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Thin Capitalization Rule vs Interest

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Abstract

In 2008, Germany introduced an interest barrier which allows the deduction of interest only if a company's net interest expenditure does not exceed 30% of the company's EBITDA. The regulation aims at preventing excessive debt financing of companies resident in Germany and distinguishes neither between long- or short-term liabilities nor between resident and non-resident creditors. It further covers all types of debt capital and does not differentiate whether the debt capital was granted by third parties or by shareholders. That is why the interest barrier was criticized extensively as being too strict and demanding.

By applying a binominal model which considers economic risks, this paper elaborates on the effects of both an interest barrier and a thin capitalization rule on an internationally operating group of companies. Further, the impact of debt and hybrid financing on group companies subject to either a thin cap or an interest barrier is measured.

I find that the thin cap is more advantageous under economic certainty and in situations of low risk, whilst the interest barrier tends to be advantageous in risky situations. In very risky situations there is almost no measurable difference between thin cap and interest barrier in case of debt financing. In case of hybrid financing, the interest barrier is advantageous also in very risky situations. Further, companies are less likely to go bankrupt and the group terminal value is higher.

Keywords: Interest barrier, thin capitalization rule, debt financing, hybrid finance, simulation

JEL-Codes: G 11, G32, G38, M41

1. Introduction

To be able to do business, companies have to be equipped with capital by their shareholders. Usually, this capital is granted to them as equity. Nevertheless, it is also reasonable for shareholders to provide debt to the company. In any case, companies have to consider the differences in taxation regarding equity and debt financing. That is why for internationally operating groups of companies the differing legal frameworks between countries are crucial factors for making decisions in corporate financing (*Obser* 2005: 1ff), especially because interest expenditure due to debt financing is usually tax-deductible in almost every country and thus considerably reduces a company's tax base (*Jacobs* 2007, 909). Hence, internationally operating companies should consider the various differing corporate tax rates between countries in their financing strategies in order to minimize their total tax base.

Accordingly, group companies resident in different countries can grant debt capital to each other. The effect of these financing strategies is maximized if the corporate tax rate of the country the debt-financed group company resides in exceeds the corporate tax rate of the country that hosts the debt-granting group company: In this case, the debt-financed group company resident in the high-tax country deducts its interest expenditure, which is then transferred as interest earnings to the debt-granting group company resident in the low-tax country. Hence, the earnings of the debt-financed group company are lowered by interest expenditures, whilst the interest earnings of the debt-granting group company are taxed at a relatively low corporate tax rate. These financing strategies allow reducing the total tax burden of a group of companies significantly. Thus, to minimize a company's tax expense, inter-company debt capital should be used to accumulate interest expenditure in group companies operating in high tax countries (*Edgar* 1992: 8).

However, because the tax revenue of countries may be systematically reduced due to these strategies, countries fear an increasing erosion of the tax base of resident companies (*Jacobs* 2007: 954). That is why the majority[1] of all industrial countries imposed thin capitalization rules (thin caps) at the end of the last century (*Brocke/Perez* 2009: 29ff), which underpin the legislator's desire to tax earnings which are originally generated in its territory (*Bauer* 2009: 167). The goal of thin caps is to prevent the construction of abusive financial structures which aim at transferring profits from high-tax countries to low-tax countries through debt financing (*Brocke/Perez* 2009: 29ff). Thus, if a thin cap is applicable, excessive interest expenditure is either not fully tax-deductible or treated like

[1] Even though thin caps have become relatively common, there are still some countries which have not yet introduced any thin cap rule. Within Europe this is the case for *Estonia*, *Finland*, *Greece*, *Malta*, *Sweden* and *Cyprus*. Moreover, *Ireland*, *Luxembourg* and *Austria* do not have specific thin caps, but apply general tax rules which prevent harmful thin capitalization situations, if necessary (*Lenz/Dörfler* 2008: 20f; *Bauer* 2009: 182; *Herzig/Bohn* 2009: 255).

dividends[2] for tax purposes at the level of the interest-paying company. That is why internationally operating companies have to consider the effects of thin caps when financing group companies resident in other countries (*Jacobs* 2007: 954f).

2. The German interest barrier

Within the European Union, the majority of thin caps usually restrict a company's interest deduction in case a certain predefined debt-ratio is exceeded by a company due to excessive debt financing. However, in 2008 Germany introduced an interest barrier which allows the deduction of interest only if a company's net interest expenditure[3] does not exceed 30% of the company's EBITDA[4] (Sec 4h German Income Tax Act). If a company's interest expenditure should exceed this barrier, the exceeding difference has to be carried forward by the company as an interest carry forward. The interest carry forward can be deducted in case the net interest expense turns out to be smaller than 30% of the EBITDA (Sec 4h clause 1 sentence 5 German Income Tax Act). Moreover, since the beginning of 2010 it has also been possible for companies to accumulate a so-called EBITDA carry forward in case the interest expenditure falls short of the 30% EBITDA-limit. In contrast to the interest carry forward, the EBITDA carry forward can be used if a company's interest expenditure exceeds 30% of the EBITDA (Sec 4h clause 2 lit a-c German Income Tax Act). Normally, this would lead to a non-deductible interest expense and thus an interest carry forward. However, if an EBITDA carry forward can be used, the maximum amount of deductible interest is increased by the EBITDA carry forward. Thus, a higher amount of interest expense can be deducted. Additionally, the German legislator provides three exemptions from the interest barrier:

1. If the net interest amounts to EUR 3,000,000 or less, the interest expenditure can be deducted. (*Häuselmann* 2010: 1). However, the shortcoming of this exemption is the fact that companies with an interest expenditure amounting to EUR 3,000,001 already entirely fall into the scope of the interest barrier. Thus, this exemption rule can be considered as an "all or nothing-exemption".
2. A company does not fall into the scope of the interest barrier if it is not a member of a group of companies (*Goebel/Eilinghoff* 2008: 238).
3. The interest expenditure can be deducted entirely if a company's equity ratio falls short of the equity ratio of the group of companies by not more than 2 percent. (*Rödding* 2009: 2650f).

[2] There is an ongoing discussion whether a requalification of interest expenditure into dividends in case of excessive debt financing violates double tax treaties and EU law (*Jacobs* 2007: 955; see also *Bauer* 2009: 167f).

[3] The net interest expenditure is the positive difference between the interest expenses minus the interest earnings, i.e. the interest expense has to exceed the interest earnings.

[4] The *EBITDA* (Earnings before interest, tax, depreciation and amortization) is calculated as follows: Sum of earnings + interest expenditures – interest earnings + depreciation (*Brähler* 2009: 286f).

The Interest barrier neither distinguishes between long- or short-term liabilities nor between resident and non-resident creditors. It further covers all types of debt capital (*Goebel/Eilinghoff* 2008: 238ff) and all legal forms. Additionally, the interest barrier does not distinguish whether the debt capital was granted by a third parties or shareholders.

3. Prior Research

The general influence of taxes on the financing decision has already been investigated in many studies. A starting point is *Modigliani /Miller* (1963), which pointed out that the tax-deductibility of interest has contributed to the preference of debt in corporate financing. The research of *Miller* (1977: 261-75), *King* (1977) and *King/Fullerton* (1984) is based on that finding. Further, *Robbins/Stobaugh* (1972) investigated whether U.S. multinational enterprises prefer financing foreign subsidiaries either with debt or equity capital provided by either the parent company, another subsidiary or by sources outside the enterprise system. *Chowdhry/Coval* (1998) have found that a subsidiary's capital structure involving the use of mainly debt or mainly equity appears to be an optimal choice only under the prerequisite of sufficiently different tax rates in both countries. *Graham* (1996, 1999, 2000, 2003), *Gordon/Lee* (2001) and *Gropp* (2002) elaborated extensively on the positive connection between tax rates and debt ratios. Additionally, *Huizinga/Laeven/Nicodeme* (2008) have emphasized on the basis of a large sample of European firms that a firm's leverage depends on both national and international tax rate differences and that the relationship between leverage and international tax rate differences thus reflects the presence of international debt shifting.

Against this scientific background, the introduction of the German interest barrier in 2008 motivated researchers to extensively explore and discuss the possible effects the interest barrier may have on the German economy. It was already extensively criticized as being too strict and harmful before it actually came into force. Accordingly, *Schwarz* (2008) argues that foreign companies would leave Germany due to the interest barrier. This would eventually lead to fewer jobs and fewer tax revenues. Others find that the interest barrier would violate European as well as Constitutional Law (*Musil/Volmering*, 2008), thus consider the entire regulation as too demanding and in need of a comprehensive revision (*Goebel/Eilinghoff*, 2008), and additionally fear severe economic damages due to the impact of the interest barrier (*Homburg*, 2007).

In an empirical investigation *Blaufus/Lorenz* (2009) demonstrate that whilst the number of companies within the scope of the interest barrier would remain constant, the tax burden of these companies would rise. Another empirical investigation by *Bach/Buslei* (2009) states that a significant number of companies would fall into the scope of the interest barrier and that not only big companies, but also some medium-size companies, are likely to be affected from it. However,

Lenz/Dörfler (2010) argue that the number of companies subject to the interest barrier would rise anyway due to the economic crisis. They further point out that, if compared to other regulations restricting the interest deduction, the interest barrier was too demanding and that recent adjustments[5] to the interest barrier only attenuated its negative effects during the financial crisis, while the necessary fundamental changes did not take place. Based on an empirical investigation *Watrin/Pott/Richter* (2009) illustrate that for their study's sample companies it was almost impossible to entirely deduct the interest carry forward within an appropriate period of time. They further warn that the tax expense would increase dramatically in case of reduced profits due to the economic crisis. They additionally point out that the tax bases of private limited companies, of companies of the energy sector and of trading companies would also particularly increase. In a survey *Herzig/Lochmann/Liekenbrock* (2008) find that the interest barrier results in an additional tax burden which overcompensates the tax reliefs of the recent tax reform.[6] Another survey performed by *Ortmann-Babel/Bolik* (2010) states that the interest barrier would be considered as a fundamental change in the tax system. Further, it would largely be rejected by the interviewees, even in case their own companies were not affected. However, *Baldauf/Pummerer* (2008) discover advantageous situations for German companies subject to the interest barrier which additionally are members of an Austrian group taxation system.

The recent amendments[7] of the interest barrier are widely considered to be meaningful by researchers. Accordingly, *Rödding* (2009) argues that the possibility to deduct the entire interest expenditure has improved due to the amendments. However, to him some unresolved weaknesses still remain. *Scheunemann/Dennisen* (2009) find that corporate financing has generally eased due to both the EBITDA carry forward and the increased interest exemption amount. The EBITDA carry forward is also considered as meaningful by *Herzig/Bohn* (2009). However, to them the problems startup companies may face due to the interest barrier are still unresolved. Further, in their eyes the increase in the interest exemption amount would only lead to a temporary relief for companies. *Göritzer* (2010) points out that the combination of the EBITDA carry forward and the increased interest exemption amount would improve the situation for companies. Nevertheless, he criticizes that the EBITDA carry forward cannot be carried forward infinitely. *Baldauf/Pummerer/Wittmann* (2010) show that the interest barrier can lead to advantageous situations when losses are offset. They also find that under specific circumstances the EBITDA carry forward may lead to less advantageous situations for companies.

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[5] With the „*Wachstumsbeschleunigungsgesetz*", which came into force in 2010, the EBITDA carry forward was introduced into the regulation. Further, the interest exemption amount was increased from EUR 1,000,000 to EUR 3,000,000 and the escape-clause was loosened.

[6] In 2008, within a big tax reform, the German corporate tax rate was reduced from 25% to 15%. Besides the primary goal to prevent harmful debt financing strategies, the interest barrier was originally also introduced to raise additional funds to refinance parts of the tax-rate decrease (*Brähler* 2009: 283ff).

[7] See footnote 5.

4. Research Question

As stated above, the majority of the academic literature considers the interest barrier as too strict and too demanding. It is argued that the regulation would not only restrict the deduction of interest due to excessive debt financing, but that it would also go too far by additionally harming companies which initially should not fall within its scope.

The majority of these studies are descriptive analyses, whilst the others are either empirical or model-based studies or surveys. However, all of these studies analyze the interest barrier on a relatively isolated basis but do not provide a comparison of the interest barrier's effects in relation to the effects of thin caps[8], i.e. it is not directly evaluated whether the interest barrier penalizes companies to a greater extent than thin caps do. Further, the majority of prior research does not consider economic risks in their investigations, i.e. the possibility that a company loses its capital invested, which may also be an important factor for measuring the effect of the interest barrier. Thus, the question remains whether a company which is subject to the interest barrier would be discriminated against in comparison to a company subject to a thin cap under economic uncertainty. Additionally, there may also be different effects due to the form of financing, e.g. if companies are not financed with debt capital, but with hybrid capital.

Accordingly, the paper's research question is the following:

How does a thin capitalization rule, in comparison to an interest barrier, affect a group of companies' terminal value under economic uncertainty if one group company is subject to either the thin cap or the interest barrier and is financed to a certain degree either a) with debt capital or b) with hybrid capital?

5. Description of the research model

In order to elaborate on the research question, a relatively simple binominal model[9], based on *Cox/Ross/Rubinstein* (1979), will be applied. The model considers economic uncertainty, which means that after each period either a profit or a loss occurs. The effects of both the thin cap and the

[8] A thin capitalization rule in the sense of this paper means a regulation which restricts the deduction of interest expense if a company exceeds a certain predefined debt-equity ratio. For an overview of thin caps and examples see e.g. *Grotherr* (2005) in *Piltz/Schaumburg*; *Kessler/Obser* (2004); *Jacobs* (2007): 954ff; *Ressler* (2008); *Bauer* (2009): 163ff; *Bohn* (2009); *Herzig* (2009); *Herzig/Bohn (2009):* 255f*; Van den Berg van Saparoea* (2010)*; Lenz/Dörfler* (2010): 18f.

[9] This model was already applied by *Eberhartinger/Pummerer* (2007); *Eberhartinger/Pummerer* (2007); *Eberhartinger/Pummerer* (2010); *Eberhartinger/Pummerer/Göritzer* (2010); *Baldauf/Pummerer/Wittmann* (2010).

interest barrier will be measured over ten periods. Accordingly, 1024 different possible outcomes can appear. Moreover, the model bears the assumption of risk-neutral investors[10], i.e. investors are indifferent to all investments, even though the risk of each investment varies.

5.1. Corporate group

The group of companies consists of a parent company and a subsidiary, both resident in two different countries within the European Union[11]. The parent company owns 100% of the shares of the subsidiary. In both countries the corporate tax rate is 25%.[12] Because this paper aims at comparing an interest barrier with a thin cap, there is either an interest barrier or a thin cap in force in the resident state of the subsidiary. Both regulations restrict the deduction of excessive interest payments from the subsidiary to the parent.

5.1.1. Parent

At the beginning of the first period, the parent's capital amounts to 100. The parent does not carry out a risky business but periodically invests its capital at a riskless interest rate of 4%. There are no dividend distributions or capital repayments by the subsidiary. Thus, the parent's capital only increases by the subsidiary's periodical interest payments and by interest from its invested capital. Because the parent does not carry out a risky business with its capital, money transferred by the subsidiary to the parent cannot be lost.

5.1.2. Subsidiary

At the beginning of the first period, the subsidiary requires a starting capital of 100, which is provided by the parent company in form of equity capital, debt capital or a combination of both. The subsidiary invests its entire capital received in assets and starts to carry out a risky business. That is why the subsidiary has no liquid funds during the ten periods. Hence, at the end of each period the subsidiary's return on assets could either be positive or negative, i.e. the subsidiary could either generate a profit or a loss. In case the subsidiary generates a profit, it invests the profit in new assets

[10] The assumption of risk-neutral investors may be considered as unrealistic since investors are usually risk averse. Nevertheless, risk neutrality appears to be a common approach for analyzing effects of taxation (e.g. *Bradley et al* 1984; *Chowdry/Coval* 1998; *Green/Hollifield* 2003). Further, it does not substantially limit the analysis, because the purpose of this paper is not to develop a general valuation model, but to determine terminal values under economic uncertainty. That is why the assumption of volatile earnings seems to be more important than modeling the probability for investors (*Eberhartinger/Pummerer/Göritzer* 2010: 11).

[11] Because the companies reside in EU-member countries, both the *parent-subsidiary directive* and the *interest and royalties directive* are transposed into national law in the resident countries. Accordingly, there is no withholding tax in case of dividend distributions or interest payments between parent and subsidiary.

[12] Because the investigation aims at evaluating the effects of both the interest barrier and a thin cap under debt and hybrid financing, tax rate differences may distort the conclusions. That is why equal tax rates in both countries are assumed. Accordingly even though the corporate tax rate in Germany is 15%, it is assumed that the corporate tax rate in the model is 25%. Further, both business tax and solidarity surcharge are not considered.

and continues to carry out the risky business in the following period. Accordingly, a potential profit in the next period would be higher than the last period's profit. In case a loss occurs, the subsidiary has to sell assets to generate earnings which equal the loss suffered. Further it also has to sell assets in order to be able to pay interest. Hence, due to the loss, fewer assets can be invested in the next period. That is why a potential future profit would be lower.

As already stated, the parent company is free to decide whether to provide the capital entirely as equity, entirely as debt or partly as equity and partly as debt. If the parent provides 100% equity capital to the subsidiary, the subsidiary does not have to pay interest on the capital granted. However, the opposite is the case if the parent provides 100% debt capital. Further, in this case both the interest barrier and the thin cap will restrict the interest deduction due to excessive debt financing. As a third option, the subsidiary can receive both equity and debt capital by the parent, e.g. 50% equity and 50% debt[13]. In this case the subsidiary has to pay interest only on a part of its capital. Even though the subsidiary is at least partly financed with equity, the subsidiary retains all earnings, i.e. there are no dividend distributions. Further, it does not have to repay the debt capital during the ten periods of investigation.

However, instead of granting debt capital the parent can also grant hybrid capital to the subsidiary. Hybrid instruments incorporate elements of both equity and debt. They are often formed by adding certain elements of typical equity instruments to debt instruments[14]. The advantage of hybrid financial instruments is the flexibility to tailor an instrument exactly to the needs of the investor or the issuer. (*Wiedermann-Ondrej* 2007: 4ff). As will be discussed later in more detail, the difference between debt and hybrid financing for the purpose of this study is that in case of debt financing interest has to be paid unconditionally at a fixed rate, whilst in case of hybrid finance interest is calculated as a fraction of the profit and thus has to be paid conditionally, i.e. only in case of profits. However, to avoid any qualification conflicts[15], the hybrid instrument is considered as debt in both countries.

[13] It could also be 80% debt capital and 20% equity capital or any other meaningful combination. The important thing is that it is not clear if and to what extent the interest barrier or the thin cap restrict the deduction of interest expenditure or not.

[14] For example inter alia silent partnerships, participating bonds, convertible bonds, warrant bonds, profit participation loans or preference shares are considered as hybrid instruments. For hybrid finance see e.g. *Eberhartinger* (1995); *Eberhartinger* in *Bischof/Eberhartinger* (2005); *Six* (2008); *Wiedermann-Ondrej* (2008).

[15] For qualification conflicts in international corporate financing with hybrid instruments see *Eberhartinger/Pummerer/Göritzer* 2010).

The corporate structure looks as follows:

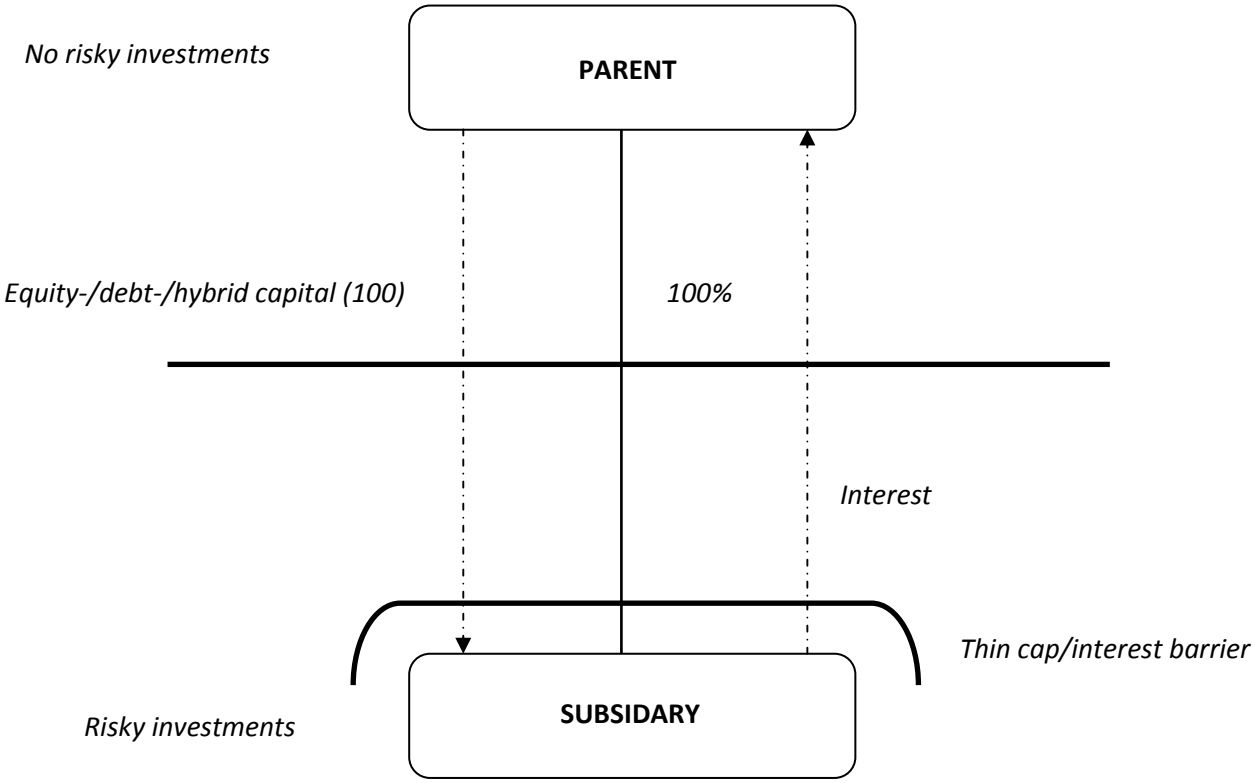

Figure 1: Group structure

5.2. Integrating economic uncertainty

To be able to analyze and compare the effects of both the thin cap and the interest barrier on a group of companies under economic uncertainty, the applied model must allow the variation of risk in accordance with the investment's expected rate of return. A binomial-model suffices to account for uncertainty. Thus, at any time *t* there are only two possible outcomes at the end of each period: either a profit or a loss. Hence, the value of the assets *A* depends on the return on assets realized in the respective period:

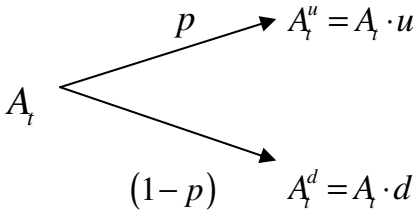

Figure 2: Economic uncertainty

It depends on both the returns (*u,d*) and the probability measure *p* whether the investment in *t-1* meets the investor's estimate and thus results either in a profit or a loss. According to *Figure 2*, the continuously compounded expected return on assets is

(1) $$E(r_A) = \ln\left(\frac{A_t \cdot u}{A_t}\right) \cdot p + \ln\left(\frac{A_t \cdot d}{A_t}\right) \cdot (1-p) = \ln(u) \cdot p + \ln(d) \cdot (1-p) \cdot$$

In financial literature (*Hull*, 2006: 245), *u* and *d* are referred to as

(2) $$u = e^{\sigma}; d = e^{-\sigma}.$$

The term σ represents the volatility of the return.

Because of the assumption of risk-neutral investors, the expected rate of return of each investment is independent of any risk and thus equals the risk-neutral interest rate. Accordingly

(3) $$E(r_A) = \ln(u) \cdot p + \ln(d) \cdot (1-p) = e^{r_r}$$

must hold. If *u* and *d* in (3) are substituted according to (2), (3) results in

(4) $$p = \frac{e^{r_f} - 1}{u - d}.$$

The probability in (4) is usually referred to as Martingale Measure (*Glassermann* 2003, 37). Under this probability measure, the expected rate of return is not a function of risk. Thus, increasing risk causes a higher (positive or negative) return. However, the increasing return is exactly compensated for by the decreasing probability of an upward move.

The following example illustrates the model under the assumption of a volatility of 20%.

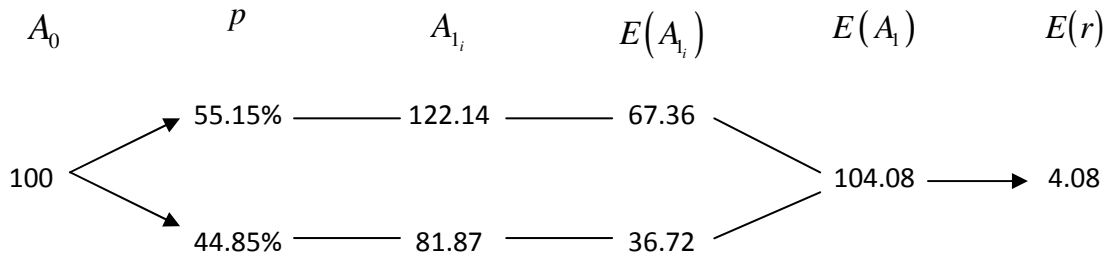

Figure 3: Example of economic uncertainty

In the beginning, all assets are invested in the risky market. Depending on the probability measure *p*, either a profit or a loss occurs. The sum of both the expected profit and the expected loss is the expected terminal value. As can be seen, the interest yield of the expected terminal value equals the risk-neutral interest rate. Accordingly, there will be no loss in case the subsidiary carries out the business under economic certainty. However, the profits the subsidiary generates under economic certainty are relatively small. The more risk the subsidiary is willing to accept, the larger the profits, but the more probable it is a loss will occur. That is why at full risk only losses will occur.

Summing up, the higher the volatility, the higher the risk, and thus the higher the return in a positive scenario and the higher the loss in a negative scenario, respectively. In case the probability *p* remained constant, the expected return would also increase with increasing risk. However,

assumption (3) guarantees that the effects of increasing returns are compensated by the change of probabilities. Accordingly, the expected terminal value remains constant.

5.3. Modeling the tax system

5.3.1. Parent

As already stated, the parent invests its capital at a risk-free interest rate. Because the parent neither receives dividend distributions nor debt repayments by the subsidiary, the parent's terminal value is calculated by adding up the parent's own interest earnings, the subsidiary's interest payments and the parent's capital. Thus, the terminal value of the parent is calculated according to

$$\widetilde{TVP}_{t_n} = \widetilde{TVP}_{t_{n-1}} + \left[\tilde{I}_{t_n} + \widetilde{TVP}_{t_{n-1}} \cdot \left(e^r - 1\right)\right] \cdot (1-\tau). \tag{5}$$

5.3.2. Subsidiary

Because the subsidiary receives either debt or hybrid capital, it has to pay interest. However, at the end of each period, the subsidiary's terminal value is calculated according to

$$\widetilde{TVS}_{t_n} = \widetilde{TVS}_{t_{n-1}} + \left(\widetilde{EBIT}_{t_n} - \tilde{I}_{t_n}\right) \cdot (1-\tau). \tag{6}$$ [16]

As already stated above, in this paper the difference between debt and hybrid capital is the way how interest is calculated and paid by the subsidiary. Accordingly, the next section discusses these differences.

5.3.2.1. Debt capital

If the subsidiary receives debt capital, it has to pay continuously compounded interest on an unconditional basis at the end of each period, i.e. irrespective of whether the subsidiary has generated a profit or a loss. The interest rate is 4%. Accordingly, if the subsidiary is entirely debt financed at the beginning of this investigation, the interest expenditure amounts to

$$\tilde{I}_{t_n} = 100 \cdot \left(e^{0,04} - 1\right) = 4,081.$$

However, in case the subsidiary is unable to pay interest any more, i.e. the assets plus the current EBIT is smaller than the interest payable, the subsidiary goes bankrupt and has to sell all its remaining assets. Thus, the subsidiary's interest is calculated as

$$\tilde{I}_{t_n} = \max\left\{\min\left[\widetilde{D} \cdot \left(e^r - 1\right); \widetilde{TVS}_{t_{n-1}} + \widetilde{EBIT}\right]; 0\right\}. \tag{7}$$

The big obvious disadvantage of debt financing is the subsidiary's obligation to pay interest also in loss-periods. Thus, the interest payable additionally reduces the subsidiary's capital and increases the

[16] In order to simplify both (5) and(6), $\tilde{I}_{t_n}$ covers both debt interest and hybrid interest payments by the subsidiary.

subsidiary's debt carry forward, whilst the interest payment is subject to tax at the parent company. In order to avoid this negative effect, a hybrid instrument is introduced into the model.

5.3.2.2. Hybrid capital

A hybrid instrument suitable for this investigation was developed by *Eberhartinger/Pummerer* (2010)[17]. Accordingly, the interest payable is subject to economic uncertainty, depends on the subsidiary's economic performance, is payable only in case of a profit and is calculated as a percentage of the subsidiary's period profit. Thus, the higher the subsidiary's profit, the higher the interest payment.

If at every intersection point of the model the expected hybrid interest payment equals the risk-free interest payment, investors are indifferent if confronted with both investment alternatives. Thus, the probability p_u to generate a profit at the end of a period depends on the economic risk. The rate of return is u. Hence, if the following equation is met, both unconditional and conditional interest lead to the same expected interest payment:

(8) $$r = \gamma \cdot p_{u\cdot} \ln(u) \text{ with } u = e^{\sigma}.$$

Substitutions and rearrangements eventually lead to

(9) $$\gamma = \frac{r}{p_u \cdot \sigma},$$

whilst γ represents the fraction of the positive return. At a risk of 30% and an interest rate of 4%, the probability to generate a profit is 49.26% in the *Cox/Ross/Rubinstein*-model. Hence, the share of the profit is

$$\gamma = \frac{4\%}{49.26\% \cdot 30\%} = 27.07\%.$$

5.4. Valuation of loss and interest carry forwards

At the end of ten periods, the question arises how loss and interest carry forwards have to be valuated and to what extent they influence the terminal value of the corporation. In general, loss carry forwards arise if companies generate losses which cannot be offset with profits. As soon as a profit is generated, loss carry forwards can partly or entirely be offset under consideration of the specific loss-offset restrictions[18]. Consequently, a part of the profit generated is always subject to tax. In contrast to loss carry forwards, interest carry forwards only arise for companies subject to the interest barrier and consist of excessive non-deductible interest expenditure.

[17] See also *Eberhartinger/Pummerer/Göritzer* (2010)

[18] In Germany, the loss-offset restriction is 60%, which serves also as loss-offset restriction in this investigation.

Because this model considers economic uncertainty, economic activities under increasing risk also increase the probability of losses. The more risk the subsidiary is willing to accept, the higher the probability of losses for the subsidiary. At very high risks, almost only losses occur. Accordingly, if there are loss carry forwards at the end of the ten year period, it largely depends on the risk of the subsidiary's economic activity whether these loss carry forwards can be offset in future periods or not. Thus, if the subsidiary after ten periods has loss carry forwards due to high risks, it is unlikely that the subsidiary will be able to offset its loss carry forward if the risk remains unchanged. Instead, the subsidiary's bankruptcy becomes probable. If there is less risk after the tenth period, the subsidiary may be able to offset its loss carry forwards. The same argumentation goes for interest carry forwards, because also interest carry forwards can only be offset if the subsidiary generates profits, which is rather unlikely under high risk. Thus, it seems to be rational to value both loss and interest carry forwards under consideration of the specific risk the subsidiary is currently facing. A valuation only on the basis of a net present value would certainly lead to wrong results. On the basis of this argumentation, *Baldauf/Pummerer/Wittmann* (2010) have developed a valuation model for both loss and interest carry forwards which is applied and, as far as hybrid finance is concerned, extended for the purpose of this investigation.

5.4.1. Valuation of the loss carry forward for debt and hybrid capital

Losses can only be offset with future profits. Thus, at the end of the tenth period it needs to be estimated whether the subsidiary is able to generate high enough profits to offset its existing loss carry forward or not. As already stated above, in the applied model the expected rate of return always equals the risk-neutral interest rate of 4%. Accordingly, the risk-neutral interest paid on the subsidiary's remaining capital in t_{10} represents the subsidiary's potential profit in future periods.

(10) $$\widetilde{EBIT}_{t_{10}} = \widetilde{TVS}_{t_{10}} \cdot \left(e^{r} - 1\right)$$

However, also in future periods the subsidiary still has to pay interest on the debt or hybrid capital granted by the parent. If the subsidiary is financed with debt capital, it periodically has to pay interest at a rate of 4% from the debt capital:

(11) $$\tilde{I}_{t_{10}} = \widetilde{D}_{t_{10}} \cdot \left(e^{r} - 1\right).$$

If the subsidiary is financed with hybrid capital instead, the interest is calculated as a portion of the subsidiary's profit. Consequently, the amount of hybrid interest paid on the subsidiary's total capital has to be multiplied by the hybrid's profit participation in order to calculate the future interest expenditure due to hybrid finance:

(12) $$\tilde{I}^{h}_{t_{10}} = \max\left[\widetilde{TVS}_{t_{10}} \cdot \left(e^{r} - 1\right) \cdot \gamma; 0\right].$$

In the next step, the debt or hybrid interest is deducted from the subsidiary's potential profit. If the result is negative, the loss carry forward cannot be offset against in future profits. If the result is positive, the losses can be offset in future periods. Additionally, there is a loss-offset restriction. According to that, at least 40% of the profit is subject to tax. The potential loss offset[19] for a subsidiary is calculated according to

(13) $$\widetilde{Pot}_{t_{10}}^{L} = \max\left[\widetilde{EBIT}_{t_{10}} - \tilde{I}_{t_{10}}; 0\right] \cdot \alpha.$$

Subsequently it is estimated how many periods the loss offset will take. Accordingly, the loss carry forward in t_{10} is divided by the potential loss offset:[20]

(14) $$\widetilde{T}_L = \max\left(\frac{\widetilde{CF}_{t_{10}}^{L}}{\widetilde{Pot}_{t_{10}}}; 0\right).$$

Then, the tax saving's net present value in t_{10} due to the loss offset is calculated.

(15) $$\widetilde{TS}_{t_{10}}^{L} = \widetilde{Pot}_{t_{10}} \cdot \tau \cdot \frac{(1+r)^{\widetilde{T}_L} - 1}{(1+r)^{\widetilde{T}_L} \cdot r}.$$

In order to consider the devaluation of loss carry forwards by the economic risk, the following exponential function is applied.

(16) $$\delta = e^{-(\sigma - r)}.$$

Hence, the value of loss carry forwards in t_{10} is calculated according to

(17) $$\widetilde{VLC}_{t10} = \widetilde{TS}_{t_{10}}^{L} \cdot \delta$$

and is eventually added to the terminal value of the group of companies.

5.4.2. Valuation interest carry forward for debt and hybrid capital

Generally, an interest carry forward is more likely offset under increasing risks because increasing risks always bear the chance of increasing profits and thus increasing EBITDA. Accordingly, the higher the EBITDA, the more interest carry forwards can be offset. However, the possibility of the interest deduction decreases again in very risky situations as losses become more and more probable. That is

[19] In order to simplify (13), $\tilde{I}_{t_{10}}$ covers both debt interest and hybrid interest.

[20] Note that if the subsidiary is able to offset loss carry forwards with 60% of its profit, the remaining 40% of its profits, less corporate income tax, increase the subsidiary's total capital. Because the subsidiary's profit is calculated from its total capital, the subsidiary's profit as well as the periodical loss-offset amount will increase in the following periods. That is why the potential loss offset will also increase from year to year. However, as can be seen from (13) and (14), the duration of the loss offset is calculated on the basis of the potential loss offset at the end of t_{10}, which is lower than the potential loss offsets in the following periods. Thus, the true loss offset period is shorter than calculated according to (14). Accordingly, (14) should not be considered as an exact calculation, but rather as an iteration. However, because the subsidiary's profits are calculated on the basis of the risk-free interest rate of 4%, the difference is negligible.

why both loss and interest carry forwards are worthless under high risk. Thus, *Baldauf/Pummerer/Wittmann* (2010) suggest the following function to evaluate the interest carry forward:

(18) $$\varepsilon = e^{-(\sigma - r)} \cdot \left[1 - e^{-10(\sigma - r)}\right].$$

In the next step, the potential interest offset is calculated. Hence, the subsidiary's riskless return of profits after t_{10} is calculated. Then, the subsidiary's depreciation, calculated from the subsidiary's total capital, is added. This leads to the EBITDA, which is then multiplied by 30% in order to achieve the maximum deductible interest amount. From this sum the interest expenditure has to be subtracted, which is 4% of the debt capital. In case of hybrid finance the interest is calculated according to (12).

(19) $$\widetilde{Pot}_{t_{10}}^{I} = \left[\widetilde{TVS}_{t_{10}} \cdot \left(e^{r} - 1\right) + \widetilde{TVS}_{t_{10}} \cdot \beta\right] \cdot \chi - \tilde{I}$$

Then the duration of the offset ot the interest carry forward is calculated:[21]

(20) $$\tilde{T}^{I} = \max\left(\frac{\widetilde{CF}_{t_{10}}^{I}}{\widetilde{Pot}_{t_{10}}^{I}}; 0\right).$$

Subsequently, the net present value of the tax savings due to the offset of the interest carry forward is calculated:

(21) $$\widetilde{TS}_{t_{10}}^{I} = \widetilde{Pot}_{t_{10}}^{I} \cdot \tau \cdot \frac{(1+r)^{T_I} - 1}{(1+r)^{T_I} \cdot r}.$$

Thus, the value of the interest carry forward after t_{10}, which is added to the subsidiary's terminal value, is

(22) $$\widetilde{VIC}_{t_{10}} = \widetilde{TS}_{t_{10}}^{I} \cdot \varepsilon.$$

The potential loss offset is calculated equal to (13)ff. Please note that a fraction of this potential loss offset is used for the offset of interest carry forwards. Accordingly, the potential loss offset is reduced by this fraction. That is why slightly fewer losses can be offset under the interest barrier.

5.5. Interest barrier and thin cap

The interest barrier is implemented into the model including both the EBITDA carry forward and the interest carry forward. However, the three exemptions[22] from the interest barrier have not been considered because since the interest barrier's introduction in 2008 the three exemptions have

[21] See also(14).
[22] See p. 2f.

already been fundamentally modified[23] once due to the economic crisis. That is why it may be not unlikely that these exemptions are modified again in near future. Thus, I regard it as reasonable just to focus only on the mechanism of the interest barrier. Another point is that similar interest barriers are also applied in other countries[24] to prevent excessive debt financing. Nevertheless, the exemptions from these interest barriers could be modified for several reasons. Thus, an investigation without exemption rules could lead to more comparable results in an international context.

The thin cap applied for this investigation serves as a standard of comparison in relation to the interest barrier to measure the different effects on companies resulting from these regulations. The thin cap applied restricts the deduction of interest in case the company exceeds a debt to equity-ratio of 3:1. Accordingly, if the subsidiary's portion of debt on the total capital is higher than 75%, the subsidiary is allowed to deduct interest corresponding only to 75% of the debt portion. Moreover, in order to assure the highest possible degree of comparability between thin cap and interest barrier, no exemptions from the thin cap are considered in the model.

6. Results

The objective of this investigation is to provide a comparison of the effects of both the interest barrier and the thin cap. Thus, one group is subject to the thin cap, the other group is subject to the interest barrier. In both groups the parent company finances its subsidiary with a) debt capital or with b) hybrid capital. Thus, the investigation is subdivided into two alternatives: In the first one, the parent finances the subsidiary with debt capital; in the second one, the parent finances the subsidiary with hybrid capital.

In order to measure whether the interest barrier or the thin cap is more advantageous for the group of companies, the terminal values of both groups after ten periods are calculated and subtracted from one another.

$$\Delta\widetilde{TVG}_{t_{10}} = \left(\widetilde{TVP}_{t_{10}}^{TC} + \widetilde{TVS}_{t_{10}}^{TC} + \widetilde{VLC}_{t_{10}}^{TC}\right) - \left(\widetilde{TVP}_{t_{10}}^{IB} + \widetilde{TVS}_{t_{10}}^{IB} + \widetilde{VLC}_{t_{10}}^{IB} + \widetilde{VIC}_{t_{10}}\right). \tag{23}$$

The higher the difference between the both terminal values, the more advantageous is either the interest barrier or the thin cap for the group of companies. The results are illustrated with the help of three-dimensional graphs. The graphs consist of the debt-ratio, the risk of the economic activities and the difference in the terminal value.

[23] See e.g. *Rödding* (2010).

[24] E.g. Italy also introduced an interest barrier in 2008, see *Boga/Broggi/Caridi* (2008); *Galeano/Rhode* (2008); *Marino/Russo* (2008); *Mayr* (2008); *Romani/Grabbe/Imbrenda* (2008).

6.1. Alternative 1: Debt finance

In this alternative, two groups of companies are compared with each other. In one group, the subsidiary is subject to the thin cap, in the other group the subsidiary is subject to the interest barrier. Both of them are financed by their parent company with debt capital, i.e. the subsidiary has to pay interest, irrespective of whether it generates a profit or a loss.

The graph has to be interpreted as follows: If there is a positive difference, the terminal value of the group with the subsidiary subject to the thin cap is higher than the terminal value of the group with the subsidiary subject to the interest barrier, i.e. the thin cap is more advantageous for the group. However, if there is a negative difference, it is more advantageous for the group if the subsidiary is subject to the interest barrier because this results in a higher group terminal value.

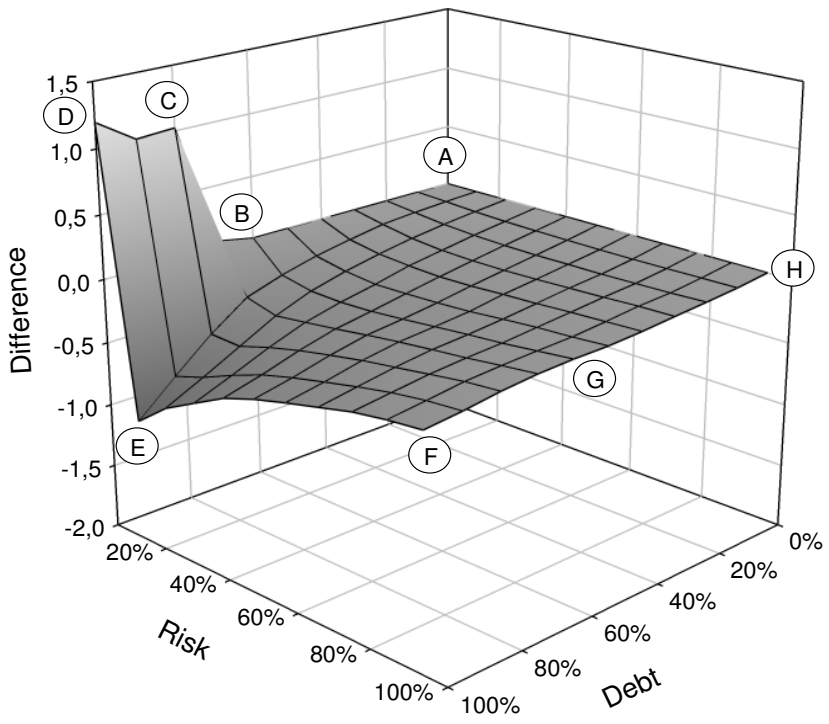

Figure 4: Debt financing

6.1.1. Economic certainty

In point A, the subsidiary operates under economic certainty and thus cannot lose its capital invested. However, investments under economic certainty lead to only low profits and thus to low EBITDA. Because in A the debt ratio is zero, the subsidiary is entirely equity-financed by the parent. Accordingly, the subsidiary does not have to pay interest to the parent. As it can be seen from the graph, there is also no measurable difference between the thin cap and the interest barrier, e.g. the group is affected by the thin cap and the interest barrier in the same way.

Alongside A to B, the subsidiary's equity is gradually substituted by debt by the parent. This results in increasing interest liabilities of the subsidiary. Surprisingly, the thin cap becomes advantageous in this situation even though the debt-ratio in point B is 80% and thus exceeds the maximum debt-ratio of 75%. This advantage of the thin cap in point B is due to the fact that the interest barrier restricts the interest deduction to a greater extent than the thin cap does because the periodically payable interest expenditure, which is relatively high due to the increasing debt ratio, clearly exceeds 30% of the subsidiary's EBITDA. The EBITDA is low because the subsidiary operates under economic uncertainty.

Alongside point C to D the above-described negative effect of the interest barrier, which is due to the combination of high debt ratio and low risk, becomes more and more obvious: In this area, the subsidiary is almost entirely debt-financed, but is still operating at the riskless interest rate of 4%. In this situation, the subsidiary subject to the thin cap must not deduct about almost 25% of its interest expenditure; the subsidiary subject to the interest barrier must not deduct an even higher amount of interest expenditure because the interest expenditure clearly exceeds 30% of the EBITDA due to the riskless interest rate. Accordingly, in a situation with high interest expenditures and low profits, the interest barrier is apparently harmful for companies.

6.1.2. Economic Uncertainty

Alongside DEF, the risk of the economic activity of the subsidiary increases, whilst the debt-ratio remains 100%. Thus, the subsidiary is still entirely debt-financed, whilst its economic activities become risky. Alongside D to E, the risk rises from 4% to 15%. Obviously the interest barrier becomes considerably more advantageous for the group than the thin cap. Because of the increased risk the subsidiary generates higher profits and thus higher EBITDA. Accordingly, the subsidiary subject to the interest barrier is able to deduct a higher amount of interest expenditure than the subsidiary subject to the thin cap; the thin cap still restricts the deduction of almost 25% of the interest expenditure, irrespective of the subsidiary's profit situation. Accordingly, the interest barrier is more advantageous for companies with high profits, even in case the company is entirely debt financed. Because high profits lead to high EBITDA, huge amounts of the interest expenditure are tax-deductible. In contrast, the thin cap still restricts the deduction of almost 25% of the interest expenditure, irrespective of the subsidiary's profit situation. The only way to change this disadvantageous situation would be to reduce its debt quota.

Additionally, the interest barrier is also advantageous for debt-financed subsidiaries in case of losses, which become probable in situations of increasing risk: The subsidiary has to pay interest on debt capital also in case of losses. However, whilst the thin cap qualifies both the economic loss and the loss due to interest payments as loss carry forward, the interest barrier distinguishes between these kinds of losses: only the economic loss is qualified as loss carry forward, the loss due to obligatory

interest payments is qualified as interest carry forward. Accordingly, a thin cap leads to higher loss carry forwards than the interest barrier. The difference between the loss carry forwards is the interest carry forward. However, the loss carry forward can always be offset only under consideration of the loss-offset limit, whilst the interest carry forward can entirely be offset as soon as 30% of the EBITDA exceeds the net interest expenditure. Consequently, the interest barrier leads to a quicker loss- and interest offset than the thin cap does. This eventually results in a lower tax burden and thus in an increased group terminal value.

Surprisingly, the EBITDA carry forward, which originally was introduced in order to ease the negative effects of the interest barrier, partially lead to disadvantageous effects for the group due to the obligation to use existing EBITDA carry forwards: If a company in the first period is able to generate an EBITDA carry forward because of high profits, but suffers a loss in the second period, the interest expenditure of the second period has to be offset with the EBITDA carry forward. This in turn shifts the interest expenditure from the interest carry forward to the loss carry forward. Thus, the above-described advantage of the differentiation between loss and interest carry forward is lost. Accordingly, due to the EBITDA carry forward the interest barrier may lead to equally high loss carry forwards as the thin cap. (see also *Baldauf/Pummerer/Widmann*, 2010: 25ff; *Liekenbrock*, 2010). This will especially be the case in situations with medium risk as profit and loss periods are likely to alternate.

Alongside point E to F the subsidiary's business becomes even more risky. The more risk the subsidiary bears, the more the advantageousness of the interest barrier is reduced, until there is almost no difference between the terminal values of both groups at a very high risk. This is because due to the increase in risk, the occurrence of losses becomes more and more probable. In this situation almost only losses occur. Moreover, the subsidiary still has to pay interest to the parent even though it hardly generates profits. Consequently, this leads to the subsidiary's bankruptcy. The same applies to the situation illustrated alongside FGH where the subsidiary is operating under full risk. Within the area of ABGH, the terminal values of both groups are almost equal as neither the maximum debt ratio nor 30% of the EBITDA is exceeded there.

6.2. Alternative 2: Hybrid finance

Also in the second alternative, two groups of companies, each consisting of a parent and a subsidiary, are compared with each other. Again, the subsidiary is either subject to a thin cap or an interest barrier. However, now the subsidiary is financed with hybrid capital, which is qualified as debt capital in the country of the parent as well as in the country of the subsidiary. Accordingly, the subsidiary

only needs to pay interest in case of a profit. The higher the subsidiary's profit, the more interest the subsidiary has to pay.[25]

If the graph shows a positive difference, the thin cap results in a higher group terminal value than the thin cap. If there is a negative difference, the interest barrier proves to be advantageous for the group.

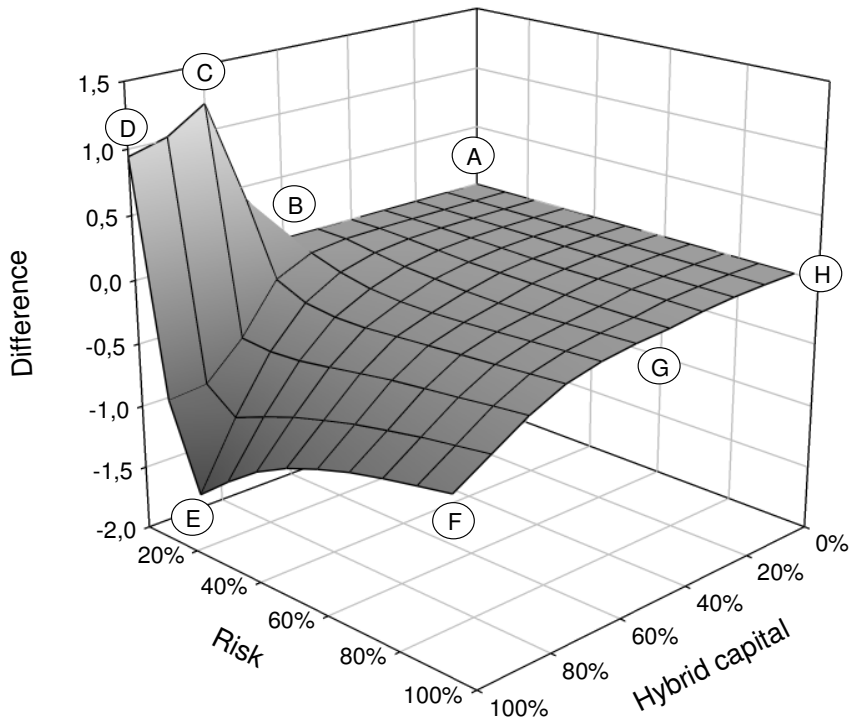

Figure 5: Hybrid financing

6.2.1. Economic certainty

Alongside A to B, no difference between thin cap and interest barrier occurs. The subsidiary subject to the thin cap does not exceed the maximum debt ratio of 75%; the subsidiary subject to the interest barrier generates sufficiently high profits to entirely deduct the interest expense. Accordingly, both the thin cap and the interest barrier allow the entire deduction of the interest expenditure in this situation.

Alongside B to C the thin cap again becomes advantageous for the subsidiary. If compared to debt-financing[26], hybrid financing results in a bigger difference in the terminal values. Even though in point B the debt ratio obviously exceeds the maximum debt ratio of 75%, the thin cap allows the deduction

[25] See p. 11ff.
[26] See p. 14ff.

of a higher amount of interest expense than the interest barrier does. This is due to the fact that interest from hybrid finance is calculated as a fraction of the subsidiary's profit. Under economic certainty, the subsidiary is constantly generating profits which increase its total capital. This increased total capital is subsequently reinvested in the market and results in increased profits again. Accordingly, the subsidiary's obligation to pay hybrid interest increases from period to period, whilst its increasing profits cannot sufficiently compensate for this trend. In other words, even though the subsidiary generates profits, the hybrid interest expenditure is too high to be entirely offset; huge parts of the interest expenditure have to be carried forward. That is why the interest barrier becomes more disadvantageous for hybrid financed subsidiaries under economic certainty than the thin cap. In point D, the subsidiary is entirely financed with hybrid capital. This results in an even higher hybrid interest expenditure, which eventually leads to a decrease of the advantage of the thin cap. Summing up, in case of hybrid financing the thin cap is more advantageous in situations of economic certainty than in case of debt financing.

6.2.2. Economic uncertainty

Along point D to point E, the subsidiary is entirely financed with hybrid capital. Further, its economic activities become risky again, which enables the subsidiary to generate higher profits. Due to increasing profits, the interest barrier leads to a higher group terminal value. However, due to the increasing interest expenditure, the interest barrier allows the entire interest deduction not until a risk-rate of 30% and above. Below this limit the subsidiary generates an EBITDA which is still too low to entirely deduct the interest expense.

Along point E to F, the advantageousness of the interest barrier is reduced again, which is due to the increasing probability of losses. However, due to hybrid financing the interest barrier still remains advantageous also in very risky situations. The reason is that interest payable due to debt financing depends only on the amount of debt capital granted. Thus, every period the parent receives the same amount of interest, irrespective of whether the subsidiary earned a profit or not. Accordingly, if the subsidiary is entirely debt financed, the maximum debt interest expenditure payable is 4.081.[27] However, in case of hybrid finance, the interest payable is calculated as a fraction of the subsidiary's profits,[28] i.e. the higher the subsidiary's profit, the higher the interest payable. That is why in profit periods the interest expenditure due to hybrid finance is generally higher than the interest expenditure due to debt finance. Hence, the non-deductibility of a part of the hybrid interest expenditure leads to considerably higher tax expenditures for the subsidiary than the non-deductibility of a part of the interest expenditure due to debt financing. Consequently, if the subsidiary is entirely financed with hybrid capital, the thin cap restricts the deduction of almost 25%

[27] $100 \cdot \left(e^{0,04} - 1\right) = 4,081$, see also p. 10.

[28] See (8)f.

of the subsidiary's interest expenditure, whilst the interest barrier qualifies a greater extent of the interest expenditure as tax-deductible. This leads to higher tax expenditures and reduces the subsidiary's total capital which is reinvested in the next period. Because less capital invested leads to lower earnings, also lower amounts of interest are paid to the parent, which increases the parent's capital to a lesser extent. Consequently, the parent invests less capital, which in sum results in a lower terminal group value. Hence the interest barrier is more advantageous in situations of increasing risks and hybrid financed subsidiaries. The same effect can be seen alongside point B to D: This area indicates a clear advantageousness of the thin cap. Because the interest barrier denies the deduction of a higher amount of interest expenditure than the thin cap, the subsidiary subject to the thin cap saves taxes and pays more interest to the parent. That is also the reason why the thin cap is more advantageous than the interest barrier in this area.

Alongside point A to point H, the subsidiary is entirely equity-financed and invests its capital at the risk-free interest rate. Thus, no interest has to be paid. That is why there are no differences between the terminal values of both groups. Alongside point F to point H, the hybrid-capital ratio is varied in situations of very high risks, whilst the capital is invested at maximum risk. As expected, there is only a slight difference between the terminal values in case the maximum hybrid capital-ratio is exceeded.

7. Conclusion

This investigation elaborates on the effects of both a thin cap and an interest barrier on an internationally operating group of companies consisting of a parent and a subsidiary under consideration of economic uncertainty. To additionally measure the impact of the method of financing on companies subject to either a thin cap or an interest barrier, the subsidiary is either financed with debt or hybrid capital by the parent company. In order to avoid any qualification conflicts, hybrid finance is qualified as debt in the resident states of both the parent and the subsidiary. However, in contrast to debt financing, hybrid financing provides profit-related interest payments to the parent.

According to this investigation, the thin cap proves to be more advantageous for the group in situations of low risk and increasing debt ratios. Because of low profits the interest barrier qualifies a greater extent of the interest expenditure as non-deductible than the thin cap does. Nevertheless, as soon as the risk and thus the subsidiary's profits increase, the interest barrier becomes more advantageous for the group. In such a situation, the subsidiary's profits are high enough to almost entirely deduct the interest expenditure. In contrast, if the subsidiary's debt ratio exceeds the thin cap's maximum debt ratio, the thin cap still qualifies parts of the interest expenditure as non-deductible, irrespective of the company's profit situation. That is why the interest barrier results in more advantageous situations for group. Hence, companies subject to the thin cap are forced not to

exceed the thin cap's maximum debt ratio; companies subject to the interest barrier could theoretically be entirely debt-financed as long as they earn high profits.

Another reason for the advantageousness of the interest barrier in risky situations is the possibility of a faster loss offset due to the differentiation between loss and interest carry forwards. Surprisingly, the EBITDA carry forward, which originally was implemented into the regulation to ease its effects on companies, partly neutralizes this advantage. In situations of very high risk, i.e. where almost only losses occur and thus the subsidiary's bankruptcy is probable, both thin cap and interest barrier lead to almost the same results in case of debt finance. In contrast, in case of hybrid finance the interest barrier remains advantageous also in very risky situations. The advantage comes from additional earnings the parent is able to generate due to higher interest earnings from the subsidiary. Further, hybrid finance leads to higher group terminal values and causes fewer bankruptcies of the subsidiary.

In general, the interest barrier is more advantageous for companies expecting high future profits on a constant basis. This leads to high EBITDA and hence increases the possibility to deduct the interest expense. Additionally, companies may increase their annual depreciation rate, which also contributes to a high EBITDA. In contrast, the thin cap restricts the amount of deductible interest as soon as the predefined maximum debt ratio is exceeded. Thus, the interest barrier relates the interest deduction directly to a company's performance, whilst a thin cap only focuses on a company's debt ratio. That is why the interest barrier may become too restrictive in case of an economic crisis, where only low profits or even losses are expected. Consequently, a company would not be allowed to deduct interest because of low profits, even though it is not excessively debt-financed. The same applies for start-up companies, where low profits or losses are quite likely to occur within the first years. However, companies do not fall into the scope of the German interest barrier in case the net interest expenditure is lower than EUR 3,000,000[29]. I believe that only few companies, and hardly ever any start-up companies, have a net interest expenditure of more that EUR 3,000,000. That is why I doubt that too many companies fall into the interest barrier's scope. Consequently, its effects cannot be as destructive to the market as supposed.

Further, in case of an economic crisis also the thin cap is likely to have negative effects on companies: If a company's equity was already reduced due to losses and it neither gets fresh equity capital by its parent nor is able to pay back its liabilities, it is not unlikely that it exceeds the maximum debt ratio and thus must not deduct large parts of its interest expenditure. Hence, not only the interest barrier but also the thin cap would threaten the existence of companies during an economic crisis. Additionally, in contrast to the interest barrier, not every thin cap provides exemptions[30].

[29] Note that the effects of exemptions from the interest barrier are not part of this investigation.
[30] For an overview of the exemptions from European thin caps see *Bauer* (2009).

8. List of symbols

$\tilde{I}_P$	Interest earnings parent company
$\widetilde{TVP}^{TC}$	Terminal value parent company with the subsidiary subject to the thin cap
$\widetilde{TVP}^{IB}$	Terminal value parent company with the subsidiary subject to the interest barrier
$\widetilde{TVS}^{TC}$	Terminal value subsidiary subject to the thin cap
$\widetilde{TVS}^{IB}$	Terminal value subsidiary subject to the interest barrier
$\Delta\widetilde{GTV}$	Difference in the terminal values of both groups
$\tilde{A}$	Assets
$\tilde{Z}$	Debt interest paid by the subsidiary
$\tilde{D}$	Debt capital
τ	Tax rate (25%)
r	Risk-free interest rate
γ	Participation of hybrid finance in case of a profit
u	Yield due to an upward move in the economy
d	Yield due to a downward move in the economy
σ	Volatility of the return on assets
p	Probability measure
r_{cond}	Conditional interest rate
$\widetilde{EBIT}$	EBIT of the subsidiary
$\tilde{I}$	Interest payments by the subsidiary
$\tilde{I}^h$	Hybrid interest payments by the subsidiary
$\widetilde{Pot}^L$	Potential loss offset
$\widetilde{Pot}^I$	Potential interest offset
α	Potential loss offset
β	Depreciation rate
χ	30%-border

$\tilde{T}^{L}$	Duration of loss carry forward offset
$\tilde{T}^{I}$	Duration of interest carry forward offset
$\widetilde{CF}^{L}$	Loss carry forward
$\widetilde{CF}^{I}$	Interest carry forward
$\widetilde{TS}^{L}$	Tax savings due to loss offset
TS^{I}	Tax savings due to interest offset
δ	Devaluation of carry forwards
$\widetilde{VLC}^{TC}$	Value of the loss carry forwards of the subsidiary subject to the thin cap
$\widetilde{VLC}^{IB}$	Value of the loss carry forwards of the subsidiary subject to the interest barrier
$\widetilde{VIC}$	Value of interest carry forwards

9. Bibliography

Bach, S./Buslei H. (2009): Empirische Analysen zur Zinsschranke auf Grundlage von Handelsbilanzdaten, paper available under http://www.socialpolitik.ovgu.de/sozialpolitik_media/papers/Bach_Stefan_uid618_pid555.pdf (November 2010).

Baldauf, T./Pummerer, E. (2008) Deutsche Zinsschranke und österreichische Gruppenbesteuerung, ÖStZ 2008, 564ff.

Baldauf, T./Pummerer, E./Wittmann, A. (2010): Zinsschranke und EBITDA-Vortrag – Wirkungsanalyse unter Unsicherheit, SFB Working Paper, verfügbar unter SFB Working, paper available under http://www.sfb-itc.at/ (November 2010).

Bauer, A. (2009): Unterkapitalisierungsregeln in Europa – eine Analyse, StuW 2, 163ff.

Bohn, A. (2009): Zinsschranke und Alternativmodelle zur Beschränkung des steuerlichen Zinsabzuges, Wiesbaden: Gabler Verlag/ GWV Fachverlage GmbH.

Boga, F./Broggi, N./Caridi, A. (2008): Italy: 2008 Finance Bill, Journal of International Taxation, Vol. 19 Issue 3, 17ff.

Bradley, M., Jarrel, G. A., Han Kim, E. (1984): On the Existence of an Optimal Capital Structure: Theory and Evidence, The Journal of Finance, 39 (3), 857ff.

Brähler, G. (2009): Internationales Steuerrecht, Wiesbaden: Gabler.

Chowdhry, B., Coval, J. D. (1998): Internal financing of multinational subsidiaries: Debt vs equity, Journal of Corporate Finance, 4 (2), 87ff.

Cox, J./Ross, S./Rubinstein, M. (1979): Option Pricing: A Simplified Approach, Journal of Financial Economics 1979, 229ff.

Eberhartinger, E./Pummerer, E/Göritzer, A. (2010): Cross-Border intra-group Hybrid Finance and International Taxation, paper available under http://www.sfb-itc.at/ (November 2010).

Eberhartinger, E./Pummerer, E., (2010) Hybride Fremdfinanzierung als Instrument der internationalen Konzernsteuerplanung unter Unsicherheit, ZfB-Special Issue 2/2010, 67ff.

Eberhartinger, E./Pummerer, E. (2009): Hybride Konzernfinanzierung, in *Urnik, S./Fritz-Schmied, G./Kanduth-Kristen, S.* (Hrsg), Steuerwissenschaften und betriebliches Rechnungswesen – Festschrift für Herbert Kofler zum 60. Geburtstag, Wien: Linde.

Eberhartinger, E./Pummerer, E. (2007): Tochterkapitalgesellschaft, Betriebsstätte und österreichische Gruppenbesteuerung - eine grenzüberschreitende Betrachtung, Steuer und Wirtschaft (1): 64ff.

Eberhartinger, E. (2004): Besteuerung und steuerliche Gestaltung hybrider Finanzierungsinstrumente, in Bischof, M./Eberhartinger, E. (eds.): Hybride Finanzierungsinstrumente, Wien: Linde

Eberhartinger, E. (1995): Bilanzierung und Besteuerung von Genussrechten, stillen Gesellschaften und Gesellschafterdarlehen, Wien: Orac

Edgar, T. (1992): The Thin Capitalization Rules: Role and Reform, Canadian Tax Journal Vol. 40 No. 1.

Galeano, G.A./Rhode, A.M. (2008): Italy Sets the Barrier to Deduction of Financing Costs at 30 Per Cent of EBITDA, Intertax Volume 36 Issue 6/7, 292ff.

Glasserman, P. (2003): Monte Carlo Methods in Financial Engineering, New York: Springer

Goebel, S./Eilinghoff, K. (2008): Rechtsvergleichende Analyse der deutschen und amerikanischen Unterkapitalisierungsregeln unter Besonderer Berücksichtigung der Zinsschranke, IStR 7/2008, 233ff.

Gordon, R. H./ Lee, Y. (2001): Do taxes affect corporate debt policy? Evidence from U.S. corporate tax return data, Journal of Public Economics 82 (2), 195ff.

Göritzer, A. (2010): Der EBITDA-Vortrag der deutschen Zinsschranke, SWI 2010, 484ff.

Graham, J. R. (1996): Debt and the marginal tax rate, Journal of Financial Economics, 41 (1), 41ff.

Graham, J. R. (1999): Do personal taxes affect corporate financing decisions?, Journal of Public Economics, 73 (2), 147ff.

Graham, J. R. (2000): How Big Are the Tax Benefits of Debt?, The Journal of Finance, 55 (5), 1901ff.

Graham, J. R. (2003): Taxes and Corporate Finance: A Review, The Review of Financial Studies, 16 (4), 1075ff.

Green, R. C., Hollifield, B. (2003): The personal-tax advantages of equity, Journal of Financial Economics, 67 (2), 175ff.

Gropp, R. E. (2002): Local taxes and capital structure choice, International Tax and Public Finance, 9 (1), 51ff.

Grotherr, *S.* (1995): Ausländische Unterkapitalisierungsregeln, in *Piltz, D./Schaumburg, H.*(Hrsg), Unternehmensfinanzierung im Internationalen Steuerrecht, Köln: Schmidt.

Häuselmann, H. (2010): Unternehmensbesteuerung nach dem Wachstumsbeschleunigungsgesetz – Teil I: Zinsschranke und Verlustnutzung bei Kapitalgesellschaften, SteuK 2010, 1ff.

Herzig, N. (2009): Steuerliche Unterkapitalisierungsregeln – Rechtsentwicklung und Perspektiven, IStR 24/2009, 870ff.

Herzig, N./Bohn, A. (2009): Internationale Vorschriften zur Zinsabzugsbeschränkung – Systematisierung denkbarer Alternativmodelle zur Zinsschranke, IStR Heft 8/2009, 253ff.

Homburg, S. (2007): Die Zinsschranke – eine beispiellose Steuerinnovation, Finanz-Rundschau 15/2007, 717ff.

Huizinga, H., Laeven, L., Nicodeme, G. (2008): Capital structure and international debt shifting, Journal of Financial Economics, 88 (1), 80ff.

Hull, J. (2006): Options, Futures and other derivatives, Upper Saddle River: Prentice Hall.

Kessler, W./Obser, R. (2004): Überblick zur Gesellschafter-Fremdfinanzierung in den Mitgliedstaaten der Europäischen Union, IStR 2004, 187ff.

King, M. A. (1977): Public policy and the corporation, London: Chapman and Hall.

King, M. A. & Fullerton, D. (1984): The taxation of income from capital. A comparative study of the United States, the United Kingdom, Sweden and West Germany, Chicago and London: University of Chicago Press.

Jacobs, O. (2007): Internationale Unternehmensbesteuerung, München: Beck.

Lenz, M./Dörfler, O. (2010): Die Zinsschranke im internationalen Vergleich, DB 01/2010, 18ff.

Liekenbrock, B. (2010): Zum EBITDA-Vortrag der Zinsschranke, DB 13, 695ff.

Marino, T./Russo, M. (2008): Italian Restyling of Interest Deduction Rules: the Amendments of the Italian Finance Bill for 2008, Intertax Volume 36 Issue 5, 204ff.

Mayr, S. (2008): Neurungen im italienischen Steuerrecht zum Jahreswechsel 2007/08; IWB 7/2008, 339ff.

Miller, M. (1977): Debt and Taxes, Journal of Finance, 32 (2), 261ff.

Modigliani, F./Miller, M. (1963): Corporate income taxes and the cost of capital: A correction, American Economic Review, 53 (3), 433ff.

Musil, A./Volmering, B. (2008): Systematische, verfassungsrechtliche und europarechtliche Probleme der Zinsschranke, DB Heft 01/02/2008, 12ff

Obser, R. (2005): Gesellschafter-Fremdfinanzierung im europäischen Konzern, Düsseldorf: IDW-Verlag

Ortmann-Babel, M./Bolik, A. (2010): Beurteilung von Zinsschranke, Verlustverrechnungsbeschränkung und steuerpolitischen Zukunftserwartungen aus Unternehmenssicht, DStR 37, 1865ff.

Ressler, G. (2008): Die Unterkapitalisierung im Körperschaftsteuerrecht, Wien: LexisNexis.

Robbins, S. M./Stobaugh, R. B. (1972): Financing foreign affiliates, Financial Management, 1 (3), 56ff.

Rödding, A. (2009): Änderungen der Zinsschranke durch das Wachstumsbeschleunigungsgesetz, DStR 2009, 2649ff.

Romani, C./Grabbe, C./Imbrenda, A. (2008): Wichtige Steueränderungen in Italien, IStR 2008, 210ff.

Scheunemann, M.P./Dennisen, A. (2009): Unternehmensbesteuerung 2010: Überblick über die im Wachstumsbeschleunigungsgesetz vorgesehenen Änderungen, BB 2009, 2564ff.

Schwarz, P. (2008):, Zur Notwendigkeit einer Zinsschranke: Empirische Befunde und Probleme, IStR 1/2008, 11ff.

Six, M. (2008): Hybride Finanzierung im Internationalen Steuerrecht, Wien: Linde.

Van den Berg van Saparoea, Anouc (2010): Optimizing the Interest Deduction Rules – A Never-Ending Story, European Taxation 1/2009, 3ff.

Watrin, C./Pott, C./Richter, F. (2009): Auswirkungen der Zinsschranke auf die steuerliche Bemessungsgrundlage – eine empirische Untersuchung, StuW 3/2009, 256ff.

Wiedermann-Ondrej, N.(2007): Hybrid Instruments and the Indirect Credit Method – Does it work?, Paper available online at http://epub.wu.ac.at/dyn/virlib/wp/eng/showentry?ID=epub-wu-01_baa&from=openURL (November 2010).

Wittkowski, A./Hielscher, S. (2010): Wesentliche Änderungen der Unternehmensbesteuerung zum Jahreswechsel 2009/2010, BRZ 2010, 11ff.

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