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Impact of a reform of the fiscal loss compensation rules on the readiness to company risk-taking

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Reinald Koch* / Jens Prassel†

Abstract

The objective of the article at hand is an empirical examination of the impact stemming from two selected changes of fiscal loss-compensation rules on corporate risk-taking. To this end, a linear difference-in-differences approach is applied to three alternative risk-measures both for an unmatched and a matched company panel. Altogether, our results suggest that if promoting corporate risk-taking is considered to be a worthwhile governmental goal, than enhancing fiscal loss-offset possibilities may be an appropriate measure. The strength of the company response may, however, depend on which source of company risk is addressed.

Keywords

Loss compensation, risk-taking, minimum tax, company behavior, difference-in-differences

JEL: H25, H32

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1. Introduction

Over the last decades, theoretical literature has provided manifold insight into the tax impact on various kinds of business decisions. Empirical literature is, in contrast, focused by majority on investment and financing decisions, whereas other fields of management decisions lack empirical investigation. This lack of empirical evidence diminishes the understanding of the interaction between tax legislation and business behavior in particular if theoretical studies come to opposing conclusions and/or if empirical studies fail to approve theoretical expectations in related questions. One such field of research addresses the impact of tax legislation on the risk-taking decision of businesses.

The taxation of enterprises should have multiple influences on the readiness to risk-taking. At first, government's participation in gains and losses leads to a partial externalisation of investment risks. Moreover, most countries apply an asymmetric tax treatment of profits and losses leading to a discrimination against risky activities. Business gains usually result in immediate tax payments, whereas business losses can only be considered in a tax reducing way by means of a loss carry-forward or loss carry-back. The resulting interest and liquidity disadvantages are expected to be even more substantial if – corresponding to international practice – inter-period loss compensation is restricted either with regard to the period and/or the amount of off-settable losses.

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Theoretical analyses concordantly reveal that profit taxes affect both the expected yield and the risk associated with possible investment alternatives, which are regarded as being the most relevant decision parameters. It therefore seems to be a fair assumption that profit taxes factor into investment decisions under uncertainty and therewith the level of risk enterprises are willing to bear. The direction of this influence, however, is all but clear. Whereas a traditional view relied on the general assumption that the existence of profit taxes discourages businesses from engaging in risky activities (see *Sandmo (1989)* for further references), *Domar/Musgrave (1944)* come to the conclusion that profit taxes should have a positive effect on risk-taking, at least if losses result in immediate tax refunds. They argue with the above mentioned participation of the state in the business risk. This view has, however, also been subject to concern especially with regard to the restrictive assumptions of the applied model. Furthermore, it seems not appropriate to immediately conclude from these theoretical investigations on the actual business behavior as empirical studies regarding other aspects of determining taxable income (e.g. tax depreciation rules) show only a small relevance for investment decisions.¹

These mixed findings led *Feldstein (1969)* to the conclusion that „policy advice would be more firmly based if the alternative contending theories of economic behavior under uncertainty were taken as working hypotheses for empirical investigation“. Empirical analyses on the impact of fiscal loss compensation, however, are predominantly focused on the quantification of tax incentives to risk by measuring marginal tax rates (see *Altshuler/Auerbach (1990)*; *Auerbach/Poterba (1986)*; *Graham (1996a, 1996b)*; *Ramb (2007)*). However, the impact of these rules on the risk-taking decision has – as far as can be seen – by now been empirically examined only with regard to households (see *Poterba (2001)* for an overview).

¹ See for example *Wagner/Schwenk (2003)*.

Difficulties in deriving appropriate measures for the amount and change of company risk could serve as a possible explanation.

Other authors look at the impact of fiscal loss compensation on other types of business decisions. *Devereux (1989)* and *Dressler/Overesch (2010)* investigate at the impact of fiscal loss-offset provisions on the level of investment. *Oestreicher/Koch (2010a, 2010b)* show the influence of an intra-group loss-offset on the legal structure of domestic and multinational corporate groups.

Following Feldstein's line of thinking it is the intention of the present paper to provide empirical evidence for the impact of a change in the fiscal loss compensation rules on economic behavior under uncertainty, i.e. the readiness to risk-taking of corporations. To this end, the paper analyses two recent loss-offset reforms in the EU-15. In order to provide comprehensive insight into possible reactions, we investigate both the effects arising after an enlargement as well as a restriction of loss-offset possibilities. Technically, a difference-in-differences approach is applied, which compares the change in the risk taken by enterprises affected by the reform to the corresponding change for enterprises that are not affected.

From a political perspective this analysis has its merits, especially as a large number of the EU member states has amended their loss offset provisions in recent years (see Section 3 for further details). If such reforms further restricted loss-offset possibilities, they may in particular be motivated by the willingness to increase future tax revenue. This goal may, however, be achieved only to a certain extent if businesses reduce, as a response, their company risk which should on average also reduce future average returns. Besides, risky investments (except for pure speculation risks) are usually expected to promote innovations and have a positive influence on the evolution of employment. Given this, an aggravation of loss-offset possibilities may exert a negative side effect.

The remainder of this paper is organised as follows: In Section 2, we review existing theoretical literature and derive our main hypothesis regarding the impact of tax loss compensation rules on company risk-taking. Section 3 briefly describes the inter-period loss compensation rules as prevailing in the EU-15 member states in 2009 as well as related reforms in the recent past. In this context, we also motivate the choice of the reforms to be investigated. Section 4 comprises the empirical analysis. To this end, different measures for company risk are presented (Section 4.1), the relevant data is described and the econometric setting is outlined (Section 4.2 and 4.3) and the regression results are presented (Section 4.4 and 4.5). At this, regression results for an unmatched as well as a matched panel data set are reported. Some concluding remarks are made in Section 5.

2. Taxation and risk-taking decisions

The relation between fiscal loss compensation rules and the level of risk-taking has been intensely examined in the literature based on theoretical models. Seminal is the article by *Domar/Musgrave (1944)* which analyses the decision between a risky and a riskless investment based on a one-period model for a risk-averse investor. Using graphically derived indifference curves and the expected loss as a measure for risk, *Domar/Musgrave* arrive at the general conclusion that the government's participation in investment losses impacts the readiness to risk-taking. Compared to a world without taxes the direction of this impact is decisively dependent on the tax rate and the restrictions in loss compensation. More restrictive loss compensation rules should, however, lead *ceteris paribus* to less risk-taking. Exceptions from these findings can only arise in case of an extraordinary preference order of the investor.

Continuative models integrate in particular differing risk definitions as well as formal descriptions of risk utility and risk aversion. The analysis of *Tobin (1958)* is

based on the (μ, σ) -criterion. *Mossin (1968)*, *Stiglitz (1969)* and *Haegert/Kramm (1975)* widen the analysis to functions of risk utility and formal descriptions of risk aversion according to the definitions by *Arrow (1965)* and *Pratt (1964)*. Relying on more general assumptions, these examinations confirm the vital results by *Domar/Musgrave (1944)* in the case of complete loss compensation. Thus, the transition from a world without loss compensation to a world with complete loss compensation leads to an increased risk-taking which is even augmented if the tax rate increases. Other authors, however, challenge the generality of the conclusions drawn from these models. *Feldstein (1969)* illustrates, by giving a counter example that previous models relied on a number of restrictive and implausible assumptions. *Mintz (1981)* shows that risk-taking may be reduced by a higher tax rate even in the presence of full loss offset depending on the production function and the capital structure.

Even greater uncertainty with regard to possible responses prevails in the literature for the case that the tax system provides for only incomplete loss-offset. Here, two opposite effects may impact the optimal level of risk. On the one hand, the participation of the government in tax losses may encourage risk-taking, whereas on the other hand the asymmetric treatment of tax profits and tax losses discriminates against risky investments. Due to this conflict theoretical studies fail to give convincing predictions for the direction of the tax effect in the presence of incomplete loss offset which led *Feldstein (1969)* to the conclusion that empirical evidence may provide further insight.

Despite the expansions and/or specifications mentioned and the uncertainty with regard to the impact of a tax rate change in the presence of full or restricted loss-offset all of the above mentioned papers confirm the results by *Domar/Musgrave* with respect to the expected risk-adjustment as a response to changed loss-offset provisions. Hence, the assumption to be tested is that an aggravation (mitigation) of

the fiscal loss compensation rules ceteris paribus reduces (increases) the readiness to take company risks.

3. Loss-offset regulations in Europe

All EU-15 member states apply a tax system that discriminates against corporate tax losses according to tax law currently prevailing. Instead of providing for an immediate tax rebate, governments participate only in tax losses if the corporation earns tax profits in future or – in some member states – earlier periods. Table 1 summarizes the relevant provisions.

Table 1

Inter-period loss compensation rules in the EU-15 countries in 2009

Loss carry-forward		Loss carry-back	
Period and amount unlimited	Belgium, Denmark, France, Great Britain, Ireland, Luxembourg, Sweden	Available	Sweden (6 years), France (3 years), Germany, Great Britain, Netherlands (all 1 year)
Period limited	Spain (15 years), Finland (10 years), Netherlands (9 years), Portugal (6 years), Greece, Italy	Not available	Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Luxembourg, Portugal, Spain
Amount limited	Austria, Germany		

Source: Koch (2010)

In all EU-15 member states losses can be utilized by way of a loss carry-forward. Among these, seven countries allow for loss carry-forward without restriction, whereas six countries apply limitations with regard to the carry-forward period. These limitations vary from five years in Greece and Italy to 15 years in Spain. The remaining two countries (Austria and Germany) limit the amount deductible in future periods (“minimum taxation”). In Austria, loss deduction is limited to 75% of the future year profits, whereas in Germany deduction is restricted to 60% of the future year profits exceeding the amount of 1 million EUR. Loss carry-back is

provided only in five member states with the carry-back period varying between one and six years.

Table 2 outlines the changes of loss compensation rules in the EU-15 member states between 1994 and 2009 and thus possible reforms to be investigated in our analysis. During this period, 10 out of 15 of the analyzed countries amended the respective provisions at least once. Looking at the direction of these reforms reveals that loss-offset possibilities have been, by majority, extended as far as the loss carry-forward period is concerned. Contrastingly, the loss carry-back period has been reduced in three out of four cases. Restrictions with regard to the maximum amount of deductible loss carry-forwards occurred with three reforms during the period under consideration. Two of these reforms introduced minimum tax provisions (Austria 2001 and Germany 2004), whereas in Belgium a minimum tax provision was abolished in 1998.

Table 2

Recent changes in the inter-period loss compensation rules in the EU15 countries

Country	Loss carry-forward		Loss carry-back
	Period	Amount	
Austria			
1994-1995	7 years	unlimited	no
1996-1998	0 years		no
1999-2000	unlimited	unlimited	no
2001-2009	unlimited	limited	no
Belgium			
1994-1997	unlimited	limited	no
1998-2009	unlimited	unlimited	no
Denmark			
1994-2001	5 years	unlimited	no
2002-2009	unlimited	unlimited	no
Finland			
1994-2009	10 years	unlimited	no
France			
1994-2003	5 years	unlimited	3 years
2004-2009	unlimited	unlimited	3 years
Germany			
1994-1998	unlimited	unlimited	2 years
1999-2003	unlimited	unlimited	1 year
2004-2009	unlimited	limited	1 year

Great Britain 1994-1997 1998-2009	unlimited unlimited	unlimited unlimited	3 years 1 year
Greece 1994-2009	5 years	unlimited	no
Ireland 1994-2009	unlimited	unlimited	1 year
Italy 1994-2009	5 years	unlimited	no
Luxembourg 1994-2009	unlimited	unlimited	no
Netherlands 1994 1995-2006 2007-2009	8 years unlimited unlimited	unlimited unlimited unlimited	3 years 3 years 1 year
Portugal 1994-1997 1998-2009	5 years 6 years	unlimited unlimited	no no
Spain 1994 1995-1997 1998-2001 2002-2009	5 years 7 years 10 years 15 years	unlimited unlimited unlimited unlimited	no no no no
Sweden 1994-1998 1999-2009	unlimited unlimited	unlimited unlimited	no 6 years

Source: Kesti (1994-2009)

The high number of recent reforms in this area firstly underlines the political relevance of the research question at present. Secondly, it offers room to choose the tax reform best appropriate for investigation with a natural experiment. To this end, the following requirements are made to the reforms: (1) Sufficient importance of the changes in the fiscal loss compensation rules; (2) No important changes in the fiscal loss compensation rules and tax rates in the years prior to and following the reform²; (3) Changes in the fiscal loss compensation rules only affect part of the taxpayers.

These requirements assure that one may reckon on an adjustment in the taxpayers' behavior driven by the reform, observed adjustments in the behavior are not distorted by changes of the tax law in the years prior to and following the reform

² A summary of the corporate tax rates applicable in the EU 15 member states during the period under consideration can be found in the Appendix.

and adjustments in the behavior can be measured on the basis of a difference-in-differences approach in comparing the reactions of enterprises affected by the reform (treatment group) with enterprises not affected (control group). The latter requirement is important as one has to take into account that the enterprises' attitude towards risk-taking is not only influenced by fiscal rules but also and decisively by economic and business conditions.

In particular, two of the reforms contained in Table 2 wholly comply with these requirements, that is to say (1) the abolishment of the minimum tax in Belgium in 1998 and (2) the implementation of such a provision in Germany in 2004. Due to the opposite direction of these two reforms an examination should reveal opposite results assumed that the expected relationship exists. The quasi-experimental character of these reforms is based on the fact that in Belgium the restriction of loss compensation with respect to the amount (only 50% could be deducted) was not applied to losses up to 20 million Belgian francs (converted approximately 500.000 €). In Germany, a restriction of loss compensation with respect to the amount was introduced applying to losses exceeding 1 million €. Therefore, the abolishment (introduction) of these restrictions only affects large-scale enterprises, whereas small enterprises remained unaffected.

4. Empirical analysis

4.1 Measurement of company risk

Ascertaining the impact of tax legislation on the risk-taking decision of corporate businesses involves two particular difficulties: (1) Measuring the dependent variable, i.e. the level of risk taken by a specific corporation and (2) isolating the tax impact on the risk-taking decision from other (economic) influences.

Traditional finance literature suggests defining risk as the standard deviation of expected future earnings (see for example *Berk/DeMarzo (2007)*). Since internal planning data is not available, however, our analysis has to be based on publicly available data. As a popular alternative, firm betas determined on historical capital market information are taken to measure the risk related to a firm. This approach, however, is not appropriate for the study at hand. Firstly, referring to beta would reduce the company sample to listed companies and therefore a rather small and not randomly chosen sample of companies. Secondly, beta reflects not the risk of an individual company but rather the risk of a group of companies which is headed by a listed corporation. In the case of a multinational group, this definition of risk would be affected by a number of different tax systems.³ Finally, firm betas measure the correlation between the systematic market-wide risk affecting all firms and the systematic risk of the firm itself. Firm-specific, diversifiable risks are not covered by this measure. Beta thus indicates how sensitive a firm's return is compared to all other firms facing market-wide economic changes and not, as required for the purpose of this paper, the overall risk of a firm (see *Copeland/Weston/Shastri (2010)*).

For these reasons, company risk in this study will be defined on the basis of published accounting data. As such ratios can only approximate the actual level of risk three different definitions are applied in order to analyze the robustness of our findings. Besides, the application of different risk measures allows us to investigate different sources of company risk.

A first definition applies the well known interaction of investment risk and investment return. If sufficient efficiency of capital markets is assumed and we disregard the fact that accounting earnings do not reflect economic returns but rather a legally defined profit, it can be expected that companies with a higher

³ Besides, we exclude group companies from our analysis for other reasons; see Section 4.2.

operative risk will in many cases at the same time have a higher expected operating profit. As for a sufficiently large sample of companies realized returns will equal expected returns, the return on assets (defined as EBIT/Total Assets) can be seen as a suitable proxy for company risk. In order to reduce the influence of potential outliers, we define RISK_1 as the cube root of return on assets.

As a second measure of risk we determine the ratio of interest payments and non-current liabilities. This definition is based on the notion that lenders will on average claim higher interest rates for loans to companies with higher risk. However, one has to bear in mind that lenders will usually base their interest claim on the after-tax risk rather than the pre-tax risk. This may lead to higher interest claims even if the respective company reduces its risk as a response to the introduction of more restrictive loss-offset provisions. In this case, the after-tax risk may rise due to the smaller risk-participation of the state and thus leading lenders to request higher interest rates. Hence, this measure may reflect both responses of companies and responses of lenders to tax reforms. Again, we apply the cube root of the interest ratio in order to avoid influential outliers.⁴ The properties of this risk measure differ from those of RISK_1 not only with regard to the consideration of taxes in its definition (after-tax risk vs. pre-tax risk). In addition, RISK_2 covers all sources of company risk, whereas RISK_1 is restricted to operative risks.⁵

As a third measure for company risk we refer to the ratio of intangible fixed assets and fixed assets. This definition of risk is based on the assumption that investments in this type of assets (e.g. costs for R&D, royalties or similar rights) are on average associated with an above average level of risk compared to an investment into property, plant and equipment. On average, valuation and volatility

⁴ As AMADEUS does not admit any breakdown of interest payments on short-term and long-term liabilities, the measured ratio may be biased in the case of short-term interest payments. In order to avoid any bias due to abnormal changes of RISK_2 in such a case, we also exclude corporations for which the range between minimum and maximum value for RISK_2 exceeds five times the median.

⁵ Financial risk is excluded since RISK_1 is not affected by the capital structure choice.

estimation of expected cash flows should be less reliable with respect to intangible assets. It has to be noted that the value for RISK_3 may depend on the accounting treatment of self-provided intangible assets, i.e. the treatment of research and development costs. Changes in the accounting treatment, however, should not lead to biased estimates in our case as any changes of the respective accounting provisions would have affected companies belonging to the control group and treatment group in the same manner.⁶ In comparison to RISK_1 and RISK_2, this measure applies the narrowest definition of risk by covering only a specific source of operative risk.

Table 3 summarizes the applied definitions of the dependent variable RISK and provides summary statistics for the Belgian and German companies.

Table 3
Descriptive statistics for dependent variables

	Definition	Country	Mean	SD	Min	Max
RISK_1	$\sqrt[3]{\frac{EBIT}{Total\ Assets}}$	BE	0.277	0.331	-2.038	2.504
		DE	0.309	0.376	-3.528	6.245
RISK_2 ⁷	$\sqrt[3]{\frac{Interest\ Paid}{Non\ Current\ Liabilities}}$	BE	0.405	0.106	0.035	1.000
		DE	0.325	0.107	0.008	1.000
SK_3	$\frac{Intangible\ Fixed\ Assets}{Fixed\ Assets}$	BE	0.038	0.136	0.000	1.018
		DE	0.069	0.164	0.000	1.000

4.2 Data and identification strategy

The financial data for Belgian and German corporations underlying the following analysis is taken from the AMADEUS database (update 125 and update 172). AMADEUS is a comprehensive, pan-European database containing financial

⁶ At least for Germany, no amendment of the respective accounting provisions has occurred during the period under consideration.

⁷ Vales greater than one were excluded as abnormal values.

information on some nine million public and private companies in 38 European countries and is distributed by the private database provider Bureau van Dijk. It contains standardized (consolidated and unconsolidated) annual accounts, financial ratios, activities and ownership information for the companies included. Updates 125 and 172 of AMADEUS, which have been applied in this paper, include annual accounts for the financial years 1994 to 2007 if full information is available.

The panel applied for our analysis consists of all Belgian and German companies, which (a) have the legal form of a corporation, (b) exceed the threshold of a very small company and (c) are not part of a corporate group (stand-alone companies). Furthermore, we exclude all corporations for which the financial information required in order to determine the respective risk-measures were not provided in AMADEUS for at least one year prior to and one year after the reform.

Companies in the legal form of a partnership have been excluded although in Belgium corporations and partnerships are treated similarly for tax purposes. Nonetheless, we assume that differences in the liability regulations may factor into the risk-adjustment decision. Very small companies (companies with an average profit⁸ of less than 100 TEUR) have been excluded since the general economic conditions for these companies are assumed to differ substantially from those for the large and medium-sized enterprises. Finally, group companies have been excluded from the analysis as for these companies there are available further possibilities for loss compensation (e.g. intra-group loss compensation or strategic intra-group debt financing). Therefore, it has to be assumed that these companies will respond to the reform in a different manner.

Analyzing the reforms in Belgium and Germany establishes the opportunity to apply a quasi-experimental setting. Due to the basic allowance with respect to the

⁸ Average profit is determined as the mean value of “profit/loss before tax” (in terms of its absolute value) for the years prior to the reform.

fiscal loss compensation prior (Belgium) and post (Germany) to the reform only large-scale Belgian and German enterprises are affected by the tax law change (treatment group). It is therefore aimed to analyse, based on this natural experiment, to what extent enterprises of this group altered risk after the reform differently than enterprises which were not affected by the reform (control group). Technically a linear difference-in-differences approach with company-specific and time-specific fixed effects of the following type is applied.

$$RISK_{it} = b_0 + b_1 \cdot SIZE_i \cdot POST_t + b_2 \cdot X_i \cdot POST_t + b_i + b_t + \epsilon_{it} \quad (1)$$

The impact of the tax reform on the level of risk is measured by the coefficient b_1 for the difference-in-differences term $SIZE_i \cdot POST_t$. In this context, $SIZE_i$ separates observations belonging to the treatment group (large-scale enterprises) from observations belonging to the control group (small scale enterprises). Large-scale enterprises are characterized by an average profit (in absolute terms) exceeding the basic allowance of the minimum tax provision (500 TEUR for Belgium; 1000 TEUR for Germany).⁹

The number of enterprises entering into the study (subdivided by country and size) is reflected in Table 4.

Table 4

Number of companies in the (unmatched) panel¹⁰

	Large-scale enterprises	Small-scale enterprises	Total
Belgium	746	1,717	2,463
Germany	1,716	3,479	5,195

⁹ Average profit is determined as the mean value of “profit/loss before tax” (in terms of its absolute value) for the years prior to the reform.

¹⁰ Numbers in Table 4 refer to the regression analysis with the dependent variable RISK_1. Values may differ for the other risk measures.

The dummy $POST_t$ labels observations referring to the period after the reform (Belgium: 1998 - 2001; Germany: 2004 - 2007) with a value of one, whereas a value of zero is assigned to this variable if the observation refers to the pre-reform period (Belgium: 1994 - 1997; Germany: 2001 - 2003).¹¹ In contrast to standard difference-in-differences settings we do not include $SIZE_i$ and $POST_t$ as plain variables. Instead, we control for company- and time-specific fixed effects.

X_i represents a vector of variables which are included in order to control for the firm-specific ability and willingness to adjust the level of risk after the reform. The intensity of investments (II), the return on equity (ROE) as well as the equity ratio (ER) should have an impact on the readiness and capability to take increased risks and therefore on the change of the firm-specific risk-taking over time. As these factors exert neither over time nor over all enterprises a constant effect they are not captured by the above mentioned fixed effects. For the purpose of examining the impact of these factors on the change in risk-taking of large-scale Belgian and German enterprises after the reform they enter the model by means of the interaction terms with the post reform dummy and the treatment group dummy ($POST_t \cdot SIZE_i$). This definition arises from the objective of our analysis not to explain the overall level of risk but rather the change after the reform. The interaction with $SIZE_i$ is a consequence of the assumption that only the corporations affected by the reform adjust their level of risk. Values for our control variables were estimated as mean value over a three year period prior to the reform. For reasons of a robustness check we also estimate specifications without including these controls or with these controls being included but interacted only with the post reform dummy ($POST_t$).

¹¹ For Belgium (Germany) periods later than 2001 (before 2001) are excluded from the analysis because of significant changes of the tax rates.

Table 5*Descriptive statistics for independent variables*

	Determination	Scale	Country	Mean	SD	Min	Max
SIZE	Takes the value 1 if profit and loss before tax is higher than 500 TEUR (Belgium) or 1000 TEUR (Germany), otherwise the value is 0.	dummy	BE	0.303	0.460	0.000	1.000
			DE	0.330	0.470	0.000	1.000
POST	Labels the period before and after the reform. For years from 1998 (Belgium) or 2004 (Germany) the value 1 is assigned, previous years take the value 0.	dummy	BE	0.500	0.500	0.000	1.000
			DE	0.571	0.495	0.000	1.000
II	Mean of the intensity of investments (Fixed Assets/Total Assets) for the period 1994 to 1996 (Belgium) and 2001 to 2003 (Germany)	numerical	BE	0.295	0.266	0.000	1.000
			DE	0.382	0.297	0.000	1.000
ROE ₁₂	Mean of the return on equity (Profit and Loss before tax/Shareholder funds) for the period 1994 to 1996 (Belgium) and 2001 to 2003 (Germany).	numerical	BE	0.197	0.712	-4.975	4.882
			DE	0.232	0.786	-4.920	4.879
ER ¹³	Mean of the equity ratio (Shareholder funds/Total assets) for the period 1994 to 1996 (Belgium) and 2001 to 2003 (Germany).	numerical	BE	0.259	0.337	-3.679	0.997
			DE	0.282	0.321	-4.131	1.000

The capability of adjusting risk should in particular depend on the structure of the assets. Enterprises with a high proportion of fixed assets should be less able to react rapidly to changed economic and business conditions. Furthermore, it can be assumed that enterprises with an above-average rate of return do not face the necessity for adjustments. Finally, the equity ratio may have an influence on the decision for or against risk adjustments. The direction of this impact, however, cannot be predicted convincingly on the basis of theoretical considerations since it should crucially be dependent on the individual attitude of the investor towards risk. It is conceivable that enterprises with a low rate of return are consciously willing to face an increased risk since for such enterprises – at least as far as corporations are concerned – the risk to encounter a loss in the case of a bankruptcy

¹² Values larger than 5 or smaller than -5 were regarded as influential outliers and therefore dropped.

¹³ Values smaller than -5 were regarded as influential outliers and therefore dropped.

is limited to just a small amount of equity. Contrariwise, it could be assumed that these enterprises are not willing to face an increased risk in order to avoid the threat of a bankruptcy. The determination of the independent variables as well as summary statistics for Belgian and German companies is reported in Table 5.

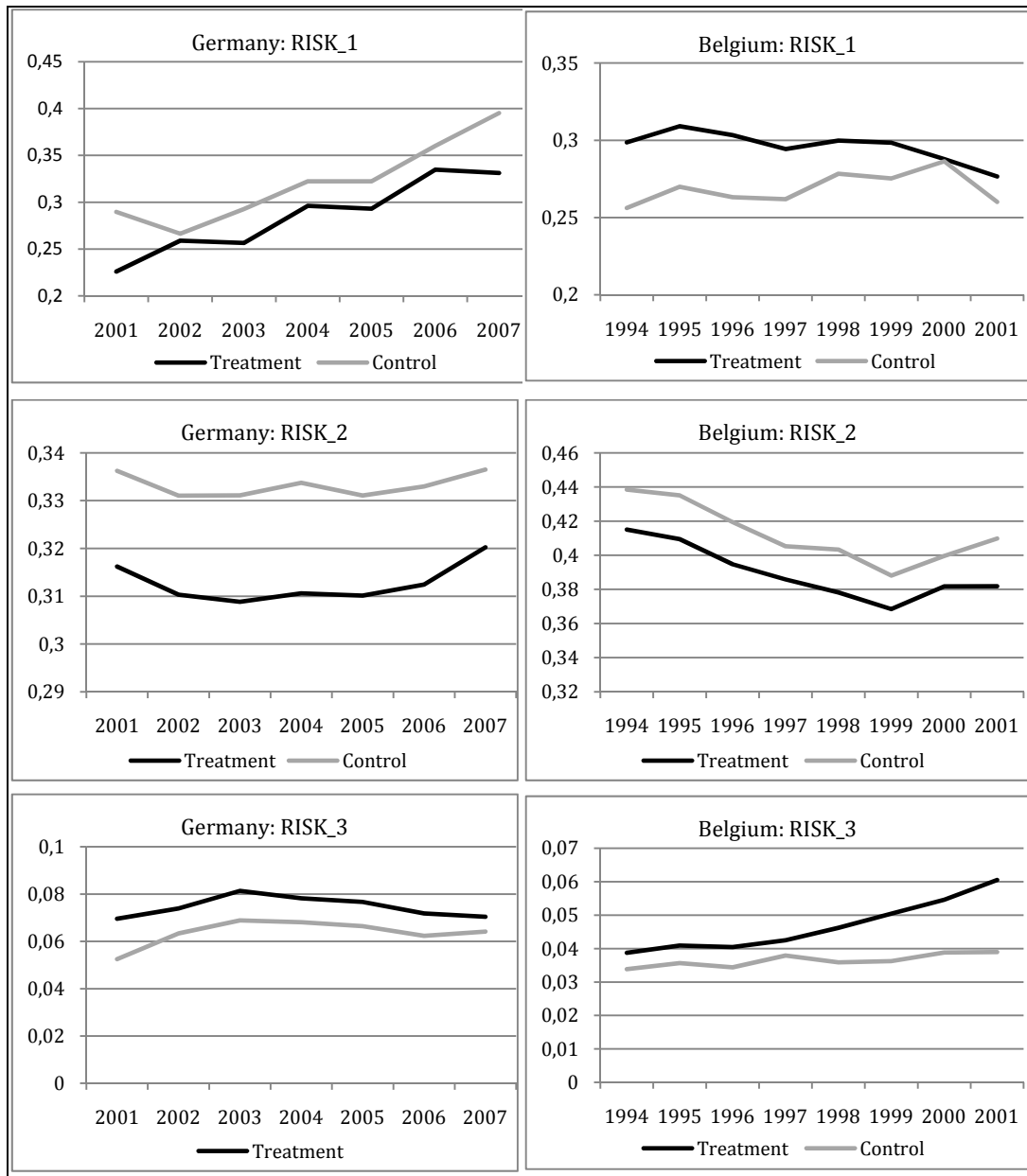
A necessary and fundamental requirement of the difference-in-differences technique is the assumption of a common trend for the dependent variables in both groups of observations (control and treatment group) (see e.g. *Meyer (1995)*) Only if the dependent variables would have changed for both groups in a similar manner without the tax reform, the response estimated by the coefficient for the difference-in-differences term can be attributed to the reform thus indicating the tax impact. The further analysis of Section 4 is therefore structured as follows: In Section 4.3 we illustrate graphically the development of the dependent variables over time in order to support the common trend assumption and providing a first indication for the validity of our research hypothesis. Section 4.4 then contains the basic regression results for an unmatched panel data set. Finally, in Section 4.5 the results of a matched panel regression are presented with the control group being defined on the basis of a propensity score matching. With this approach we attempt to enhance the comparability of treatment group and control group and therefore the accuracy of the difference-in-differences estimator.

4.3 Development of risk-measures

In order to validate the presumption of a common trend, Figure 1 compares graphically the development of the three risk measures (mean values) for the treatment and the control group over time. Hereby, parallel developments prior to the reform (for Belgium prior to 1998; for Germany prior to 2004) support the common trend assumption. Moreover, the post-reform developing may give a first indication of the reform impact on company risk-taking.

Figure 1

Development of the mean values for the risk-measures prior to and after the reforms (unmatched panel)



Source: Own calculations

The graphs in Figure 1 show, first of all, systematic differences in the level of the risk-measures for large-scale and small-scale corporations. The average interest ratio (RISK_2) is higher for small-scale corporations in both countries and over the whole period under consideration. Contrariwise, with regard to investments in intangible fixed assets (RISK_3) large-scale corporations in Belgium and Germany concordantly show a higher risk throughout the periods. These facts, however, should not challenge the overall quality of the risk-measures applied. The observed differences in the risk-level should rather be due to the fact that both measures capture risk in a different manner. Whereas RISK_3 only covers a certain part of company risk, that is to say intangible assets investments, RISK_2 basically comprises company risk as a whole and thus not only a specific operative risk. What is more, RISK_2 presumably is influenced by the negotiation power towards the lenders. Finally, RISK_2 should measure the after-tax risk taken by the corporation instead of the pre-tax risk, as it is the case for RISK_3. As regards the average return (RISK_1) no concordant difference between large-scale and small-scale corporations can be ascertained. While the return on assets of large-scale corporations in Belgium exceeds the respective values for small enterprises in all periods, the situation in Germany turns out to be vice versa.

Looking at the variation of risk-measures over time reveals that the average values of RISK_2 and RISK_3 followed a similar trend prior to the reform (Belgium: 1994 to 1997; Germany: 2001 to 2003) for both groups of corporations. These findings substantiate the assumption of a common trend for these risk-measures and hence support the presumption that application of a difference-in-differences approach leads to unbiased estimators. Considerable discrepancies between the developing of the control and the treatment group, however, are observed for RISK_1, especially as far as the German tax reform is concerned constituting a

limitation towards the accuracy of the difference-in-differences estimator in this case.

A distinct different developing of risk-measures after the reform can be identified for RISK_3, especially in the Belgian case. A relative increase (decrease) of RISK_3 for the treatment group of large-scale Belgian (German) corporations compared to the control group is evident for the periods after the reform in 1998 (2004). This result is thus in line with our hypothesis that these corporations have widened (reduced) risk-taking after the abolishment (introduction) of the minimum tax. As to the other risk-measures no significant differences can be deduced from the diagrams. It has to be kept in mind, however, that these figures on the one hand give only a first indication for the hypothesis to be tested. On the other hand, the reform impact could be considerable yet not strong enough to appear in such rather rough graphical illustrations.

4.4 Regression results (unmatched panel)

Table 6 presents the regression results for the analysis of the abolishment of the Belgian minimum taxation in 1998. For each risk-measure three different specifications were estimated. Specifications (1), (4) and (7) take the difference-in-differences term $SIZE \cdot POST$ as well as company-specific and time-specific fixed effects into account. The other specifications additionally control for further company characteristics which are to be expected to influence positively or negatively the adjustment of the readiness to risk-taking. At this, specifications (2), (5) and (8) include these controls solely with respect to the treatment group. This setting conveys the expectation that a risk adjustment applies to these corporations only. Specifications (3), (6) and (9) include the controls for all corporations.

The results in Table 6 support the hypothesis that large-scale Belgian corporations enlarged risk-taking after the abolishment of minimum taxation, in part. For RISK_3 we find a significantly positive influence for all three specifications

supporting the expectation that large-scale corporations invested into intangible fixed assets to a significantly greater amount after the reform. The size of this effect lies in a range of 1.13 and 1.56 percentage points, depending on the estimated specifications; the semi-elasticities vary between 0.31 and 0.43 indicating a sharp increase of the values for this risk-measure after the reform.

RISK_2 shows as well positive coefficients for all three specifications. The results are significant on a 10-percent level as regards specification (5) and (6), respectively. Here, semi-elasticities of between 0.010 and 0.027 are estimated indicating a substantially smaller impact than for RISK_3. It has to be kept in mind, however, that the level of RISK_2 is also influenced by the bargaining power of corporation and lender which may explain the smaller response. Besides, it may be the case that companies respond less strongly with regard to sources of risk different from the investment in intangible assets. For RISK_1, measuring risk on the basis of EBIT, a significant higher risk-taking of large-scale corporations can only be ascertained for specification (2). Without taking further interaction terms into account or including controls for all corporations, the adjustment in risk-taking, however, is revealed to be insignificant or even significantly negative. Since we have to assume that the significantly positive change with respect to specification (2) is traced back to the partial inclusion of the interaction terms, there is no support for the expectation of an increase in risk-taking of large-scale corporations related to this risk-measure.

Table 7 depicts the respective results for the regression analysis as regards the German tax reform in 2004. Here, large-scale corporations are expected to reduce risk-taking compared to small-scale corporations which are not affected by the reform. This expectation, however, can only be confirmed for RISK_3 showing a significant negative estimator for $SIZE \cdot POST$ in specification (8). In specification (9), the negative coefficient is significant on a 10.1-percent level. The size of the

coefficients (between -0.002 and -0.01) as well as the semi-elasticities (between -0.03 and -0.14) is considerably smaller, meaning that German corporations reacted less strongly to the introduction of the minimum tax than Belgian corporations did in the opposite case.

RISK_1 and RISK_2 show, on the contrary, significantly positive or insignificant coefficients. It has to be pointed out, however, that there is no parallel developing of RISK_1 for large-scale and small-scale corporations in Germany prior to the reform (refer to the upper left diagram in Figure 1) meaning that $SIZE \cdot POST$ may be affected by other influences.

The results concerning the included control variables give no clear support to our theoretical expectations. For the investment intensity (II) and the return on equity (ROE) we supposed that corporations with high values for these variables are only to a small extent able or ready to change risk-taking. Hence, the coefficients for the respective interaction terms should bear the opposite algebraic sign compared to $SIZE \cdot POST$. For the investment intensity, this effect can in both countries be observed only with respect to RISK_2 and RISK_3 (exception: specifications (6)), whereupon the coefficients are significant only for RISK_3. The estimators for the interaction terms with ROE show significant opposite algebraic signs only for RISK_1. With regard to the equity ratio, interaction terms bear in most specifications the opposite sign than $SIZE \cdot POST$ meaning that corporations characterized by a high equity ratio respond less strongly to the reform.

Table 6*Regression results: Belgium (unmatched panel)*

VARIABLES	(1) RISK_1	(2) RISK_1	(3) RISK_1	(4) RISK_2	(5) RISK_2	(6) RISK_2	(7) RISK_3	(8) RISK_3	(9) RISK_3
<i>SIZE · POST</i>	-0.0141* (0.00822)	0.0584*** (0.0172)	0.00335 (0.00963)	0.00407 (0.00312)	0.0110* (0.00555)	0.00634* (0.00307)	0.0142*** (0.00277)	0.0156* (0.00821)	0.0113*** (0.00296)
<i>SIZE · POST · II</i>		0.0566* (0.0275)			-0.0177 (0.0118)			-0.0266** (0.0105)	
<i>SIZE · POST · ROE</i>		-0.0612*** (0.00976)			0.00768** (0.00337)			0.00341 (0.00592)	
<i>SIZE · POST · ER</i>		-0.253*** (0.0436)			-0.00258 (0.0127)			0.0114* (0.00605)	
<i>POST · II</i>			0.0215 (0.0142)			0.00620 (0.00684)			-0.0196*** (0.00452)
<i>POST · ROE</i>			-0.0512*** (0.0116)			0.00705* (0.00362)			0.00169 (0.00219)
<i>POST · ER</i>			-0.198*** (0.0351)			-0.0161* (0.00803)			0.00285 (0.00290)
Observations	16,653	16,570	11,112	10,883	10,848	38,189	36,996	36,750	16,653
Adjusted R-squared	0.431	0.436	0.535	0.540	0.540	0.597	0.578	0.585	0.431

Notice: ***, ** and * label significance on a level of 1%, 5% and 10%. Robust und clustered (with respect to years and four size classes) standard errors are given in parentheses. A constant, year-dummies and firm-specific fixed-effects were included but not reported.

Table 7

Regression results: Germany (unmatched panel)

VARIABLES	(1) RISK_1	(2) RISK_1	(3) RISK_1	(4) RISK_2	(5) RISK_2	(6) RISK_2	(7) RISK_3	(8) RISK_3	(9) RISK_3
<i>SIZE · POST</i>	0.0100 (0.0105)	0.112*** (0.0200)	0.0303*** (0.0104)	-0.000987 (0.00269)	0.00185 (0.00478)	-0.00127 (0.00275)	-0.00173 (0.00160)	-0.00966* (0.00521)	-0.00273 (0.00158)
<i>SIZE · POST · II</i>		0.0419** (0.0200)			-0.00790 (0.00674)			0.0114* (0.00627)	
<i>SIZE · POST · ROE</i>		-0.117*** (0.00958)			-0.00126 (0.00233)			-0.00411 (0.00253)	
<i>SIZE · POST · ER</i>		-0.266*** (0.0399)			-0.000575 (0.00849)			0.0109 (0.00724)	
<i>POST · II</i>			0.0301** (0.0110)			-0.00312 (0.00449)			0.0107** (0.00417)
<i>POST · ROE</i>			-0.0845*** (0.00764)			-0.000703 (0.00110)			-0.00287 (0.00197)
<i>POST · ER</i>			-0.216*** (0.0219)			-0.00570 (0.00510)			0.000902 (0.00468)
Observations	25,022	24,663	24,398	18,152	17,961	17,789	27,558	27,123	26,804
Adjusted R-squared	0.488	0.501	0.516	0.658	0.660	0.661	0.769	0.769	0.769

Notice: ***, ** and * label significance on a level of 1%, 5% and 10%. Robust und clustered (with respect to years and four size classes) standard errors are given in parentheses. A constant, year-dummies and firm-specific fixed-effects were included but not reported.

4.5 Regression results (matched panel)

The results presented in Section 4.4 were based on a company panel including, subject to certain exceptions, all German and Belgian corporations included in AMADEUS. This approach brings with it the advantage of a relatively high number of observations. On the other hand, including all observations can only lead to meaningful estimates for the difference-in-differences term if the respective risk measures would have changed accordingly for both groups of companies in the absence of a reform. Although Figure 1 in Section 4.3 illustrates that the development of the risk-measures prior to the reforms comply with this requirement in most of the cases, some substantial discrepancies between treatment and control group can be observed.

In order to enhance the quality of the panel in terms of comparability of treatment and control group, the estimations presented in Section 4.4 were repeated for a matched panel. Following the approach suggested by *Rosenbaum/Rubin (1983, 1985)*, we assigned to each of the treatment group companies by means of a propensity score matching (nearest neighbor, no replacement) that company from the control group that matched best in terms of development of the respective risk measure prior to the reform.¹⁶ The developing of the risk-measures for the matched panel (see Figure 2) indicates that previously existing discrepancies between both groups of companies were removed. The matching procedure should therefore have contributed to enhancing the validity of the regression analysis, despite the fact that the number of observations included in the panel has been reduced.

The regression results included in Tables 8 and 9 now confirm for RISK_2 and RISK_3 concordantly and significantly in half of the specifications the expected risk

¹⁶ *Rosenbaum/Rubin* call this approach “Nearest available matching on the estimated propensity score”.

adjustment after the reform. For RISK_2 we find in accordance with our hypothesis a significant extension of the risk taken by large Belgian enterprises after the reform, whereas for Germany the opposite effect can be observed. The same holds true for RISK_3 with the difference that for this risk-measure significant coefficients are estimated for both countries (for RISK_2 this is the case only for Germany). With regard to the size of the measured effects, the adjustment concerning RISK_3 (semi-elasticities of between -0.068 and -0.244 (Germany) and 0.366 and 0.415 (Belgium)) exceeds the respective adjustment estimated for RISK_2 (semi-elasticities of between -0.014 and -0.017 (Germany) and 0.006 and 0.012 (Belgium)). These estimates for the semi-elasticities indicate that only the adjustment for RISK_3 is of any economic relevance. Furthermore, we find that the reaction to an abolishment of the minimum tax (Belgium) exceeds the reaction to the opposite reform (Germany) in size.

Only for RISK_1 the hypothesis of a tax induced risk-adjustment after the introduction or abolishment of a minimum tax cannot be verified. We find significantly positive coefficients for both tax reforms, meaning that only the risk adjustment of the Belgian companies meets with our theoretical expectations. A possible explanation for these mixed findings may be the fact that a companies' return on assets is not only affected by the overall economic climate and possible tax planning strategies, but is to a substantial extent random figure.¹⁷ Possibly, the size of the panel is not sufficiently large enough to outrule any substantial impact of such random changes.

¹⁷ See in this context also *Graham (1996a, 1996b)* who bases his measure of the marginal tax rate on the assumption of a random walk with drift for future year earnings.

Figure 2

Development of the mean values for the risk-measures prior to and after the reforms (matched panel)

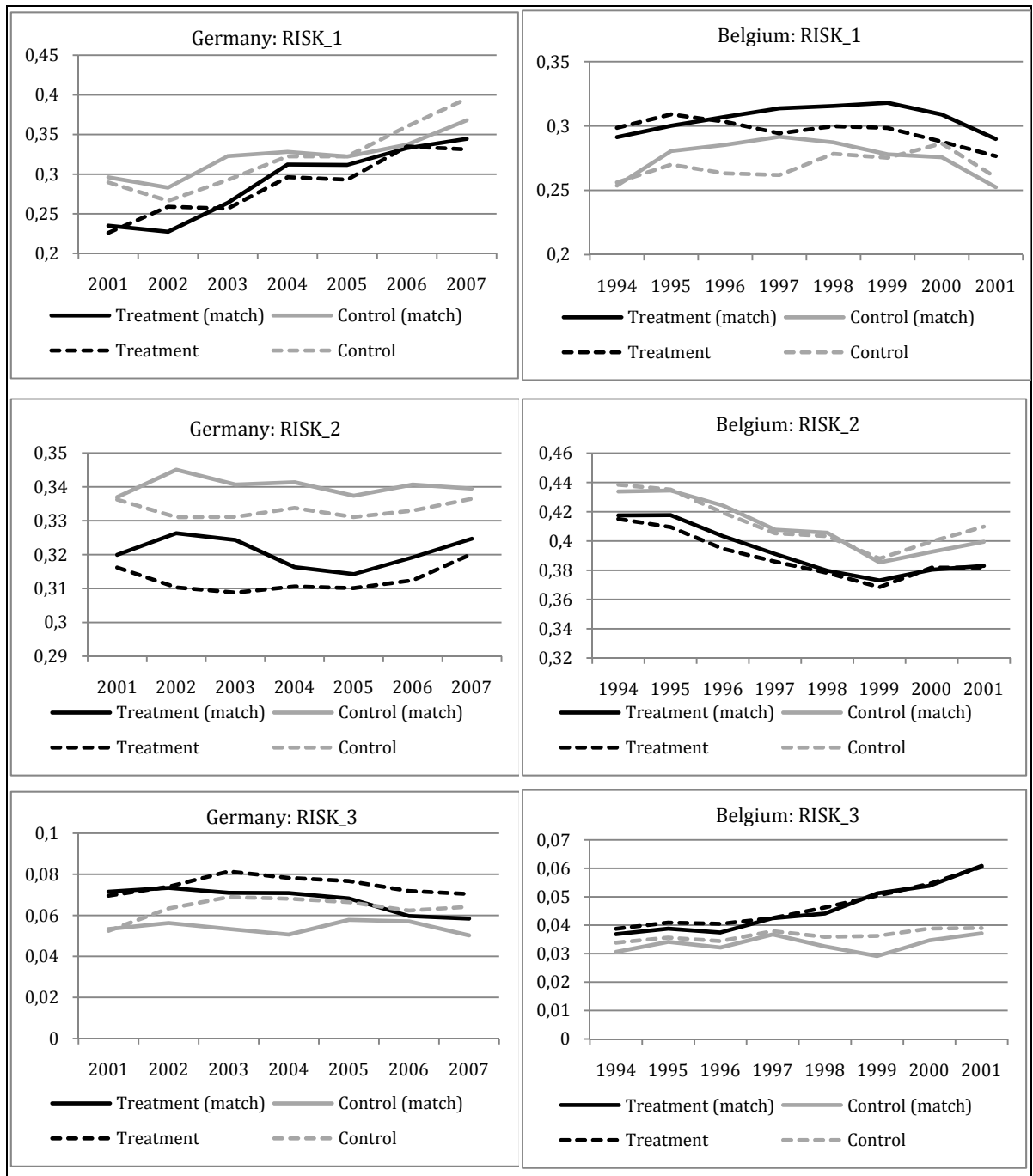


Table 8*Regression results: Belgium (matched panel)*

VARIABLES	(1) RISK_1	(2) RISK_1	(3) RISK_1	(4) RISK_2	(5) RISK_2	(6) RISK_2	(7) RISK_3	(8) RISK_3	(9) RISK_3
<i>SIZE · POST</i>	0.0109 (0.00921)	0.0883*** (0.0180)	0.0355*** (0.0114)	0.00245 (0.00379)	0.00236 (0.00659)	0.00464 (0.00351)	0.0145*** (0.00280)	0.0161 (0.0105)	0.0137*** (0.00349)
<i>SIZE · POST · II</i>		0.0503 (0.0343)			0.00161 (0.0103)			-0.0251** (0.0110)	
<i>SIZE · POST · ROE</i>		-0.0815*** (0.0112)			0.00397 (0.00312)			0.00495 (0.00809)	
<i>SIZE · POST · ER</i>		-0.247*** (0.0494)			0.00169 (0.0135)			0.0110 (0.00884)	
<i>POST · II</i>			0.0244 (0.0188)			0.00890 (0.00674)			-0.0236*** (0.00627)
<i>POST · ROE</i>			-0.0793*** (0.0102)			0.00356 (0.00292)			-0.00313 (0.00588)
<i>POST · ER</i>			-0.265*** (0.0474)			-0.0167** (0.00743)			0.00388 (0.00519)
Observations	7,661	7,608	7,574	4,050	4,023	4,019	11,432	11,325	11,301
Adjusted R-squared	0.405	0.423	0.430	0.523	0.530	0.531	0.550	0.544	0.543

Notice: ***, ** and * label significance on a level of 1%, 5% and 10%. Robust and clustered (with respect to years and four size classes) standard errors are given in parentheses. A constant, year-dummies and firm-specific fixed-effects were included but not reported.

Table 9*Regression results: Germany (matched panel)*

VARIABLES	(1) RISK_1	(2) RISK_1	(3) RISK_1	(4) RISK_2	(5) RISK_2	(6) RISK_2	(7) RISK_3	(8) RISK_3	(9) RISK_3
<i>SIZE · POST</i>	0.0482*** (0.0129)	0.154*** (0.0384)	0.0543*** (0.0150)	-0.00466** (0.00193)	-0.00340 (0.00827)	-0.00561** (0.00266)	-0.00417 (0.00284)	-0.0148* (0.00712)	-0.00553* (0.00287)
<i>SIZE · POST · II</i>		0.0209 (0.0241)			-0.00409 (0.00949)			0.00865 (0.00958)	
<i>SIZE · POST · ROE</i>		-0.123*** (0.0130)			-0.0171*** (0.00563)			-0.00617 (0.00443)	
<i>SIZE · POST · ER</i>		-0.265*** (0.0746)			0.00783 (0.0135)			0.0204** (0.00925)	
<i>POST · II</i>			0.0107 (0.0182)			0.000347 (0.00635)			0.00567 (0.00621)
<i>POST · ROE</i>			-0.0965*** (0.0110)			-0.0110*** (0.00381)			-0.00714** (0.00289)
<i>POST · ER</i>			-0.151** (0.0582)			-0.00341 (0.0103)			0.0160** (0.00691)
Observations	7,275	7,223	7,196	4,586	4,559	4,542	-0.00417 8,367	-0.0148* 8,291	-0.00553* 8,264
Adjusted R-squared	0.492	0.500	0.503	0.664	0.668	0.668	0.744	0.744	0.744

Notice: ***, ** and * label significance on a level of 1%, 5% and 10%. Robust and clustered (with respect to years and four size classes) standard errors are given in parentheses. A constant, year-dummies and firm-specific fixed-effects were included but not reported.

5. Conclusion

Theoretical literature derives, by majority, a positive impact of fiscal loss compensation on risk-taking by businesses. However, these effects have not yet been verified empirically as far as can be seen, so that an empirical assessment of the influence of loss-compensation provisions on the corporate decision on risk-taking could provide further insight.

Based on this, the objective of the article at hand is the empirical examination of the impact on corporate behavior of two selected reforms with opposing direction, namely the abolishment of minimum taxation for large-scale Belgian enterprises in 1998 and the introduction of minimum taxation for large-scale enterprises in Germany in 2004. To this end, a linear difference-in-differences approach with company-specific and time specific fixed effects is applied to three alternative risk-measures allowing for a comparison of the changes in risk-taking as regards corporations affected and corporations not affected by the reforms. Regression models were estimated for both an unmatched and a matched set of panel data. In order to create the matched panel, a nearest-neighbor propensity score matching was used. Relying on a matched panel involves the advantage of a better-fit control group on the cost of excluding a number of observations. For these reasons, the results for both panels are reported.

The responses estimated for the three risk-measures differ to considerable extent. Both for the matched and the unmatched panel we find that large-scale Belgian (German) corporations increased (reduced) investment in intangible fixed assets, and therewith company risk, substantially, the size of this effect being larger for the abolishment of minimum taxation (Belgium). Also in line with theoretical expectations we find that the average interest rate faced by large Belgian (German) corporations has increased (been reduced) after the reform. Compared to the

investment in intangible assets, this effect, however, is considerably smaller and significant only for a small part of the specifications. For a third risk measure, which is defined as the return on assets, we find no clear support for our expected company response to the reform.

Altogether, our results suggest that if promoting corporate risk-taking is considered to be a worthwhile governmental goal in the light of fostering innovations and supporting labor market development, than enhancing fiscal loss-offset possibilities may be an appropriate measure. The strength of the company response should, however, depend on which source of company risk is addressed.

Appendix

Tax Rates in the EU15 from 1994 to 2009

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AT	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	25.00	25.00	25.00	25.00	25.00
BE	40.17	40.17	40.17	40.17	40.17	40.17	40.17	40.17	40.17	33.99	33.99	33.99	33.99	33.99	33.99	33.99
DE	55.64	59.00	59.00	57.50	56.60	52.30	51.60	38.36	38.36	39.58	38.29	38.31	38.34	38.36	29.51	29.44
DK	34.00	34.00	34.00	34.00	34.00	32.00	32.00	30.00	30.00	30.00	30.00	28.00	28.00	28.00	25.00	25.00
ES	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	32.50	30.00	30.00
FI	25.00	25.00	28.00	28.00	28.00	28.00	29.00	29.00	29.00	29.00	29.00	26.00	26.00	26.00	26.00	26.00
FR	33.33	36.66	36.66	36.66	41.66	40.00	36.66	35.33	34.33	34.33	34.33	33.83	33.33	33.33	33.33	33.33
GB	33.00	33.00	33.00	31.00	31.00	31.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	28.00	28.00
GR	35.00	35.00	35.00	40.00	40.00	40.00	40.00	37.50	35.00	35.00	35.00	32.00	29.00	25.00	25.00	25.00
IE	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50
IT	52.20	53.20	53.20	53.20	41.25	41.25	41.25	40.25	40.25	38.25	37.25	37.25	37.25	37.25	31.40	31.40
LU	39.39	40.29	40.29	39.35	37.45	37.45	37.45	37.45	30.38	30.38	30.38	30.38	29.63	29.63	29.63	28.59
NL	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	34.50	34.50	34.50	31.50	29.60	25.50	25.50	25.50
PT	39.60	39.60	39.60	39.60	37.40	37.40	37.40	35.20	33.00	33.00	27.50	27.50	27.50	25.00	25.00	25.00
SE	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	26.30

Literature

- Altshuler, R., Auerbach A. J. (1990), The Significance of Tax Law Asymmetries: An Empirical Investigation, *The Quarterly Journal of Economics* 105, 61-86.
- Arrow, K. J. (1965), *Aspects of the Theory of Risk-Bearing*, Helsinki.
- Auerbach, A. J., Poterba, J. M. (1986), Tax Loss Carryforwards and Corporate Tax Incentives, NBER Working Paper No. 1863.
- Berk, J., DeMarzo, P. (2007), *Corporate Finance*, Addison Wesley, Boston et. al.
- Copeland, T. E., Weston, J. F., Shastri, K.(2010), *Financial theory and corporate policy*, 4th ed., Addison Wesley, Boston et al.
- Devereux, M.P. (1989), Tax asymmetries, the cost of capital and investment: some evidence from United Kingdom panel data, *Economic Journal* 99, 103-112.
- Domar, E. D., Musgrave, R. A. (1944), Proportional Income Taxation and Risk-Taking, *The Quarterly Journal of Economics* 58, 388-422.
- Dressler, D., Overesch, M. (2010), Investment Impact of Tax Loss Treatment – Empirical Insights from a Panel of Multinationals, ZEW Discussion Paper No. 10-097, Mannheim.
- Feldstein, M. S. (1969), The Effects of Taxation on Risk Taking, *Journal of Political Economy* 77, 755-764.
- Graham, J. R. (1996a), Debt and the Marginal Tax Rate, *Journal of Financial Economics* 41, 41-73.
- Graham, J. R. (1996b), Proxies for the Corporate Marginal Tax Rate, *Journal of Financial Economics* 42, 187-221.

- Haegert, L., Kramm, R. (1975), Der Einfluss von Ertragsteuern auf die Vorteilhaftigkeit von Investitionen mit unterschiedlichem Risiko, Zeitschrift für betriebswirtschaftliche Forschung 27, 69-83.
- Kesti, J. (Ed.), European Tax Handbook 1994 – 2009, IBFD, Amsterdam
- Koch, R. (2010), Die Aufkommens- und Belastungswirkungen alternative Vorschläge zur Reform der Konzernbesteuerung in Europa, Lang, Frankfurt/Main
- Mintz, J. M. (1981), Some additional results on investment, risk taking, and full loss offset corporate taxation with interest deductibility, The Quarterly Journal of Economics, 631-642.
- Meyer, B. D. (1995), Natural and Quasi-Experiments in Economics, Journal of Business&Economic Statistics 13, 151-161.
- Mossin, J. (1968), Taxation and Risk-Taking: An Expected Utility Approach, *Economica* 35, 74-82.
- Oestreicher, A., Koch, R. (2010a), The determinants of opting for the German group taxation regime with regard to taxes on corporate profits, *Review of Managerial Science* 4, 110-158.
- Oestreicher, A., Koch, R. (2010b), Taxation and Corporate Group Structure – Evidence from a Sample of European Multinationals, mimeo.
- Poterba, J. M. (2001), Taxation, Risk Taking, And Household Portfolio Behavior, NBER Working Paper 8340.
- Pratt, J. W. (1964), Risk aversion in the small and in the large, *Econometrica* 32, 122-136.

- Ramb, F. (2007), Corporate Marginal Tax Rate, Tax Loss Carryforwards and Investment Functions – Empirical Analysis Using a Large German Panel Data Set, Deutsche Bundesbank Discussion Paper, Economic Series, 21/2007, Frankfurt.
- Rosenbaum, P. R., Rubin, D. B. (1985), Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score, *The American Statistician* 39, 33-38.
- Rosenbaum, P. R., Rubin, D. B. (1985), The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika* 70, 41-55.
- Sandmo, A. (1989), Differential Taxation and the Encouragement of Risk-Taking, *Economics Letters* 31, 55-59.
- Stiglitz, J. E. (1969), The Effects of Income, Wealth, and Capital Gains Taxation on Risk-Taking, *The Quarterly Journal of Economics* 83, 263-283.
- Tobin, J. (1958), Liquidity Preference as Behavior Towards Risk, *The Review of Economic Studies* 25, 65-86.
- Wagner, F. W., Schwenk, A. (2003), Empirische Steuerwirkungen als Grundlage einer Reform der Gewinnbesteuerung – Ergebnisse aus den Dax 100-Unternehmen, in: Schwaiger, M., Harhoff, D. (Eds.), *Empirie und Betriebswirtschaft – Entwicklungen und Perspektiven*, Schäffer-Poeschel, Stuttgart.



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