corporations display an annual balance sheet total of not more than € 4,015,000. Corporations are classified as medium-sized if the annual balance sheet total ranges between € 4,015,000 and € 16,060,000. The balance sheet total of large corporations exceeds € 16,060,000.

Due to the panel structure of the exploited financial accounts data, ZEW TaxCoMM is able to take the intertemporal effects of tax provisions into account. In this regard it thus contrasts with other microsimulation models which resort to mainly cross-sectional tax data as principal source of information. Furthermore, ZEW TaxCoMM is capable of tracing the consequences of changes in tax provisions in high detail, since it derives flow data from financial stock data and thereby allows a detailed simulation of firm specific tax assessment. Precisely, all relevant tax data is computed “bottom-up” on the basis of financial accounts and not exogenously taken as input from other primary sources.

As a central link between both the financial accounting and the tax accounting sphere, ZEW TaxCoMM uses the *profit on ordinary activities* as defined in § 275 II No 14/ III No 13 CC (Commercial Code). In a first stage, the model, therefore, comprises a sequence of modules which determine required modifications of variables for each firm separately. These modifications account for deviations of financial accounting schemes from corresponding tax accounting regulations and practices for both corporate tax as well as trade tax purposes. While the relevant modules may vary with respect to their computational complexity and the technical approach chosen, they all are conceived along the lines of four essential notions:

- Exploit and never contradict all available information from financial statements
- Consistently trace firm-level developments over time
- Opt for the most realistic assumption with regard to firm-level choices, even if it is not in line with tax-minimizing behaviour
- Modules must easily adapt to different tax regulations and reform scenarios

In a second stage of the microsimulation procedure, the identified required modifications are applied to the profit on ordinary activities for each firm separately. *Table 4* summarizes these potential modifications.⁹

Table 4: Potential modifications of the profit of ordinary activity for tax purposes

Depreciation (Goodwill, intangible fixed assets, other immovable fixed assets, movable fixed assets)
Provisions (Other Provisions)
Creditors (Long-Term Trade Creditors)
Special Capitalised Expenses
Interest Deduction Limitations
Dividend Tax Exemption
Investment Grants and Subsidies
Non-Deductible Expenses
Add-back & Deductions for Trade Tax
Integrated Fiscal Units
Fiscal Loss Carryforward
Contributions from foreign permanent establishments

ZEW TaxCoMM then calculates the firm-specific tax due by applying the respective tax rates to the computed scenario- and firm-specific tax bases for corporate income tax and trade tax purposes. Since total amounts of tax due are not comparable across companies, ZEW TaxCoMM computes an effective tax burden measure particularly suitable for microsimulation purposes.

By definition, the employed effective tax rate measures the relative wedge between pre-tax and post-tax values of a given target variable. A target variable which can be easily extracted from financial accounts data is the future value of periodical pre-tax cash flow¹⁰ (FV^{CF}). To generate the post-tax value of this variable (FV_{τ}^{CF}), periodic pre-tax cash flow (CF_t) are reduced by profit taxes (τ) and accumulated according to the time horizon (T). Hence, the ZEW TaxCoMM effective tax burden on cash flow is defined as

⁹ For a concise explanation of the principles and technicalities of the German tax and business law, see Wolff et al. (2005). For a more detailed description of ZEW TaxCoMM see Reister et al. (2008).

¹⁰ The periodic cash flow used follows the definition of the Society of Investment Professionals in Germany (Schmalenbach Association). It is reduced by cash flow arising from tax-exempt foreign income.

$$\tau_{eff} = \left| \frac{FV^{CF} - FV_{\tau}^{CF}}{FV^{CF}} \right|$$

$$= \left| \frac{\sum_{t=1}^T CF_t \cdot (1+i)^{T-t} - \sum_{t=1}^T CF_{t,\tau} \cdot (1+i_{\tau})^{T-t}}{\sum_{t=1}^T CF_t \cdot (1+i)^{T-t}} \right|.$$

The (unique) interest rate (i) used to calculate the future value of cash flow is the average yield of German industrial securities in the period of 2003 to 2005 which amounts to 4.2%. While this (gross) interest rate is directly applied to compute future values of pre-tax cash flow, a net interest rate (i_{τ}) is needed for the calculation of respective post-tax cash flow future values.

Conceptually, the approach chosen here combines a forward-looking perspective with a backward-looking foundation. It is backward-looking in that it resorts to historic real data instead of relying on hypothetical investments but forward-looking since the impact of tax reforms on an important investor's target variable can be simulated endogenously.

Validating ZEW TaxCoMM

Validating ZEW TaxCoMM is not an easy task since tax statistics do not report disaggregated data on firm specific tax due. Yet, as regards the validation at firm level, ZEW TaxCoMM's capability to consistently approximate tax bases and hence, resulting corporate income and trade taxes due can be evaluated on the basis of information about taxes paid on income included in the ZEW TaxCoMM data sample taken from the DAFNE database for the corresponding years 2003 to 2005. However, this is a relatively rough approach since the financial accounting item "taxes on profit" reflects tax prepayments, tax refunds and deferred taxes within a reporting period. Thus, it might significantly deviate from the tax due for that specific period. However, for companies with relatively stable profits over time, both variables should be rather close. Therefore, validation of the ZEW TaxCoMM will rely on comparing computed taxes due with taxes paid on profits for this type of companies. In total, 129 companies belong to this group of firms with a very smooth profit dynamic (+/- 5% over all three years considered). Looking at the relative gap between the simulated tax due and financial "taxes on profit", the corresponding mean relative deviation for all 387 observations amounts to 2.0% if outlying results (below respectively higher than 1st and 99th percentiles) are eliminated. We conclude that there is no considerable systematic deviation of the ZEW TaxCoMM microsimulation results from underlying "real" taxes due.

That the gross taxable income is very realistically simulated is also confirmed in course of the extrapolation of the dataset. In this context, the intervals of gross taxable corporate income for which the Federal Statistical office refuses to report the number of firms¹¹ match with those intervals to which we allocate only a few firms on the basis of ZEW TaxCoMM. This would not be the case if ZEW TaxCoMM would systematically over- or underestimate the actual income.

4 Assessing the 2008 German Corporate Tax Reform from a Micro-Perspective

4.1 Regulatory changes in detail

The consequences of the German corporate tax reform 2008 are still at the heart of an ongoing academic and political debate. The reform followed a persistent international trend of cutting tax rates and financing these tax rate cuts by broadening the tax base. In order to broaden the tax base, countries increasingly tend to detach the corporate income tax base from profits by including non-deductible business expenses. Prominent examples are thin-capitalisation or earning-stripping rules that aim at limiting debt financing within group structures. An even broader concept of restricting the deductibility of interest expenses applies for instance in Denmark, Italy and since the 2008 reform also in Germany. In these countries, the non-deductible interest expenses not only capture interest on shareholder loans, but regulations restrict the deductibility for all interest expenses in excess of a predefined ratio of total assets or EBITDA. Besides interest expenses, the use of losses is often restricted as well. As regards local taxes on corporations, they are either directly based on capital instead of profits (e.g. “taxe professionnelle” in France) or apply to a tax base that taxes also business expenses (e.g. interest add-backs for trade tax in Germany and interest as well as labour cost add-backs for “IRAP” in Italy). To sum up, the German tax reform follows a distinct and internationally prevalent pattern that is not unique to the German tax system. Hence, its evaluation also provides valuable insights into the general implications of tax rate cut cum base broadening reforms on heterogeneous firms. The regulatory changes underlying the analysis will be sketched in the following.

¹¹ For some intervals covering the highest positive or negative gross taxable income, the Federal Statistical Office only reports the aggregate income but not the number of firms in this interval, since it would otherwise be possible to conclude on the identity of the respective firms.

The German tax law as of the year 2007 constitutes the reference tax system which serves as the natural benchmark to assess the reform-induced changes in firm-level effective tax burdens.¹² *Table 5* juxtaposes the basic elements of the reference tax system 2007 and the corresponding major changes in tax regulations implemented in the course of the corporate tax reform. *Table 5* shows that the 2008 reform is characterized by broadening the profit tax bases (abolishment of declining balance depreciation, additional restrictions concerning loss offset, stronger limitations of interest deductibility) accompanied by a reduction of profit tax rates (corporate income tax rate is reduced from 25% to 15%, trade tax rate from 16.67% to 14% if an average municipal multiplier of 400% is assumed).

Table 5: Regulations concerning German taxes on profits before and after the 2008 corporate tax reform

Tax Year 2007	Tax Year 2008
<u>Taxes on profits:</u> <ul style="list-style-type: none"> - corporate income tax ("Körperschaftsteuer") - solidarity surcharge ("Solidarit�t�zuschlag") - trade tax ("Gewerbesteuer") 	<u>Taxes on profits:</u> <ul style="list-style-type: none"> - corporate income tax ("Körperschaftsteuer") - solidarity surcharge ("Solidarit�t�zuschlag") - trade tax ("Gewerbesteuer")
<u>Tax bases:</u>	<u>Tax bases:</u>
<u>Corporate income tax:</u> <ul style="list-style-type: none"> - trade tax is deductible - depreciation: generally straight-line method is applied, declining balance depreciation at a rate of 30% is possible for movable property (§ 7 ITA) - exemption (95%) of dividend income according to § 8b CTA - loss carry back (limitation: € 511,500) to the previous year and loss carry forward (€ 1,000,000 without limitation, exceeding amounts to 60%) are possible (§ 10d ITA) - losses can generally only be set off against positive income if legal and economic identity of a corporation is maintained (§ 8 IV CTA) - limitation of the deductibility of interests resulting from debt financing only for shareholders loans (§ 8a CTA) 	<u>Corporate income tax:</u> <ul style="list-style-type: none"> - trade tax is no longer deductible (§ 4 IV ITA) - depreciation: generally straight-line method is applied, declining balance depreciation is abolished (§7 ITA) - exemption (95%) of dividend income according to § 8b CTA - loss carry back (limitation: € 511,500) and loss carry forward (€ 1,000,000 without limitation, exceeding amounts to 60%) are possible (§ 10d ITA) - losses can generally only be set off against positive income if there are no substantial changes in shareholder structure (proportional loss offset if 25% to 50% of shareholder change, no loss offset if more than 50% of shareholder change, § 8c CTA) - general limitation of the deductibility of interests resulting from debt financing to 30% of tax EBITDA with an exemption limit of € 1,000,000 and the possibility of an interest carry forward (§ 8a CTA, § 4h ITA, "Zinsschranke")
<u>Solidarity surcharge:</u> <ul style="list-style-type: none"> - levied on corporate income tax due (§ 3 Solidarity Surcharge Act) 	<u>Solidarity surcharge:</u> <ul style="list-style-type: none"> - levied on corporate income tax due (§ 3 Solidarity Surcharge Act)
<u>Trade tax:</u>	<u>Trade tax:</u>

¹² For details concerning the calculation of corporate taxable income in Germany see Endres/Oestreicher/Scheffler/Spengel (2007).

<ul style="list-style-type: none"> - corporate taxable income is used as a starting point and modified by certain adjustments (§ 7 TTA) - exemption (95%) of dividend income according to § 9 TTA only for dividends resulting from an amount of holding of at least 10% (“gewerbesteuerliches Schachtelprivileg”) - only loss carry forward (€ 1,000,000 without limitation, exceeding amounts to 60%) possible (§ 10a TTA) - losses can generally only be set off against positive income if legal and economic identity of a corporation is maintained (§ 10a TTA, § 8 IV CTA) - addition of 50% of interest expenditures resulting from long-term loans (no exemption limit granted, § 8 TTA) 	<ul style="list-style-type: none"> - corporate taxable income is used as a starting point and modified by certain adjustments (§ 7 TTA) - exemption (95%) of dividend income according to § 9 TTA only for dividends resulting from an amount of holding of at least 15% (“gewerbesteuerliches Schachtelprivileg”) - only loss carry forward (€ 1,000,000 without limitation, exceeding amounts to 60%) possible (§ 10a TTA) - losses can generally only be set off against positive income if there are no substantial changes in shareholder structure (proportional loss offset if 25% to 50% of shareholder change, no loss offset if more than 50% of shareholder change, § 10a TTA, § 8c CTA) - addition of 25% of all interest expenditures as well as parts of rental, lease and licence fees deemed to be interest expenditures (exemption limit: € 100,000, § 8 TTA)
<u>Tax rates:</u> <ul style="list-style-type: none"> - corporate income tax: 25% (§ 23 CTA) - solidarity surcharge: 5.5% (§ 4 Solidarity Surcharge Act) - trade tax: varying municipal rates (minimum 200%, at average about 400%) and a multiplier of 5% (§§ 11, 16 TTA) 	<u>Tax rates:</u> <ul style="list-style-type: none"> - corporate income tax: 15% (§ 23 CTA) - solidarity surcharge: 5.5% (§ 4 Solidarity Surcharge Act) - trade tax: varying municipal rates (minimum 200%, at average about 400%) and a multiplier of 3.5% (§§ 11, 16 TTA)

Source: Own compilation.

The central aims of the corporate tax reform as declared by the German federal government were the improvement of Germany’s location attractiveness from a tax perspective, by cutting profit tax rates and the enhancement of tax neutrality with respect to the choice of legal form as well as financing decisions (Bundestag (2007)). Furthermore, companies as well as local and federal governments should benefit from an improved planning reliability. After all, a major focus of the entire reform has been put on the sustained strengthening of the German tax base. As a consequence, revenue neutrality played a major role in the design of the reform.

4.2. Implications of the German Corporate Tax Reform on the Distribution of the Tax Burden Across Firms

As a primary output, ZEW TaxCoMM calculates the annual tax due at the level of each firm. To gain insight in the distribution of the tax burden across companies of different sizes and economic activity, the following analysis is based on the effective tax burden on cash flow (*Table 6*). The effective tax burden on cash flow, as shown in *Section 3*, represents the tax induced relative cut of the future value of periodical pre-tax cash flow.¹³

¹³ Implausible values have been eliminated by applying the Median Absolute Deviation Method (MAD) with a tolerance interval of 20xMAD. This procedure removed 142 firms from the dataset.

In the reference tax system 2007, the average effective tax burden on cash flow across all economic activities amounts to 26.38% for small corporations, 19.41% for medium-sized corporations and 19.21% for large corporations. Furthermore, *Table 6* reveals a considerable variation of the average effective tax burden on cash flow across company size and economic activity. By definition, the effective tax burden on cash flow is driven by the annual tax due as well as annual cash flow. While it declines *ceteris paribus* with rising cash flow, it increases *ceteris paribus* with rising annual taxes due. Under the tax regime of 2007, the effective tax burden on cash flow ranges from an average of 9.56% for medium-sized corporations in the energy sector to 29.87% for small corporations in the service sector.

Table 6: ZEW TaxCoMM average effective tax burden on cash flow (in %) for reference and reform tax system and deviation between the two systems (in percentage points)

Economic Activity	Small Corporations			Medium-Sized Corporations			Large Corporations		
	2007	2008	Δ	2007	2008	Δ	2007	2008	Δ
Mining, Manufacturing	22.23%	17.22%	-5.01	19.08%	14.70%	-4.39	18.33%	14.78%	-3.55
Energy, Water Supply	12.13%	9.96%	-2.17	9.56%	7.86%	-1.70	7.78%	6.64%	-1.15
Construction	23.80%	18.53%	-5.27	21.60%	16.51%	-5.09	15.43%	12.53%	-2.91
Trade, Hotels, Restaurants	22.85%	17.44%	-5.41	17.97%	13.95%	-4.01	20.14%	16.60%	-3.54
Transportation, Telecommunication	23.54%	18.61%	-4.93	14.91%	12.63%	-2.28	15.03%	12.19%	-2.84
Other Services, Activities	29.87%	23.15%	-6.73	20.79%	15.56%	-5.23	20.74%	18.29%	-2.45
All economic activities	26.38%	20.41%	-5.97	19.41%	14.83%	-4.59	19.21%	16.42%	-2.80

Note: This table shows the ZEW TaxCoMM effective tax burden on cash flow in % and its reform induced changes in percentage points for different company sizes and economic activities, on average. The results are based on the extrapolated sample. The effective tax burden on cash flow represents the tax induced relative cut of the future value of periodical pre-tax cash flow. Implausible values have been eliminated by applying the Median Absolute Deviation Method (MAD) with a tolerance interval of 20xMAD. This procedure removed 142 firms from the dataset. Company size categories are defined as explained in footnote of *Table 2*. Source: ZEW TaxCoMM

After the corporate tax reform of 2008, the effective tax burden on cash flow varies between 7.86% for medium-sized corporations in the energy sector and 23.15% for small corporations in the service sector. The average decline in the tax burden is highest for small corporations (5.97 percentage points) and lowest for large corporations (2.80 percentage points). The reduction of the tax burden for large corporations is comparably low since large corporations are to a greater extend subject to newly implemented interest deduction ceiling regulations

and extended interest add-backs. The average share of corporations underlying the interest deduction ceiling regulation, for instance, amounts to 6.73% for large corporations as opposed to virtually 0% for small corporations and 0.11% for medium-sized corporations.

Table 7 illustrates in detail how the reduction in the effective tax burden is distributed within the sample.

Table 7: Distribution of the reduction in the effective tax burden on cash flow (in percentage points)

Percentile	1%	5%	10%	25%	50%	75%	90%	95%	99%
Reduction of effective tax burden in percentage points	-3.31	0.04	0.30	1.13	5.28	8.40	9.86	13.37	32.17

Note: This table displays the distribution of the reform induced reduction in the effective tax burden on cash flow in percentage points. The results are based on the extrapolated sample. Source: ZEW TaxCoMM

25% of the corporations in the sample experience a decrease in the effective tax burden on cash flow of less than 1.13 percentage points. However, under 2008 tax law, less than 5% of all corporations in the microsimulation sample are subject to an increased effective tax burden on their cash flow. Moreover, the reduction ranges between 1.13 and 8.40 percentage points for 50% of the corporations. Only 10% of the corporations see their effective tax burden on cash flow to be reduced by more than 9.86 percentage points. The elements of the corporate tax reform 2008, which broaden the tax base, mitigate the effect of the tax rate cut on the effective tax burden on cash flow. Regulations of the corporate tax reform 2008 that broaden the tax base are, for instance, the abolition of the deductibility of trade tax for corporate tax purposes, the abolition of the declining balance method and extended restrictions governing the deduction of interest expenses. In this context, the modified regulations governing add-backs of interest expenses for trade tax purposes might have ambiguous effects on companies of different structure. In case of mostly small and medium-sized corporations with low interest expenses, the newly introduced allowance of € 100,000 in interest deduction can translate to an absolute relief compared to the reference tax system.

The extent to which tax rate cuts translate into a decrease in the effective tax burden is closely related to the profitability of the corporation.¹⁴ In contrast, structural ratios such as debt ratio

¹⁴ The financial ratios referred to in this analysis are defined as follows: The profitability of a corporation is defined as the 3-year average ratio of annual profit of ordinary activity to annual balance sheet total. The 3-year average ratio of interest-bearing liabilities to annual balance sheet total yields the debt ratio. The capital intensity is given by the 3-year average ratio of tangible fixed assets to annual balance sheet total.

and capital intensity indicate the exposure of corporations to elements of the reform which broaden the tax base. Therefore, companies of high profitability, low debt ratio and low capital intensity are largely expected to gain most from the reform. By capturing the heterogeneity of firms, ZEW TaxCoMM can very precisely illustrate this issue. *Table 8* matches the reduction in the effective tax burden on cash flow with the relevant financial ratios of the corporations in the sample. Precisely, the reduction in the tax burden is separated into quarters, the boundaries of which are defined by the quartiles given in *Table 7*. For each quarter, *Table 8* shows the corresponding median of financial ratios across those companies contained in that respective quarter.

Table 8: Matching up effective tax burdens on cash flow with financial ratios

Reduction in effective tax burden	Financial Ratio	Median of Financial Ratio	Standard Deviation of Financial Ratio
1st quarter	Profitability	-1.29%	30.78%
2nd quarter		1.66%	12.68%
3rd quarter		5.86%	23.79%
4th quarter		5.41%	29.70%
1st quarter	Debt Ratio	48.26%	28.20%
2nd quarter		41.11%	24.35%
3rd quarter		34.59%	24.63%
4th quarter		28.98%	28.85%
1st quarter	Capital Intensity	20.59%	28.34%
2nd quarter		16.93%	23.84%
3rd quarter		11.16%	18.84%
4th quarter		7.08%	18.37%

Note: This table shows for each quarter of the reduction in effective tax burden on cash flow the corresponding median of profitability, debt ratio and capital intensity across companies contained in the respective quarter. The results are based upon the extrapolated sample. The boundaries of the quarters are defined by the quartiles of the distribution given in *Table 7*. Profitability is defined as the 3-year average ratio of annual profit of ordinary activity to annual balance sheet total. The 3-year average ratio of interest-bearing liabilities to annual balance sheet total yields the debt ratio. The capital intensity is given by the 3-year average ratio of tangible fixed assets to annual balance sheet total. Source: ZEW TaxCoMM

ZEW TaxCoMM shows that corporations falling into the lowest quarter of the reduction in the effective tax burden are indeed of low profitability, largely debt financed and show a high capital intensity. Hence, while these corporations benefit from tax rate cuts to a comparably smaller extent, their tax burden is hit particularly hard by extended interest add-backs, the interest deduction ceiling regulations and the abolition of the declining balance depreciation. Vice versa, the decline in the effective average tax burden is most accentuated for highly profitable corporations with a low debt ratio and low capital intensity. Corporations falling into

the third or fourth quarter, i.e. experiencing a reduction in the effective tax burden of more than 5.28 percentage points, are of a similarly high profitability. Yet, the 25% of corporations that benefit most from the corporate tax reform feature, in addition to the high profitability, a considerably lower debt ratio and a lower capital intensity.

Table 7 clearly indicated that a vast majority of corporations experiences a decline in the effective tax burden on cash flow. *Table 8* matched the degree of reduction in effective tax burden up with corresponding financial ratios. *Table 9* takes a complementary look at the distribution of winners and losers across company sizes and economic activities.

Table 9: Share of “winners” and “losers” of the reform 2008

Economic Activity	Small Corporations		Medium-Sized Corporations		Large Corporations	
	"Winner"	"Loser"	"Winner"	"Loser"	"Winner"	"Loser"
Mining, Manufacturing	94.19%	5.53%	92.12%	7.88%	90.88%	9.12%
Energy, Water Supply	77.32%	22.68%	80.45%	19.55%	73.68%	26.32%
Construction	95.40%	4.60%	98.13%	1.87%	96.29%	3.71%
Trade, Hotels, Restaurants	95.77%	4.00%	93.97%	6.03%	93.62%	6.38%
Transportation, Telecommunications	92.02%	7.98%	73.69%	26.31%	94.25%	5.75%
Other Services, Activities	97.66%	2.28%	96.93%	3.07%	88.06%	11.94%
All economic activities	96.25%	3.64%	94.29%	5.71%	89.13%	10.87%

Note: This table displays the share of companies according to company size and economic activity that are “winner” or “loser” of the corporate tax reform 2008. The results are based on the extrapolated sample. Company size categories are defined as in the footnote of *Table 2*. Source: ZEW TaxCoMM

The share of “winners” ranges from 73.68% for large corporations in the energy sector to 98.13% for medium-sized corporations in the construction sector. With regard to all economic activities, the highest share of “winners” can be stated for small corporations and the lowest share for large corporations. Despite the important tax rate cuts, there is still a distinct share of corporations that do not benefit from the tax reform but incur an increase in the effective tax burden on cash flow. This result holds true for each size range and economic activity.

Table 10 provides an insight in the determinants for being a “winner” or “loser” of the tax reform and strengthens the arguments brought forward to explain the differentials in tax burden reductions. High profitability, low debt ratio and low capital intensity favour a reduction in the tax burden and therefore characterise the “winner” of the reform. However, if companies face a lower profitability, rely heavily on debts and have a huge share of tangible fixed assets, they are more likely to lose with regard to the tax reform of 2008. These sector-specific indications are in line with the more general analysis in *Table 8*.

Table 10: Average financial ratios of “winners” and “losers” of the reform 2008

Economic activity	Profitability		Debt Ratio		Capital Intensity	
	"Loser"	"Winner"	"Loser"	"Winner"	"Loser"	"Winner"
Mining, Manufacturing	0.89%	3.58%	53.14%	45.20%	31.56%	25.54%
Energy, Water Supply	5.48%	5.56%	49.54%	41.01%	64.98%	66.84%
Construction	-1.04%	2.29%	51.44%	40.73%	22.32%	16.16%
Trade, Hotels, Restaurants	0.46%	3.23%	46.62%	43.71%	21.01%	16.78%
Transportation, Telecommunications	2.06%	2.29%	53.10%	46.02%	56.50%	31.40%
Other Services, Activities	-0.74%	3.11%	48.08%	37.00%	35.87%	25.37%
All economic activities	0.09%	3.10%	49.63%	40.56%	33.41%	22.38%

Note: The table displays the average financial ratios of “losers” and “winners” of the reform for different economic activities. The financial ratios are defined as in footnote of *Table 8*. Source: ZEW TaxCoMM

4.3 Estimating the Effects of Firm Characteristics on the Reduction in the Effective Tax Burden

Tables 8 and 10 provide some insights into the characteristics of firms and economic sectors that benefit to a higher or lower degree from the tax reform. However, it should be interesting to see the marginal effects of firm characteristics on the reform induced reduction in firm-level effective tax rates. For this purpose, we run some straightforward regression analysis using ordinary least squares estimation (OLS).¹⁵ The baseline equation is indeed kept very simple as there should be only a few variables which have an impact on firm-level reform consequences. We regress the reduction in the effective tax rate (Reduc) of firm $i = 1, \dots, N$ on the

¹⁵ The regression is run on a reduced dataset excluding observations with implausible values for the variables used in the analysis. Precisely, observations with reductions in the tax rate exceeding 100% have been deleted. Moreover, observations showing a profitability above 1000% or below -1000% respectively have been eliminated from the sample. Over-indebted companies have been excluded, as well.

profitability (ProfitR), the debt ratio (DebtR) and the capital intensity (CapR).¹⁶ The estimation equation thus reads

$$\text{Reduc}_i = \beta_0 + \beta_1 \text{ProfitR}_i + \beta_2 \text{DebtR}_i + \beta_3 \text{CapR}_i + u_i$$

with u_i as a residual. The extent to which tax rate cuts translate into a reduction in the effective tax rate is closely related to the profitability of the corporation. In contrast, the debt ratio and capital intensity indicate the exposure of corporations to elements of the reform which broaden the tax base. High debt ratios and capital intensities should thus come along with moderated reform induced reductions of tax levels. The respective financial ratios are taken from the financial accounts of the extrapolated dataset. Since the current version of ZEW TaxCoMM does not yet account for behavioural responses, it is clear that the financial ratios determine the reduction in the effective tax burden and that the causality is not reverse. The reduction in the effective tax rate on cash flow constitutes the difference between the effective tax rate as derived by ZEW TaxCoMM under the reference tax regime 2007 and the reform regime 2008. We run the regression on the extrapolated dataset to ensure that the marginal effects are derived from non-distorted data.

The result from this estimation is given in column (1) of *Table 11*. As expected, the coefficient of profitability is positive. An increase in profitability by one percentage point would raise the reform induced reduction in the effective tax burden by 0.07 percentage points. The impact of the capital intensity is negative, since the tax reform abolished the declining balance depreciation. When controlling for industry fixed effects, the results remain unchanged (column (2) of *Table 11*).

An additional specification accounts for the fact that the reform might hit firms differently according to their size. Consequently, the effect of firm characteristics on the reduction of the tax burden might depend on the size of the firm. A dummy variable L is therefore introduced for large firms as well as an interaction of L with profitability, debt ratio and capital intensity. The results are shown in column (3) of *Table 11*. For large corporations, the increase of profitability by one percentage point triggers an increase in the reduction of the tax burden of 0.09

¹⁶ The financial ratios referred to in this analysis are again defined as in the previous section: The profitability of a corporation is defined as the 3-year average ratio of annual profit of ordinary activity to annual balance sheet total. The 3-year average ratio of interest-bearing liabilities to annual balance sheet total yields the debt ratio. The capital intensity is given by the 3-year average ratio of tangible fixed assets to annual balance sheet total.

percentage points¹⁷ which is considerably higher compared to the baseline specification. For large corporations, an increase in profitability seems to pay off more in terms of reform induced reduction in the effective tax burden. This might be the case because a higher profitability and thus higher EBITDA potentially prevents firms from being captured by the interest deduction ceiling regulation or at least increases the amount of deductible interest expenses.

Table 11: Effects of firm characteristics on the reduction in the effective tax burden

Dependent Variable	Reform induced reduction in the effective tax burden			
	(1)	(2)	(3)	(4)
Profitability	0.0683*** (0.000890)	0.0687*** (0.000893)	0.0678*** (0.000838)	0.0687*** (0.000853)
Debt Ratio	0.00204*** (0.000260)	0.00224*** (0.000263)	0.00492*** (0.000224)	0.00579*** (0.000220)
Capital Intensity	-0.0473*** (0.000249)	-0.0462*** (0.000266)	-0.0480*** (0.000232)	-0.0468*** (0.000211)
L*Profitability			0.0225** (0.0111)	
L*Debt Ratio			-0.0603*** (0.00271)	
L*Capital Intensity			0.0360*** (0.00162)	
L			-0.00746*** (0.000860)	
IDCR*Profitability				-0.0101 (0.0138)
IDCR*Debt Ratio				-0.717*** (0.0286)
IDCR*Capital Intens				0.345*** (0.0149)
IDCR				0.108*** (0.0111)
Constant	0.0567*** (0.000104)	0.0540*** (0.000149)	0.0567*** (9.92e-05)	0.0557*** (9.85e-05)
Observations	1,737,176	1,737,176	1,737,176	1,737,176
R ²	0.046	0.048	0.054	0.098

Note: This table displays the results of the OLS estimation. Robust standard errors are in parentheses. ***/**/* denotes significance at the 1%/5%/10% level. The dummy variable DB indicates if the firm applied the declining balance depreciation prior to the reform. The dummy variable L designates firms that are classified as large corporations with total assets exceeding € 16,060,000. To identify firms which are subject to the newly introduced interest deduction ceiling regulation, the dummy variable IDCR is introduced. Specification (2) controls for industry fixed effects.

The effect of the debt ratio turns out to be negative for large firms (-0.06) but positive, though very small, for small and medium-sized corporations (0.005). This result suggests that broadening the tax base by restricting the deductibility of interest expenses hits large corporations

¹⁷ The coefficient of the interaction term yields the deviation between the partial impact for large corporations and for those companies not explicitly specified by a dummy variable (small and medium-sized corporations). Hence, the elasticity for large corporations is computed as $0.0678 + 0.0225 = 0.0903$.

harder. An increase in debts relative to total assets is *ceteris paribus* related to a lower benefit from the tax reform in terms of reduction in the effective tax burden. The incidence of firms being subject to the interest deduction ceiling regulation is much smaller for small and medium sized corporations due to the exemption threshold of € 1 million. Moreover, small firms might even benefit from the newly introduced exemption of up to € 100,000 of interest expenses from add-backs for trade tax purposes thus explaining the slightly positive coefficient for the debt ratio. For larger firms, the exemption limit presumably does not outweigh the higher burden resulting from adding back 25% of all interest expenses instead of 50% of interest on long term debt. The coefficient of capital intensity is -0.012 for large corporations and thus comparably low with respect to the other specifications.

In an additional step, we distinguish between firms that are subject to the interest deduction ceiling regulation and those that are not. Therefore a dummy variable (IDCR) is introduced, indicating if a company is subject to this regulation. Again, interaction terms between IDCR and the financial ratios are included as well. Column (4) of *Table 11* summarizes the result for this specification. Most remarkably, the coefficient of the debt ratio decreases to - 0.71 for companies subject to the considered regulation. Hence, at the condition that the interest deduction ceiling regulation applies, an increase of the debt ratio by one percentage point drives down the reduction in the effective tax burden by 0.71 percentage points. This effect is comparably strong since any additional interest expense is not tax deductible. The coefficient of profitability is positive since an increase in profitability and thus in EBITDA results *ceteris paribus* in a higher amount of deductible interest expenses.

4.4 Revenue Consequences of the German Corporate Tax Reform

To shed light on the reform induced changes in the tax revenue, ZEW TaxCoMM aggregates the firm specific tax due for each year. The results are displayed in *Table 12*. For the reference tax system 2007 the 3-year average tax revenue collected from corporations of all sizes amounts to € 49.762 billion (column 5). The respective contribution of trade tax to the total tax revenue amounts to € 22.709 billion (46% of the overall revenue). The corporate income generates tax revenue of € 25.642 billion (52% of the overall revenue). Comparing the contributions of companies of different sizes to the overall revenue (columns 2 - 4) reveals that large corporations pay 75% of the overall tax revenue, although they make up only 5% of all corporations considered.

With regard to the respective share of corporate income tax and trade tax in overall revenue, the results illustrate that the trade tax gains fiscally in importance in course of the reform. The tax rate cuts which have been considerably higher for the corporate income tax as compared to the trade tax mainly drive this result. At the same time, the trade tax is no longer deductible as a business expense, which adds to the increased effective weight of the trade tax burden.

Table 12: Tax revenue in bn € for the reference tax system, the tax system of 2008 and change in %

	3-year Average			
Tax system	Small Corporations	Medium-sized Corporations	Large Corporations	Total
Reference tax system 2007				
Overall tax revenue (bn €)	6.326	6.215	37.221	49.762
thereof trade tax	2.855 (45.1%)	2.836 (45.6%)	17.018 (45.7%)	22.709 (45.6%)
Thereof corporate income tax	3.290 (52%)	3.202 (51.5%)	19.150 (51.5%)	25.642 (51.5%)
Thereof solidarity surcharge	0.181 (2.9%)	0.176 (2.8%)	1.053 (2.8%)	1.467 (2.9%)
Post-reform tax system 2008				
Overall tax-revenue (bn €)	4.929	4.832	30.185	39.945
Δ-%	-22.08%	-22.25%	-18.90%	-19.73%
thereof trade tax	2.328 (47.2%)	2.276 (47.1%)	14.416 (47.8%)	19.021 (47.6%)
Δ-%	-18.44%	-19.74%	-15.29%	-16.24%
thereof corporate income tax	2.465 (50%)	2.422 (50.1%)	14.947 (49.5%)	19.834 (50%)
Δ-%	-25.08%	-24.36%	-21.95%	-22.65%
thereof solidarity surcharge	0.136 (2.8%)	0.133 (2.8%)	0.822 (2.7%)	1.091 (2.7%)
Δ-%	-25.08%	-24.36%	-21.95%	-22.65%

Note: The table displays simulated tax revenues in billion € for the reference and reform tax system on the basis of the extrapolated sample and corresponding deviations in %. Tax revenue is calculated by aggregation of firm-level annual taxes due. Results are itemized according to the different taxes: Trade tax and corporate income tax plus solidarity surcharge. Company size categories are defined as explained in footnote of Table 2. Source: ZEW TaxCoMM

In the short run, when disregarding behavioural responses to changes in the tax system, the corporate tax reform 2008 results in a decline in tax revenues. The deficiency as simulated by ZEW TaxCoMM amounts to a total of € 9.817 billion and splits up into a loss of € 5.808 billion from corporate income tax, a loss of € 3.688 billion from trade tax and a loss of € 0.376 billion from the solidarity surcharge.

It is reasonable to compare the revenue effects computed by ZEW TaxCoMM with the outcomes of other approaches. Besides ZEW TaxCoMM, the Federal Ministry of Finance (Bundesstag (2007)) as well as Bach et al. (2007) and Radulescu/Stimmelmayer (2010) provide estimates on how the reform affects tax revenues. The results put forward by Bach et al. (2007) rely on the BizTax model which primarily determines the impact of tax rate cuts and trade tax

regulations on tax revenues.¹⁸ Radulescu and Stimmelmayer (2010) analyse the 2008 reform on the basis of a dynamic computable general equilibrium model (IfoMod). Due to fundamental differences in the model setup as regards e.g. the data basis, the modeling of institutional details as well as the consideration of behavioural responses and interactions between sectors, the results of IfoMod and ZEW TaxCoMM are, however, hardly comparable. To sum up, the comparison with the estimates of the Federal Ministry of Finance turns out to be most viable and is therefore illustrated in *Table 13*.

Table 13: Revenue Effects in bn € as estimated by the government and comparison to ZEW TaxCoMM results

	Corporate Income Tax	Trade Tax	Solidarity Surcharge	Overall
ZEW Tax CoMM	-5.808	-3.688	-0.367	-9.817
Federal Ministry of Finance¹	-6.150	-3.967	-0.585	-10.701
Deviation	0.342	0.279	0.218	0.884

Note: The table displays the revenue effects of the corporate tax reform as proposed by the Federal Ministry of Finance and as derived by ZEW TaxCoMM. These figures refer to income collected from corporations.

¹The revenue effects estimated by the Federal Ministry are displayed net of those revenue gains the Ministry presumes to earn from the self-financing effect of the reform and from special restrictions on tax avoidance (e.g. relocation of functions, security lending).

Source: ZEW TaxCoMM and Federal Ministry of Finance (Bundestag (2007)).

According to the Federal Ministry of Finance, the presumed financing gap of the corporate tax reform totals € 10.701 billion.¹⁹ For comparison, the revenue loss computed by ZEW TaxCoMM is € 9.817 billion and thus about € 900 million lower. This deviation does not seem implausibly high. ZEW TaxCoMM simulates the considered tax base regulations more precisely at micro level and thus derives revenue gains from the broadening of the tax base that outweigh the effect from the tax rate cut to a larger extent.

5 Implications for Reforming Corporate Taxation in Germany and Other Countries

By establishing a relation between firm characteristics and the impact of the corporate tax reform 2008, the analysis in *Section 4.2* and *4.3* provided evidence that companies losing from the reform feature a low profitability, a high debt ratio and a high capital intensity. About 5% of all corporations can be deemed to be losing from the reform. While these firms benefit less from the tax rate cut, they are more heavily exposed to the tax base broadening

¹⁸ As opposed to the ZEW TaxCoMM, the BizTax model does not precisely simulate tax base regulations.

¹⁹ These are deficiencies in revenue collected from corporations. The share of trade tax collected from corporations is approximated with 55% of total trade tax. The share of solidarity surcharge on corporate income is approximated with 11% of total solidarity surcharge revenue. The displayed loss is net of those revenue gains the Ministry presumes to earn from the self-financing effect of the reform and from special restrictions on tax avoidance (e.g. relocation of functions, security lending) (Bundestag (2007) p. 39).

regulations which finance the tax rate cuts. In two regards, this result bears high relevance in view of the current economic crisis. On the one hand, the number of losers will presumably rise. On the other hand, by causing earnings and investments to plummet while the cost of financing soars, the economic crisis hits the losers of the reform especially hard. While the increase in demand and costs of debt financing raises the overall amount of interest expenses, the decrease in profitability and EBITDA lowers the amount of interest expenses that is deductible for tax purposes. Moreover, higher interest expenses increase the tax burden from interest add-backs for trade tax purposes. Hence, the losers of the reform see their tax burden increase even more as compared to the pre-reform tax regime. Based on the regression results, the base line specification (column (1) of *Table 11*) suggests that if the profitability decreases by 20 percentage points, the reduction in the effective tax burden is reduced by 1.2 percentage points. It is even reduced by 1.8 percentage points for large corporations. If companies have to rely more heavily on debt financing due to liquidity constraints, an increase in the debt ratio of 20% reduces the benefit of the tax reform by 1.2 percentage points for large corporations and by 10.4 percentage points for companies already subject to the interest deduction ceiling regulation.

Consequently, by taxing an increasing amount of non-deductible expenses, the tax reform imposes additional restrictions on the liquidity of corporations thus reinforcing the negative implications of the crises on the financial situation of corporations. While this situation causes massive need for company restructuring, the very same is constrained by the regulation that bans loss set off when substantial changes in shareholder occur. To sum up, a tax rate cut cum base broadening reform especially when detaching the tax base from profits by banning the deduction of business expenses, additionally endangers the existence of firms in times of massive economic downturn. This finding has been exemplarily illustrated for the German corporate tax reform 2008, but similar consequences can be stated for other countries with comparable patterns of corporate taxation.

The governments of these countries now took measures to relieve companies from an additional tax burden in times of drastic economic downturn. These measures mainly focus on regulations considered as harmful in times of economic crisis, i.e. regulations that detach the tax base from profits. To name some examples, France intends to abolish the regional non-profit tax “taxe professionnelle” as of January 1st 2010, and Italy will introduce some reliefs to its interest deduction ceiling regulation in terms of an EBITDA carry forward. The most

important modifications planned or already implemented by the German government are roughly sketched in the following.

As regards the interest deduction ceiling regulation, the exemption limit has been raised from € one million to € three million (§ 4h II 1 a ITA)²⁰. Moreover, the government intends to mitigate the pro-cyclical effects of this regulation by introducing an EBITDA carry forward as of 2010. If interest expenses to be deducted for tax purposes are below 30% of EBITDA and no exemption or escape clause is used, it should be possible to carry forward the balance (§ 4h I ITA)²¹. An EBITDA carry forward thus increases the maximum amount of potentially deductible interest expenses in subsequent years. The tax burden from interest add-backs for trade tax purposes is relieved by reducing the share of interest included in rent and leasing expenses for immovable property from 65% to 50% (§ 8 No.1 e TTA)²².

The regulations governing the treatment of losses are modified in such a way that loss carry-forwards are not lost if the acquired, loss-making firm is insolvent and its fundamental business structure is preserved after acquisition (§ 8c I a CTA)²³. To facilitate business restructurings within groups, loss carry-forwards should no longer be lost if the buying and selling entity are directly or indirectly owned at 100% by a third party of that group (§ 8c I 5 CTA). Moreover, loss carry-forwards should not be lost due to changes in the shareholding structure to the extent of hidden reserves included in domestic business property (§ 8c I 6 f CTA). To stimulate investments, the declining balance depreciation has been reintroduced at a rate of 25% for two years (§ 7 II ITA)²⁴.

6 Conclusions

This paper presented a new corporate microsimulation model, ZEW TaxCoMM, which allows for the coherent micro-based analysis (ex ante and ex post) of reform induced revenue implications and the distribution of the tax burden between firms of different characteristics.

²⁰ Act on an improved consideration of insurance contributions for tax purposes (Gesetz zur verbesserten steuerlichen Berücksichtigung von Vorsorgeaufwendungen).

²¹ Act on the “Acceleration of Economic Growth” (Gesetz zur Beschleunigung des Wirtschaftswachstums).

²² Act on the “Acceleration of Economic Growth” (Gesetz zur Beschleunigung des Wirtschaftswachstums).

²³ Act on an improved consideration of insurance contributions for tax purposes (Gesetz zur verbesserten steuerlichen Berücksichtigung von Vorsorgeaufwendungen).

²⁴ Act implementing the tax regulations included in the package of measures of “Securing Jobs by Strengthening Growth” (Gesetz zur Umsetzung steuerrechtlicher Regelungen des Maßnahmenpakets “Beschäftigungssicherung durch Wachstumsstärkung”).

In this paper, ZEW TaxCoMM was employed to evaluate the distributional and revenue consequences of the German corporate tax reform 2008. For 50% of the corporations in the sample, the effective tax burden on cash flow is reduced by between 1.13 and 8.4 percentage points. On the other hand, despite the important tax rate cuts, 5% of all firms considered experience an increasing or unchanged tax burden. As regards revenue implications, ZEW TaxCoMM determines average revenue losses of € 9.817 billion. The decline is higher for corporate income tax, the trade tax thus gaining in importance.

The German corporate tax reform 2008 followed the persistent international trend of tax rate cut cum base broadening reforms and especially of detaching the tax base from profits by restricting the deduction of business expenses. Hence, the results on the distribution of the tax burden according to firm characteristics stand exemplarily for other reforms following a similar pattern.

ZEW TaxCoMM shows explicitly that high profitability, low debt ratio and low capital intensity favour a strong decline in the tax burden measure. The results of a simple estimation approach with OLS confirm these findings for a *ceteris paribus* setting.

The analysis showed that tax rate cut cum base broadening reforms, especially when detaching the tax base from profits by banning the deduction of business expenses, additionally endanger the existence of firms in times of massive economic downturn. Policy makers in Germany and other countries reacted by modifying the most harmful regulations, which implied the taxation of economic worth instead of profits.

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