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Costs of Financial Distress: the German Evidence

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Abstract

According to the trade off theory of capital structure, costs of financial distress are an important counterpart of tax benefits. As it treats optimal capital structure choice given ex ante benefits and costs of debt and equity, costs of financial distress also have to be measured from an ex ante perspective. However, attempts to estimate the magnitude of these costs in empirical studies concentrate on ex post costs of financial distress and – more restrictive – predominantly on the direct and therefore more easily measurable costs, such as court-and lawyer-fees. Considering Germany, the empirical evidence is even more limited.

Our study reviews the literature on measuring costs of financial distress and applies slight modifications of two existing empirical methodologies to German data: (1) the ex post approach of *Opler/Titman* (1994) and (2) the ex ante approach of *Bar-Or* (2000). Despite our limited data set, we find - in line with *Opler/Titman* (1994) - that performance measures such as changes in sales are negatively influenced by leverage across all firms. But in contrast to their results, we are not able to document an interaction effect between economic and financial distress: in distressed industries firms with high ex-ante leverage even seem to fare better than their ex-ante lower levered competitors. After discussing some theoretical implications of *Bar-Or's* model, we confirm for our German data set that ex ante costs of financial distress are significant across industries and rise with leverage. However, we also report that some of our results – and very likely also some of *Bar-Or's* results – are sensitive to assumptions in the valuation procedure which is fundamental to *Bar-Or's* methodology. Even under conservative assumptions about future growth, our estimates for the absolute expected costs of financial distress amount to an average of 28.6 % of firm value across all sample firms. This result raises doubts about the models ability to correctly quantify expected costs of financial distress for our database.

1 Introduction

The trade off theory of capital structure maintains that firms choose their capital structure by comparing the benefits and the costs of using debt. The benefits of debt usually comprise tax savings and avoidance of agency costs of equity. Financial researchers agree that a major part of the costs or disadvantages of using debt comes in the form of "bankruptcy costs" or "costs of financial distress". This paper aims to measure these costs empirically for a sample of German industrial firms. By doing so it makes several contributions to the existing literature:

- By measuring these costs for German data the paper provides first insights towards a potential comparison of these costs with other countries. Such a comparison is interesting for two reasons:
  - (1) Measured in book values, German firms on average seem to have higher debt/equity ratios than US firms.[1] Estimates on costs of financial distress may answer the question whether the observed difference in leverage ratios is related to differences in costs of financial distress
  - (2) German firms have different governance structures than US firms. In particular, banks still play a major role in financing corporations, thus leading to closer ties to banks.[2] Our study may answer the question whether one result of this closer relationship are lower costs of financial distress.
- Empirical studies on costs of financial distress are very sparse for German data. To our knowledge there is no study that tries to estimate indirect costs of financial distress ex post and/or expected costs of financial distress ex ante. Our study therefore aims to fill this gap.
- In general, the integration of disadvantages/costs of debt into the calculation of corporate values is difficult. While the tax shield is a common part of the discounted cash flow valuation formula, financial research has not yet been able to give sound answers to the question about the magnitude of the absolute and marginal costs of debt. Our estimates might thus serve as a yardstick for practical valuation purposes.

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1 See e.g. *Rajan/Zingales* (1995) Table II p. 1427. The authors point out that the results are sensitive to accounting adjustments, especially the treatment of pension liabilities. See *Rajan/Zingales* (1995) p. 1433.

2 Banks are still important equity blockholders of German firms. By voting the proxies for many individual shareholders, German banks have additional control over many firms. See e.g. *Denis/McConnell* (2003) pp. 11.

Our analysis focuses on two particular empirical approaches to measure costs of financial distress:

- *Opler/Titman* (1994) calculate ex post indirect costs of financial distress as sales losses of ex-ante highly levered firms in industry-wide economic downturns.
- *Bar-Or* (2000) tries to estimate ex ante costs of financial distress for different capital structures by comparing market values of equity with equity values derived from analysts earnings forecasts.

We chose these two models, first because empirical results suggest that indirect costs exceed direct costs of financial distress and thus seem more important for the capital structure choice.[3] Second the approach of *Bar-Or* is to our knowledge the only one that calculates ex ante expected costs of financial distress which is the relevant cost measure when trading off marginal (ex ante) benefits against marginal (ex ante) costs of debt.

The main results of our study are as follows: Firstly, using the *Opler/Titman* approach we are not able to document a significant relation between sales growth and leverage in distressed industries for our German database. Regression coefficients of the interaction dummy between leverage and industry distress are even positive in all specifications (though not significant in every case). On the other hand our results suggest that for all firms (distressed and non-distressed industries) there is a significant negative impact of leverage upon performance. In addition to this we find a very low explanatory power of this model specification. Secondly, applying the *Bar-Or* methodology on our database yields substantial expected costs of financial distress for German firms: We calculate average "preliminary" distress costs for all of our sample firms of 28 % of firm value (median is 44 %). This exceeds the average expected costs calculated by *Bar-Or* for US firms (20 % of firm value)[4] and thus raises doubts on the model´s ability to correctly quantify the expected costs of financial distress for our database. On the other hand there is a significant relation between costs of financial distress and firm leverage. Regressing the *Bar-Or* (2000) costs of financial distress measure on several control variables, we find that firm leverage, interest coverage and book to market ratio all seem to be significant determinants of the dependent variable.

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3 Cf e.g. *Altman* (1984), *Opler/Titman* (1994), *Andrade/Kaplan* (1998).

4 In his study *Bar-Or* differentiates between „preliminary" and final estimates for the costs of financial distress. The 20 % noted above are the preliminary number calculated as average over all sample firms. After some adjustments *Bar-Or* reports an estimate for the firm with the average leverage in his sample of 8% of firm value. See *Bar-Or* (2000) pp. 15, 38 and section 3 b) of this paper.

The rest of the paper is organised as follows. Section 2 reviews theoretical arguments concerned with costs of financial distress and discusses existing empirical studies that try to measure the magnitude of these costs. In section 3, the data, methodology and results of our empirical study based on the *Opler/Titman* framework are reported. Section 4 describes the ex ante-approach based on *Bar-Or* and reports the results of its application on our database. Section 5 discusses some implications of our results and gives suggestions for further research.

2 Costs of Financial Distress

2.1 Theory

Several models analyze the impact of bankruptcy costs/costs of financial distress on the capital structure choice of corporations.[5] The purpose of these models is primarily to analytically find the optimal leverage as a trade off between costs of financial distress/bankruptcy costs and tax savings associated with debt financing. The models differ in several aspects:

- Modelling the event "bankruptcy"/"financial distress": Some are based on the assumption that bankruptcy occurs when the firm faces a negative interest coverage, i.e. if periodic operating income is lower than periodic interest payments.[6] In other models the distress event is triggered by the face value of debt exceeding the market value of the firm.[7]
- Modelling the costs given the distress event occurs: Some theoretical models account for fixed costs that are directly attributed to the legal bankruptcy procedure (e.g. costs for legal advisors, lawyers, courts etc.). These costs are defined as a fixed amount or as a fixed fraction of the asset value. Additional to the legal fees and costs some models account for the loss of tax benefits in bankruptcy, thus leading to negative consequences of bankruptcy even without explicitly considering bankruptcy costs.[8] Some models differentiate between these costs depending on whether debtholders decide to liquidate or to reorganize the company.[9] *Titman/Tsykaplov* (2002) additionally introduce a variable component of distress costs that depends on the magnitude of the (negative) difference

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5 E.g. *Kraus/Litzenberger* (1973), *zur Linden* (1975), *Kim* (1978), *Chen* (1979), *Flath/Knoeber* (1980), *Morris* (1982), *Bradley/Jarrell/Kim* (1984).

6 E.g. *Kraus/Litzenberger* (1973) p. 912.

7 *Kim* (1978) p. 49.

8 *Chen* (1979) pp. 285; *Morris* (1982) pp. 288.

between operating income and interest payments thus accounting for the magnitude of the distress.

When discussing means of modelling costs of financial distress, several aspects have to be addressed:

- Differentiation between direct and indirect costs of financial distress:

  Usually, financial researchers refer to the terms "direct" bankruptcy costs or "direct" costs of financial distress when addressing the costs directly linked to the usage of the bankruptcy procedure, i.e. costs for lawyers, legal advisors and courts. Given the public information on these payments, direct costs are easily identified and measured.

  "Indirect" bankruptcy costs or costs of financial distress generally refer to all losses in value due to distress. Some of the indirect costs occur after the company files for bankruptcy: These losses may be caused by inefficient reorganization/liquidation decisions triggered by certain priority rights of some debtholders.[10] These costs of course depend on the legal environment.[11] But probably the larger part of indirect costs already occurs before the firm enters bankruptcy: Companies that sell long lived assets may e.g. loose customers due to the distress related impending uncertainty that it will be able to provide service or continue to deliver successor models in the future.[12] Companies with highly specific assets may incur substantial losses when cash is urgently needed to pay down debt and accordingly assets have to be sold at "fire sales" .[13] Finally, healthier competitors may aggressively exploit the opportunity to gain market share on product markets and drive financially vulnerable firms out of the market.[14]

  In the following we will use the notion "costs of financial distress" to refer to all costs, direct and indirect, prior and post entering bankruptcy.

- Differentiation between financial distress and economic distress:

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9 *Chen* (1979) pp. 282.

10 E.g. *Drukarczyk, J.* (1991).

11 Recently *Kahl* has given an alternative explanation for losses in value while the firm is in bankruptcy: Creditors postpone the liquidation/reorganization decision in order to gather information and learn more about the true state of the firm. See *Kahl* (2002).

12 *Opler/Titman* refer to this costs as "customer driven". *Opler/Titman* (1994) p. 1016.

13 See e.g. *Shleifer/Vishny* (1992), *Pulvino* (1998).

14 E.g. *Fudenberg/Tirole* (1986); *Bolton/Scharfstein* (1990).

One can imagine several ways on how capital structure decisions can impose negative consequences upon firm value via "distress":

First, in economic downturns companies with higher leverage may face higher indirect costs of financial distress (e.g. due to the loss of customers) than their more conservatively financed competitors. That is, high leverage could make companies more vulnerable to economic distress as it accelerates problems of the operating business (e.g. industry downturns, loss of market share, shrinking margins etc.) due to the high associated interest payments.

Second one can think of financial distress only to be caused by contractual arrangements on the right hand side of the balance sheet: That is costs of financial distress would then refer only to the costs caused by renegotiating and rewriting financial contracts for a given operating business.

In reality, economic and financial distress go hand in hand. Thus, financial researchers are faced with the "reverse causality problem" (e.g. *Opler/Titman* (1994), p. 1016): Economic distress (e.g. a downturn in revenues) may be the cause for as well as the result of financial distress. Therefore in most cases empirical researchers are not in a position to differentiate between economic and financial distress.[15] The differentiation of financial and economic distress is also difficult on a theoretical level. Economic distress is usually associated with declines in sales, operating performance etc.,[16] leading to "costs" in the form of lower firm values. While such costs also exist for all-equity firms, it can be assumed that for firms with high leverage, these declines lead to additional financial distress costs as described above. However, it is hardly conceivable that the latter costs arise without any decline in operating performance. Thus costs of financial distress in most cases require some economic distress if economic distress is defined as "declines in operating performance". A clear separation of the two types of costs is therefore extremely difficult.

2.2 Empirical Evidence

2.2.1 Ex post costs of financial distress

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15 A rare exception is the study of *Andrade/Kaplan* (1998) who rely on a database of troubled firms from highly leveraged transactions that have positive operating income and thus are not subject to economic distress.

16 E.g. *Andrade/Kaplan* (1998).

According to the differentiation proposed above, ex post costs of financial distress are the actual costs that occur during the distress. They can only be measured with hindsight. Thus many studies attempt to measure ex post costs of financial distress by collecting samples of firms that are either bankrupt or undergoe a private debt reorganization.[17] Most of the studies measure the direct costs of financial distress as costs associated with the bankruptcy procedure provided by the respective bankruptcy law. Almost all studies prove the existence of some fixed costs of financial distress by showing the total costs being a concave function of firm size. According to the results of these studies, direct costs lie between 3 % and 7.5 % of the asset value before distress occurs.[18]

Several studies also estimate the indirect costs of financial distress: *Cutler/Summers* (1988) analyze the Pennzoil/Texaco court trial and calculate a net loss in value for both companies of 1.1 billion USD. Following this idea *Bhagat/Brickley/Coles* (1994) analyze 355 court trials for indirect costs of financial distress; using regression analysis they find on average costs of 1.5 Mill. USD caused by the uncertainty about the court's decision and its economic consequences.[19] *Opler/Titman* (1994) focus on indirect costs of financial distress by exploring if firms with high ex-ante leverage experience stronger performance declines during a subsequent industry distress than low-levered firms in the same situation. They provide evidence that ex-ante highly levered firms face lower sales growth in distressed industries than firms with lower ex-ante leverage.[20] In a recent study *Campello* (2003) shows that industry-adjusted sales growth is lower for more indebted firms especially when rival firms in the same industry use less leverage.[21] *Altman* (1984) estimates indirect costs of financial distress by calculating the difference between realized profits in distress and profit projections which in turn are derived by multiplying a regression based sales forecast with an average profit margin. His estimates lead to indirect costs of financial distress of 8.1 % of firm value in the third year before distress occurred.[22] *Chen/Merville* (1999) use Altman´s Z-score model to divide their sample into three risk classes and show that the deviation between

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17 E.g. the studies of *Warner* (1977), *Ang/Chua/McConnell* (1984), *Weiss* (1989), *Campbell* (1997), *Betker* (1997).

18 *White* (1989), *Weiss* (1990), *Ang/Chua/McConnell* (1984), *Campbell* (1997), *Betker* (1997).

19 *Bhagat/Brickley./Coles* (1994) S. 221. The authors do not relate this cost to the market value of the firms.

20 See *Opler/Titman* (1994) p. 1025. We will refer to this study in detail later.

21 *Campello* (2003) pp. 372.

22 See *Altman* (1984) pp. 1074.

realized earnings in distress and a distress free earnings projection is significantly different for the three risk classes, whereby the class with the continuously increasing insolvency risk experiences the highest average deviation.[23] *Andrade/Kaplan* (1998) concentrate on highly leveraged transactions (HLT) that became financially distressed, but still have positive operating earnings.[24] Thus the authors argue to estimate the "pure" financial distress costs excluding any costs of economic distress. They calculate losses in market values due to financial distress; the mean costs of financial distress are - adjusted for industry/market effects - roughly 10 % of firm value. These costs are not statistically different from zero.[25] The authors conclude that their cost estimates are not high; as a possible explanation they point to the fact that HLTs occur in mature industries where indirect costs due to fire sales of specific assets are not substantial.

For Germany there is a large body of literature that is concerned with indicators of distress and the estimation of distress probabilities.[26] Some studies also rely on *Altman´s* Z-Score model.[27] German studies on the costs of bankruptcy are very limited though. *Gessner et al.* (1978) estimate that direct costs of bankruptcy under the former bankruptcy code amount to some 4.5 % of asset value after the bankruptcy filing .[28] To our knowledge there are no studies that try to estimate indirect costs of financial distress.

2.2.2 Ex ante costs of financial distress

As all of the numerous studies above are concerned with the empirical estimation of costs of financial distress after financial distress took place, none of them directly tries to calculate *ex ante* costs of financial distress.[29] Only these, however, are the relevant costs when choosing the optimal capital structure. In order for the above studies to generate relevant ex ante costs, additional distress probabilities would need to be calculated. A number of papers concentrate on this special issue but they in turn do not relate their probability estimates to distress costs (e.g. *Shumway* 2001,

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23 See *Chen/Merville* (1999) pp. 277.

24 *Andrade/Kaplan* (1998) pp.1447.

25 *Andrade/Kaplan* (1998) p. 1466 and table 7. Median values are 20.7 % and 24.3 % und thus substantially higher.

26 See e.g. *Gebhardt* (1980), *Baetge* (1980), *Feidicker* (1992).

27 See e.g. *Albrecht/Baetge/Jerschensky/Roeder* (1999) or *Baetge* (2002).

28 *Gessner et al.* (1978).

29 Some studies, e.g. *Andrade/Kaplan* (1998), are explicitly aware that ultimately ex ante costs of financial distress should be measured.

Philosophov/Philosophov 2002). Principally, one could think of combining the information from the latter studies with the results from the studies from section 2.2.1. The general problem with combining an ex post financial distress costs estimate with a distress probability estimate is that (1) a meaningful combination would require firm-specific estimates which are unlikely to be available when having to rely on different studies for each estimate and that (2) the probability studies usually do not estimate marginal distress probabilities based on changes in capital structure but rather probabilities that rely on a set of "ad hoc"-variables. Additionally in order to specify the probability one would have to assume a certain time horizon, in which the bankruptcy state may occur.[30] These obstacles prevent a simple combination of ex post costs with distress probabilities and thus make a strong argument for a different methodology for measuring ex ante costs of financial distress. To our knowledge, the only approach that directly tries to assess these ex-ante costs has been put forward by *Bar-Or* (2000). He argues that whereas ex ante costs of financial distress would be incorporated in observable market prices of equity, financial analysts would not include these costs when estimating their company's earnings-per-share. This assumption, which he also empirically confirms with an EPS-bias analysis, allows to calculate a market value of equity using DCF valuation based on earnings forecasts and subtract market capitalization from this value. As a result, one would obtain an estimate of ex ante costs of financial distress for a given capital structure. Of course this approach implies that all benefits of debt (tax savings, lower agency costs of equity) are fully reflected in the analysts estimate and in the market capitalization of the firm. As this approach will be applied and modified below, we will postpone a detailed description until section 4..

3 Opler/Titman's ex post-approach

3.1 The model

Opler/Titman (1994) (henceforth referred to as OT) propose and estimate a pooled regression model to investigate the influence of financial distress on firm performance (measured by sales growth, stock returns and growth in operative income) for a sample of 46.799 firm years in the 1972 to 1991 period. They emphasize on indirect costs of financial distress.

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30 For instance the probabilities of distress and default depend on the time horizon in which default or bankruptcy may occur. See e.g. *Bar-Or* (2000) pp. 39 for a discussion.

OT analyze whether firms in distressed industries with high ex-ante leverage perform worse than their peers with low ex-ante leverage. This means that according to OT's method, firms in distressed industries with *high ex-ante leverage* proxy for *financially distressed* firms. If their performance was significantly lower than that of firms in the same industry, but with low ex-ante leverage, then this could be considered evidence for the existence of significant costs of financial distress.

OT measure performance either as industry adjusted sales growth, stock returns or change in earnings before interest and taxes (EBIT) and perform a regression analysis to explain performance using several independent variables (see *Table I* for their regression specification). These include profitability, logarithm of sales to control for a size related performance impact, the industry-adjusted investment-to-assets ratio to proxy for investment behavior's influence on performance and the industry-adjusted asset sale ratio to control for performance effects stimulated by asset sales.

Most importantly, their analysis of costs of financial distress focuses on a number of dummies and dummy interaction variables. One dummy indicates a distressed industry, another dummy indicates whether a firm is in the high leverage group and the interaction of both dummies measures the combined effect of distressed industry *and* high leverage on performance. *Table I* shows the regression equation.

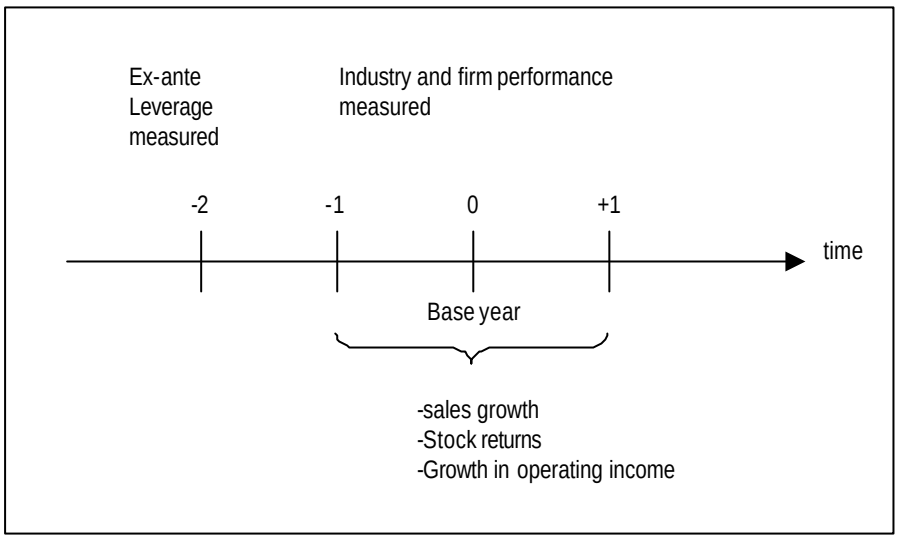
Table I: Opler/Titman regression specification[31]

Alternatively:

- Sales growth				
- Stock returns	=	α	+ b_1	*ln sales*
- ΔEBIT			+ b_2	*Industry adj. Profitability*
			+ b_3	*Industry adj. Investments / assets*
			+ b_4	*Industry adj. Asset sale rate*
			+ β_5	Distressed Industry **Dummy**
			+ β_6	High leverage **Dummy**
			+ β_7	Distressed Industry **Dummy x** High leverage **Dummy**
			+ ε	

In order to avoid the reverse causality problem mentioned in the previous section, OT use time lags to measure ex-ante leverage before measuring performance as shown in *Figure I.*

Figure I: Opler/Titman (1994) research design[32]



Starting from any base year 0, OT first investigate whether the industry of a particular firm is distressed over the two year horizon from year –1 to year 1 (Distressed Industry Dummy). They also measure the particular firms performance (proxied for by sales growth, earnings growth and stock returns) over the same period. The leverage of the firm, measured in book values, enters with its value one year prior to this two year observation horizon (year –2, Leverage Dummy). Sales, profitability, investments/assets and asset sale rate are used as control variables and enter the model with their values just at the outset of the two-year observation period. Both, the dependent variables and all control variables except sales are industry adjusted by subtracting the industry mean. Similar to OT's suggestion, we specify the following regression equation .

31 Modified from *Opler/ Titman* (1994).

32 Slightly modified from *Opler/ Titman* (1994), p. 1020.

Table II: Our regression specification

Alternatively:

$$\begin{matrix} SGA_{i,t} \\ EGA_{i,t} \\ SRA_{i,t} \end{matrix} = \alpha + b_1 \; LSL_{i,t-2} + b_2 \; EAA_{i,t-2} + b_3 \; IAA_{i,t-2} + b_4 \; ASA_{i,t-2} + \beta_5 \; DD1_t + \beta_6 \; LD1_{i,t-3} + \beta_7 \; (DD1_t \bullet LD1_{i,t-3}) + \varepsilon$$

$SGA_{i,t}$ is the industry adjusted (*A* stands for industry adjusted) sales growth of firm i over the two year period preceding a certain base year t. Similarly $EGA_{i,t}$ is the earnings growth and $SRA_{i,t}$ the stock return, both for firm i over the same period and both industry adjusted. $LSL_{i,t-2}$ is the natural logarithm of firm i's sales two years prior to the base year t (i.e. at the outset of the two year observation period). $EAA_{i,t-2}$ is the ratio EBIT/assets, $IAA_{i,t-2}$ the ratio of investments/assets and $ASA_{i,t-2}$ the ratio of asset sales/assets, all three are static variables of firm i two years prior to the base year t and all are industry adjusted. $DD1_t$ and $LD1_{i,t-3}$ are respectively the above described distress and leverage dummies. Similar to OT, in order to perform industry-adjustments, we calculate the absolute difference between a firm's value of a certain variable and the industry mean for that same variable across all firms in the industry in a certain year.

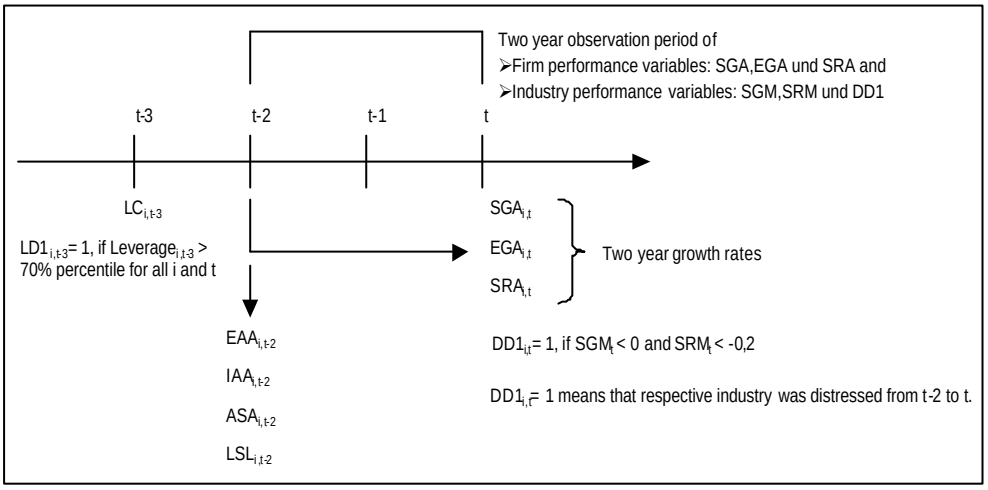
Concerning the dummies, $LD1_{i,t-3}$ is our leverage dummy for firm i three years prior to t (i.e. one year prior to a specific two year observation period). It is set equal to one if firm i's leverage in that year exceeds the 70 % leverage-percentile over all firms *and* all years and equal to zero otherwise. $LD2_{i,t-3}$ is an alternative leverage dummy set to one if firm i's leverage exceeds the 90 % percentile, everything else equal. $DD1_t$ is the distressed industry dummy in t, which we set one if the mean[33] sales growth over the

33 It is not quite dear which definition OT use for their distressed industry dummy: On their page 1024 an industry is distressed if it exhibits negative *median* sales growth and stock returns below –

two years preceding t was negative *and* the mean stock return was below -0,2[34] over that same period and zero otherwise. $DD5_t$ equals $DD1_t$, except that it uses median sales growth instead of mean sales growth.

Figure II summarizes our time lag design. Note that it conserves OT's fundamental relations (two year observation period and ex ante leverage), the only difference being the base year: OT's base year 0 is always the middle of the two year observation period, whereas our base year t always marks the end of a two year period.

Figure II: Time lag design of our regression



Since we use two dummy variables and one interaction dummy in our regression equation, there are a number of possible intercepts which are of relevance for our interpretations. *Table III* shows the different dummy constellations.

Table III: Possible intercepts of our regression

No.	Intercept		Dummy Constellation	Interpretation
1.	a	If:	$DD1_t = 0$ and $LD1_{i,t-3} = 0$	Normal industry, low ex-ante leverage
2.	$a + b_5$	If:	$DD1_t = 1$ and $LD1_{i,t-3} = 0$	Distressed industry, low ex-ante leverage
3.	$a + b_6$	If:	$DD1_t = 0$ and $LD1_{i,t-3} = 1$	Normal industry, high ex-ante leverage
4.	$a + b_5 + b_6 + b_7$	If:	$DD1_t = 1$ and $LD1_{i,t-3} = 1$	Distressed industry, high ex-ante leverage

0,3, whereas on their page 1026 distressed industries have negative *mean* sales growth and stock returns below –0,3. See *Opler/Titman* (1994), pp. 1024 and 1026.

34 In OT, all other things equal, the mean stock return must be below –0,3 for this dummy to be set 1.

Which of the constellations measures costs of financial distress again depends on the distinction between economic distress and financial distress. If one refers to the "pure" definition of *Andrade/Kaplan* (1998) only No. 3 with coefficient $ß_6$ measures financial distress. Taking a broader view and allowing for interactions between economic and financial distress, constellation No. 4 measures the total costs.

We use DATASTREAM as our data source and employ DATASTREAM's CDAX industry classifications and constituent lists to retrieve data for all firms in an industry. For every firm we obtain data for all available years from 1987-2001.[35] This procedure yields a final sample (firms with valid observations only) of 347 firms and about 2966 valid data sets for the base regression with SGA as dependent variable.[36]

Table IV shows the industries that are distressed during a specific two-year observation period (grey shading), depending on the distress dummy we use. In brackets we show the number of firms from each industry that suffer from distress and at the same time deliver valid regression data sets. If we use the median based distress dummy DD5, 5.5 % of all valid data sets stem from distressed industries. If we use DD1, this number amounts to only 2.1 %. In OT's study it is ca. 3 %.[37]

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35 We exclude all banks and insurance firms, as debt instruments are a source of income and leverage therefore plays a different role for these firms.

36 In order for an industry to be accepted in the final sample, OT require that it should have a minimum of four firms, see *Opler/Titman* (1994), p. 1022. In our sample, the industry with the fewest firms that deliver valid datasets is "media" with six firms and hence we meet OT's requirement. OT also require that their industries have "at least one firm in the top three sample leverage deciles and one firm not in the top three deciles per year". *Opler/Titman* (1994), p. 1022. This requirement is also met by our sample: only firms in industry "utilities" are consistently (1987-2001) low levered. Some industries as e.g. media and software mainly consist of younger firms. In early years (1987-1995) they might only have one or two constituents and therefore low variability in leverage

37 See *Opler/Titman* (1994), p. 1022.

Table IV : Distribution of distressed industries and firms[38]

1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total Distressed Obs.
Distress Definition DD1															
						basic resources (12)			telecommunications (10)			consumer cycl (28)		construction (23)	73
Distress Definition DD5															
					basic ressources (21) financial services (36) consumer cycl (19) machinery (34)								construction (53) financial services (6)		168

Tables V and VI show the descriptive statistics for our entire sample.[39] *Table V* divides all observations in those stemming from distressed industries (i.e. where DD1 = 1) and those stemming from normal industries (i.e. where DD1 = 0). *Table VI* does the same based on the industry distress definition according to DD5. Note that in some cases (especially with sales) outliers seem to deter means. We will therefore focus on the medians.

In period t-3 mean ex-ante leverage is similar between firms in distressed and non-distressed industries (for either DD1 or DD5). But considering leverage in period t, we note a substantial difference between distressed and non-distressed industries: now mean leverage of firms in industries that have been distressed from t-2 to t is higher than in industries that have been healthy during the same time. Looking at medians the effect is even more pronounced. OT report a similar effect and mention as a possible explanation that firms in distressed industries could have been forced to build up leverage from t-2 to t as a result of other finance resources drying up during distress.[40]

OT also observe that firms in distressed industries are much smaller (as measured by sales) than firms in normal industries.[41] Looking at sales as a proxy for size, we get mixed results: Mean sales are higher in non-distressed industries than in distressed industries (for both distress definitions), but median sales show the opposite relation.

If we use DD1 as industry distress definition and compare the median two-year growth rates of sales, stock returns and EBIT in distressed industries with those in normal industries, we find that the former are lower than the latter. While this is also true for DD5, surprisingly here mean sales growth is positive even in distressed industries. But

38 The observations in *Table IV* are based on the sales variable.

39 The descriptive statistics in *Tables V and VI* are based on the total sample, i. e. all available firm-years are included. Thus, the descriptive statistics reflect all firm-years that were used to calculate the industry mean adjustments.

40 See *Opler/Titman* (1994), p. 1024.

41 See *Opler/Titman* (1994), p. 1023 and 1024.

DD5 classifies an industry as distressed using medians and median sales growth is indeed negative. Obviously, due to some outliers, sales growth is skewed to the right,[42] so DD5 based on medians correctly classifies industries as distressed despite mean sales growth being positive. The same argument holds for the EBIT growth, where mean in the distressed group is positive, while median EBIT growth is negative.

Table V: Descriptive Statistics for Distress Dummy 1(DD1)

The table shows descriptive statistics for variables in distressed and non-distressed industries when using DD1 to define distress. Leverage is measured as total liabilities divided by total assets. The table shows total sales, two-year sales growth, two-year stock return and two-year EBIT growth.

Distressed Firm-Years (DD1)

Variable	Leverage	Leverage	Sales (TEUR)	Sales (TEUR)	Sales Growth	Stock Return	EBIT Growth
Time	in t-3	in t	in t-1	in t	in t	in t	in t
Mean	0.4174	0.4660	2,014,268	1,889,032	-0.0164	-0.3166	-0.2643
Median	0.4001	0.4869	436,774	329,604	-0.0394	-0.3381	-0.3954
Std. Dev.	0.1948	0.2183	5,221,914	4,955,070	0.3867	0.2837	1.4908
Observations	66	73	64	71	64	56	62

Non-Distressed Firm-Years (DD1)

Variable	Leverage	Leverage	Sales	Sales	Sales Growth	Stock Return	EBIT Growth
Time	in t-3	in t	in t-1	in t	in t	in t	in t
Mean	0.4075	0.4001	2,228,469	2,268,459	1.1984	0.1544	104.0941
Median	0.3961	0.3970	250,219	232,925	0.1371	-0.0034	0.0738
Std. Dev.	0.2361	0.2040	7,827,732	8,386,258	21.5576	0.8843	5846.3570
Observations	2,880	3,867	3,550	3,849	3,280	2,570	3,351

Table VI: Descriptive Statistics for Distress Dummy 5 (DD5)

The table shows descriptive statistics for variables in distressed and non-distressed industries when using DD5 to define distress. Leverage measured as total liabilities divided by total assets. The table shows total sales, two-year sales growth, two-year stock return and two-year EBIT growth.

Distressed Firm-Years (DD5)

Variable	Leverage	Leverage	Sales	Sales	Sales Growth	Stock Return	EBIT Growth
Time	in t-3	in t	in t-1	in t	in t	in t	in t
Mean	0.4051	0.4398	1,105,160	1,164,232	0.3662	-0.2981	0.6270
Median	0.4025	0.4506	263,363	278,041	-0.0543	-0.2876	-0.3252
Std. Dev.	0.1997	0.2226	2,478,341	2,576,692	3.2953	0.2851	13.3050
Observations	160	164	165	168	164	144	164

Non-Distressed Firm-Years (DD5)

Variable	Leverage	Leverage	Sales	Sales	Sales Growth	Stock Return	EBIT Growth
Time	in t-3	in t	in t-1	in t	in t	in t	in t
Mean	0.4078	0.3996	2,278,233	2,310,722	1.2168	0.1700	107.3254
Median	0.3959	0.3952	252,987	233,268	0.1431	0.0068	0.0877
Std. Dev.	0.2371	0.2035	7,950,617	8,500,409	21.8812	0.8942	5937.4180
Observations	2,786	3,776	3,449	3,752	3,180	2,482	3,249

42 Standard deviation of sales growth in the distressed group at DD5 is more than eight times the standard deviation in the same group at DD1. Most extreme outlier in the distressed group is Mainzer Aktien Bierbrau which in 1993 had sales growth of 3930 %.Removing this observation decreases mean to 0.1264 which is still positiv. Excluding the 5 outliers showing more than 200 % sales growth reduces mean of the DD5 distressed group to – 0.031. -

3.2 Results

Before we present results of our regressions, a brief review of OT's findings seems appropriate. The authors report a significantly negative coefficient for the interaction dummy thus showing that highly levered corporations face substantially lower sales growth in industry downturns than their less levered competitors.[43] After performing additional analyses on stock return and operating income the authors conclude that the sales growth reductions are "*customer-*" or "*competitor-driven*" and hence represent costs of financial distress.[44] Furthermore OT report a negative and significant leverage dummy coefficient and thus conclude that *"leveraged firms lose market share to their more conservatively financed counterparts even in good times"* (p.1025). Which combination of coefficients may be attributed to "costs of financial distress" again depends on the relation between economic and financial distress. OT seem to view the negative interaction dummy coefficient as their most important result (p.1025). Thus they concentrate on the *additional* costs that high leverage imposes on firms that already face economic distress. Interpreting financial distress solely in terms of high leverage, OT would also have reported significant costs: the regression coefficient for the leverage dummy β_6 is – 3 % and highly significant. (p. 1026, *Table IV*). Counter-intuitive on first sight seems OT's significant *positive* coefficient of the industry distress dummy, suggesting that sales growth is 11,1 % higher for firms in distressed than for those in non-distressed industries. (*Table IV*, p.1026). While OT do not mention this result, it is important to keep in mind that the dependent variable is industry-adjusted by deducting the industry mean. Thus the average of the adjusted dependent variable has to be zero in the distressed industries as well as in the non-distressed industries.[45] Under these circumstances the coefficients of the distressed industry dummy are difficult to interpret.

Our own regression results are shown in *Tables VII and VIII*. We focus on the sales growth equations (SGA as dependent variable) for the beginning. According to *Tables VII and VIII*, we document that independent of which industry distress dummy (DD1 or DD5) and which leverage dummy (LD1 or LD2) we use, the leverage dummy's coefficient estimate is negative and the industry distress dummy is positive. This is in

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43 See *Opler/Titman* (1994), p. 1025. *Campello* extends this analysis by showing that leverage of the competitors has an impact on this effect. See *Campello* (2003) p. 373.

44 *Opler/Titman* (1994), p. 1033.

45 In fact, this holds for our data set.

concordance with OT's results.[46] But contrary to OT, the coefficient estimate of our interaction dummy is positive across all four sales growth specifications.

Whereas in OT's sales growth equation, the coefficient estimates for each of the three dummies are all significant at the 1 % level, only in one of our four sales growth specifications (DD1/LD1) are all three dummies significant at a 10 % confidence level. In this sense it is our most powerful specification. Overall, OT report an adj. R^2 of 5 % for their sales growth regression. For our sales growth specifications we obtain an adj. R^2 of only about 1,7 %-1,9 %. They all have similar explanatory power.

46 See *Opler/Titman* (1994), p. 1026.

Table VII: Regression results for distress definition DD1

Regression model as specified in table II.[47]

SGA, SRA and EGA are dependent variables measuring industry-adjusted two-year sales growth, industry-adjusted two-year stock returns and industry-adjusted two-year EBIT growth respectively. LD1 (LD2) is a leverage dummy indicating whether a firm is in the 70% (90%) percentile of the distribution of total liabilities to total assets. LSL is defined as the natural logarithm of total sales. EAA, IAA and ASA are industry-adjusted earnings-to-assets, industry-adjusted investment-to-assets and industry-adjusted asset sales-to-assets ratios. DD1 is a dummy indicating whether an industry is in distress.

Results for Pooled Least Squares Regressions - Industry Distress Definition according to DD1							
Industry Distress Definition according to **DD1**		Dependent Variables					
		SGA		SRA		EGA	
		LD1	LD2	LD1	LD2	LD1	LD2
Independent Variables	Time Lag						
Intercept		**2,396081**	**2,38221**	**-0,002133**	**-0,01356**	**106,2166**	**85,61878**
LSL	-2	**-0.214356**	**-0.219799**	**-0,000276**	**0,000463**	**-10,58605**	**-9,962669**
EAA	-2	**0,356696*** **	**0,35233*** **	**0,02916*** **	**0,029326*** **	**-5,106563*** **	**-4,955278*** **
IAA	-2	**-1,83119**	**-1,867031**	**0,026538**	**0,033598**	**-3,599517**	**-2,311816**
ASA	-2	**-0,227959**	**-0,212365**	**0,010145**	**0,008413**	**0,83232**	**-0,507576**
DD1		**0,32981***	**0,456666*** **	**-0,01733**	**-0,017992**	**100,1766*** **	**108,5044*** **
LD...	-3	**-0,551197** **	**-0,954684***	**0,035693**	**0,105145**	**-26,62304**	**4,12141**
DD1*LD...	LD: -3	**0,58389***	**0,764068**	**-0,150402**	**-0,254474***	**29,03378**	**-0,614153**
adj. R^2		0,017931	0,0182	0,003037	0,003757	-0,001674	-0,001789
sample		1990-2001	1990-2001	1990-2001	1990-2001	1990-2001	1990-2001
incl obs		12	12	12	12	12	12
nr cross sections used		347	347	307	307	348	348
tot panel obs		2966	2966	2457	2457	2978	2978
other		White estim.	White estim.	White estim.	White estim.	White estim.	White estim.

47 * significant at the 10% confidence level.
** significant at the 5% confidence level.
*** significant at the 1% confidence level.

Table VIII: Regression results for distress definition DD5

Regression model as specified in table II.

SGA, SRA and EGA are dependent variables measuring industry-adjusted two-year sales growth, industry-adjusted two-year stock returns and industry-adjusted two-year EBIT growth respectively. LD1 (LD2) is a leverage dummy indicating whether a firm is in the 70% (90%) percentile of the distribution of total liabilities to total assets. LSL is defined as the natural logarithm of total sales. EAA, IAA and ASA are industry-adjusted earnings-to-assets, industry-adjusted investment-to-assets and industry-adjusted asset sales-to-assets ratios. DD5 is a dummy indicating whether an industry is in distress.

Results for Pooled Least Squares Regressions - Industry Distress Definition according to DD5							
Industry Distress Definition according to	DD5	Dependent Variables					
		SGA		SRA		EGA	
		LD1	LD2	LD1	LD2	LD1	LD2
Independent Variables	Time Lag						
Intercept		**2,371066**	**2.35044**	**-0,002894**	**-0,008344**	**97,28693**	**76,08943**
LSL	-2	**-0,212676**	**-0,217566**	**-0,000256**	**0,000215**	**-10,37896**	**-9,740036**
EAA	-2	**0,356253****	**0,35199*****	**0,029007****	**0,029087****	**-5,515965****	**-5,358634****
IAA	-2	**-1,84152**	**-1,88068**	**0,022607**	**0,029494**	**-4,948351**	**-2,779973**
ASA	-2	**-0,227237**	**-0,212186**	**0,010479**	**0,009898**	**0,912445**	**-0,472364**
DD5		**0,194267**	**0,221863**	**0,003032**	**-0,008987**	**105,0405****	**113,8392****
LD...	-3	**-0,547584****	**-0,93481***	**0,030151**	**0,069893**	**-27,41992**	**4,517449**
DD5*LD...	LD: -3	**0,12908**	**0,272518**	**0,074864**	**0,275024**	**26,49915**	**-7,340585**
adj. R^2		0,01783	0,01804	0,003061	0,004189	-0,001248	-0,001364
sample		1990-2001	1990-2001	1990-2001	1990-2001	1990-2001	1990-2001
incl obs		12	12	12	12	12	12
nr cross sections used		347	347	307	307	348	348
tot panel obs		2966	2966	2457	2457	2978	2978
other		White estim.	White estim	White estim.	White estim.	White estim.	White estim.

Table IX shows a calculation of the different intercepts for each of the possible dummy scenarios based on the coefficient estimates from *Tables VII and VIII.*

Table IX: Overview of intercepts for different sales growth regressions

Intercepts for sales growth regressions		
Intercepts	DD1 / LD1	DD1 / LD2
a	2,39608	2,3822
$a + b_5$	2,72589	2,83887
$a + b_6$	1,84488	1,42752
$a + b_5 + b_6 + b_7$	2,75858	2,6472
Intercepts	DD5 / LD1	DD5 / LD2
a	2,37107	2,35044
$a + b_5$	2,56533	2,572303
$a + b_6$	1,823482	1,415628
$a + b_5 + b_6 + b_7$	2,146827	1,91001

Looking at the intercepts of all four specifications we find that industry adjusted sales growth is significantly lower for *all* firms with high ex-ante leverage than for those with low ex-ante leverage. All leverage dummy coefficients are negative on a 5 % and 10 % confidence level respectively. Also corresponding to OT's results, though not explicitly mentioned there, is our finding that industry adjusted sales growth c. p. seems to be *higher* for ex-ante low leveraged firms in distressed industries than for ex-ante low leveraged firms in normal industries[48]. As argued above due to the industry-specific adjustment the coefficients are difficult to interpret. The positive distress dummy coefficients are statistically significant only in the DD1 specifications. But contrary to OT we find that industry adjusted sales growth c. p. is not lower for firms with high ex-ante leverage in distressed industries. The interaction dummy coefficients are positive across all four specifications and even significant at a 5 % confidence level in the DD1/LD1 model. Thus highly-levered firms do not seem to face additional losses in economic downturns compared to their lower levered competitors. Clearly this is a counter-intuitive result. A possible interpretation of this finding are benefits of high leverage, e.g. potential value enhancing management decisions which lower-levered companies in the same situation would possibly avoid.[49] On the other hand the fact that in our model the improved performance for these firms is measured by revenues (and

48 See also *Opler/Titman* (1994), p. 1026.

49 *Wruck* (1990) argues that "forced" reorganization in the context of distress situations may enhance the operational efficiency of a company. Furthermore, some authors argue that the threat of bankruptcy could improve the bargaining power of management against other stakeholders of the firm that earn economic rents, e.g. employees. See e.g. *Jensen* (1989), *Bronars/Dear* (1991) and *Dasgupta/Sengupta* (1993).

not by any profit measure that could be affected by cost reductions) does not support this hypothesis in this case. Clearly more research is needed to explain our finding.

Finally, in *Tables VII and VIII* we note that the coefficient estimates of the control variable EAA are significantly positive across all sales growth specifications, whereas the other control variables are not significant.

The regression results for the other two dependent variables, stock returns and EBIT growth (industry adjusted) are disappointing: The adjusted R^2 is ca. 0 %, most of the coefficient estimates of the dummy variables are insignificant with varying coefficient signs in the stock return equations. Since OT primarily use these regressions to distinguish customer- and competitor-driven sales losses from management-driven sales losses, and since our results do not convincingly indicate sales losses for financially distressed firms, we will not devote any further attention to the stock return and EBIT growth equations.

In addition to the models above, we altered OT's research design, regressing non industry adjusted but otherwise identical dependent variables on our list of regressors.

We report the results only qualitatively.[50] Considering again the sales growth model, the coefficient estimate of the distressed industry dummy is now significantly negative across all of our new specifications (confidence levels are at 1 % and 5 % respectively), as was originally expected.

The estimate for the leverage dummy remains negative (mainly significantly) for all four equations, showing statistical significance only in the DD1/LD1 (at 5 %) and the DD5/LD1 (10 %) model.

Consistent with our earlier results, we are not able to document a negative interaction between distress and leverage: the estimate for the interaction variable mainly remains insignificant with changing sign across different specifications.

Surprisingly the explanatory power of the models increases substantially when removing the industry adjustment: for the modified equations we report adjusted R^2 between 3.6 % and 3.8 %.

Whereas for the sales growth models, the parameter estimates of leverage and interaction dummies resemble the results of the equations with adjusted dependent variables. Unfortunately this is not true for the unadjusted models of the two other dependent variables, EBIT-growth and stock returns: For these specifications adj. R^2 range from – 0,2 % to 1,4 %. Besides the negative coefficient estimate for the distress

50 Of course, the respective tables may be obtained from us.

dummy in all stock return equations none of the different dummy variables has any statistically significant impact upon the dependent variable.

At last, we investigate two other questions regarding OT's research design: 1. Is leverage in OT's research design lagged too much? Leverage could also enter the regression with its value at the beginning of each two-year observation period, instead of one year prior to this period. 2. Is a two-year observation period too long? Performance-declines as a result of financial distress might only be picked up over a shorter time horizon.

To analyze these questions, we implement two small changes to OT's research design: Concerning the first question we simply specify a time lag of t-2 instead of t-3 for the leverage. Regarding the second question we calculate one-year- (from t-1 to t) instead of two-year growth rates (from t-2 to t) from our raw data. This means our performance observation horizon is now one year, instead of two. Disappointingly, the results of these modifications do not allow us to draw any new conclusions. Hence, we do not present them here.

All in all, with our German CDAX firms and using OT's method, we do not succeed in proving the existence of a significant effect of high ex-ante leverage on performance for firms in distressed industries.

4 The ex ante approach of Bar-Or

4.1 The model

According to *Bar-Or* (2000), costs of financial distress can be described as the difference between the value of the equity of a firm under partial debt financing as derived from a DCF approach (flow to equity) based on IBES earnings forecasts and the market capitalization of that firm. His key assumption is that the earnings forecasts are not adjusted for expected costs of financial distress whereas the capital market entirely deducts expected costs of financial distress: Let $FDC_{i,t}$ be the financial distress costs of firm i at time t, $E_{i,t}^{D}$ be the equity value under partial debt financing of firm i at time t as derived from a discounted flow to equity model based on earnings forecasts and $MC_{i,t}$ finally be the market capitalization of firm i at time t. Then, *Bar-Or's* idea is that: $FDC_{i,t} = E_{i,t}^{D} - MC_{i,t}$ and hence he suggests the two relative measures

$$FDC^{I}_{i,t} = \frac{E^{D}_{i,t} - MC_{i,t}}{E^{D}_{i,t} + L_{i,t}} \tag{1}$$

(where $L_{i,t}$ are the total liabilities of firm i at time t) and

$$FDC^{II}_{i,t} = \frac{E^{D}_{i,t} - MC_{i,t}}{E^{D}_{i,t}} \tag{2}$$

for the costs of financial distress as a fraction of firm value and equity value respectively.

$MC_{i,t}$ is defined as the share price of firm i at time t, $P_{i,t}$, multiplied with the number of shares outstanding, $n_{i,t}$. In *Bar-Or's* original model $E^{D}_{i,t}$ is derived by the following three phase procedure:

$$E^{D}_{i,t} = \sum_{t=1}^{n} \frac{Earn_t}{(1+r)^t} + \sum_{t=n+1}^{10} \frac{Earn_2(1+g)^{t-2}}{(1+r)^t} + \frac{Earn_2(1+g)^9}{(r-m)} \bullet \frac{1}{(1+r)^{10}} - CAPEX\_ADJUST - WC\_ADJUST \tag{3}$$

where $Earn_t$ is an IBES analyst forecast for the after interest and after tax earnings of firm i in year t, g is an IBES consensus forecast of five-year earnings growth, r is the cost of equity derived from a single factor CAPM, m is the terminal growth rate of earnings and n is the number of years for which yearly earnings forecasts are available.[51] $CAPEX\_ADJUST$ and WC_ADJUST are terms to adjust present value of earnings in order to get present value of the (free) cash flow to equity. In the first phase, *Bar-Or* discounts whatever the maximum number of available earnings forecasts (n) is, for each firm. In the second phase the earnings forecasts up to year 10 are projected, using a mid-term growth rate estimate by analysts. The third phase is the terminal value phase.

When calculating $E^{D}_{i,t}$ we deviate slightly from *Bar-Or's* original version in that we do not first discount the earnings and then adjust them using his proposed adjustment terms. Instead, we start directly by building the flow to equity and then discount it. This is for two reasons. First, in our view *Bar-Or* did not sufficiently explain his approach in calculating the adjustment terms for us to be able to replicate it.[52] Secondly, as data is

51 See *Bar-Or* (2000), p. 8.

52 See *Bar-Or* (2000), p. 9-10.

available for the conversion of earnings to a flow to equity, we propose to directly use it instead of later adjusting for an earnings-cash flow mismatch. We use the following formula:

$$E_{i,t}^{D} = \sum_{t=1}^{10} \frac{FtE_{i,t}}{(1+k^{f})^{t}} + \frac{\left(\frac{FtE_{i,11}}{k^{f}}\right)}{\left(1+k^{f}\right)^{10}} \quad (4),$$

where k^{f} is the cost of equity under partial debt financing[53] and $FtE_{i,t}$ the flow to equity of firm i in year t. Our valuation date is 1/1/1999 which corresponds to *t=0*. *Formula (4)* implies that the terminal growth rate (after year t=10) is 0 %. For the composition of $FtE_{i,t}$, we propose:

$$FtE_{i,t} = E_{i,t} - NI_{i,t} - \Delta NWC_{i,t} + \Delta P_{i,t} + \Delta Llt_{i,t} + \Delta Lmt_{i,t} \quad (5)$$

Here, $NI_{i,t}$ are the net-investments, $NWC_{i,t}$ is the net working capital, $P_{i,t}$ are the pension provisions, $Llt_{i,t}$ are the long term liabilities, $Lmt_{i,t}$ are the medium term liabilities and $E_{i,t}$ are the earnings, all of firm i in year t. The Δ indicates the annual change in the respective variable.

Similarly to *Bar-Or* we use IBES earnings per share estimates[54] – $EPSE_{i,t}^{IBES}$ - for the maximum number of years that they are available *k*, starting with year t=1 (1/1/2000).[55] We then project future EPS, - $EPSE_{i,t}^{P}$ -, up to year *t=11* (which is the first year of the terminal value phase) using an IBES estimated mid term 5-year growth rate g_i, applied to the last available explicit IBES estimate: $EPSE_{i,t=k+j}^{P} = EPSE_{i,t=k}^{IBES} \cdot (1+g_i)^{j}$. We use this growth rate until year t = 5. Between t = 6 and t = 10, we apply a fade factor that fades down the mid term growth rate. As a basic fade factor, we use 50 %. For a sensitivity analysis, we also employ fade factors of 25 % and 75 %. All the EPS estimates are then multiplied with the number of shares outstanding in *t=0* (1/1/1999) to obtain the earnings estimates.

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53 Again using a single factor CAPM with $k^{f} = i + (r_M - i)\beta$, where i is the risk free rate and r_M the expected return on the market portfolio.

54 Estimates of absolute corporate earnings were not available from IBES.

55 For a given firm, this maximum number of estimates is four: 1/1/2000, 1/1/2001, 1/1/2002 and 1/1/2003.

Concerning the prediction of each of the five adjustment terms in equation (5) from *t=1* to *t=11*, we proceed as follows: For *t = 1* to *t = 3* (i.e. 1/1/2000 to 1/1/2002) we take the actually realized variable values (which are known today, but were not known on our valuation date) as proxies for the analyst estimates. For *t = 4* we take the mean of the respective variable over the years *t = -2* to *t = 2*. Finally for *t = 4* to *t = 11* we linearly fade this mean towards 0, so that at the beginning of the terminal value phase $FtE_{i,t} = E_{i,t}$ holds.

4.2 The impact of leverage on FDC

Although not explicitly stated, one major hypothesis of *Bar-Or´s* approach is that expected costs of financial distress increase with increasing leverage.[56] In order to check this hypothesis *Bar-Or* carries out an "industry specific analysis": he divides his industry sub-samples into leverage quintiles and calculates average FDC values for every quintile in every industry sub-sample. In a second step he subtracts the average FDC value of the lowest quintile from the average FDC value of every other quintile. By choosing the lowest leverage quintile with costs of financial distress[57] close to zero as a benchmark, the author wants to cancel out all other possible deviations between calculated value and market price which are not systematically related to leverage und thus arrive at "point estimates of the expected financial distress cost for average firms within an industry and leverage range"[58]. These expected costs of financial distress are hypothesized to increase in leverage. Indeed for most of the industries in his sample, *Bar–Or* reports monotonotically increasing FDC values over the different leverage quintiles.[59] To further analyze the impact of leverage, he performs a regression analysis on the entire sample ("market wide-analysis") using the calculated FDC values as dependent variable and leverage as well as some additional control variables (R&D expenses, standard deviations of market and asset returns, size etc.) as independent variables. The coefficient estimate for the leverage variable is positive and statistically

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56 When presenting his results *Bar-Or* states that they "exactly fit the pattern hypothesized: expected distress costs increase in leverage". p. 37.

57 *Bar-Or* reports that zero levered firms are not availaible as benchmarks in several industries and thus chooses the lowest levered quintile as general benchmark. See pp. 37.

58 *Bar-Or* (2000), p 35.

59 See *Bar-Or* (2000) p. 36, table 5.2..

significant, thus again supporting the hypothesized relation between leverage and expected costs of financial distress.[60]

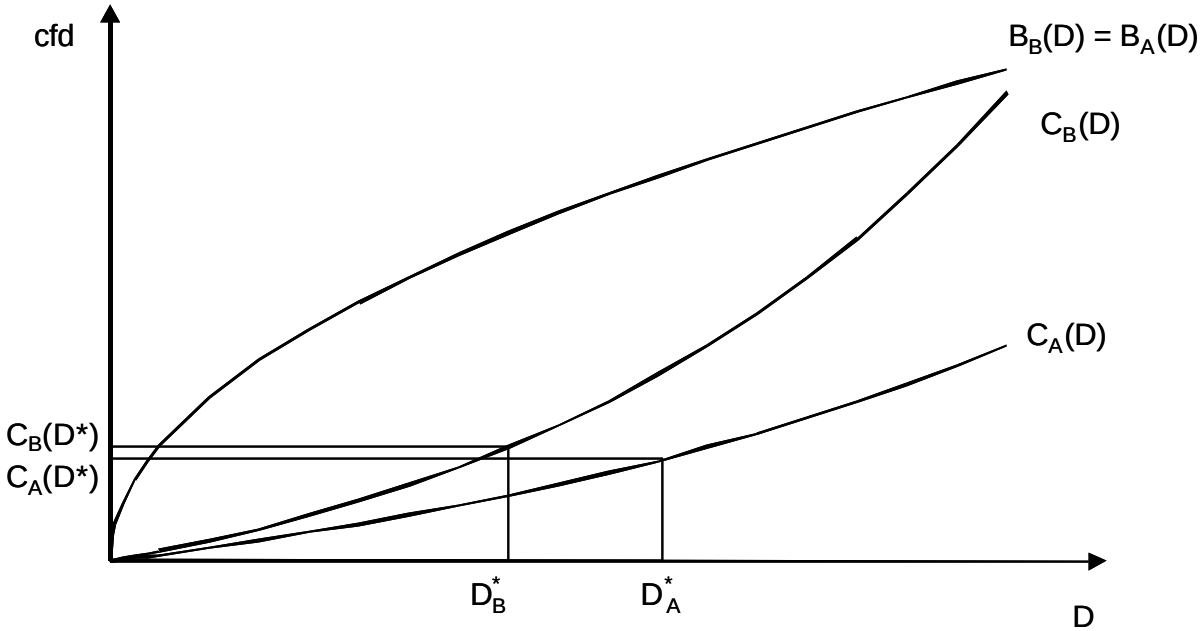
Taking the trade-off theory of optimal capital structure's point of view and looking at a single firm, *Bar-Or´s* major hypothesis seems to be obvious: In order to achieve an interior solution for the optimal capital structure, total costs of debt have to increase progressively at increasing leverage and at increasing absolute debt level. The optimal debt level is where marginal benefits of debt equal marginal costs. When looking at a cross section of different firm leverages however, the hypothesis becomes less obvious: As managers/owners of the firms choose their leverage by trading off benefits with costs of debt, the observed debt levels and leverages (should) reflect the *optimal* capital structure for these firms. Thus the precise hypothesis in this case should state that expected costs of financial distress *at optimal capital structures* are increasing in leverage. If different firms face different cost functions of debt, this modified hypothesis does not necessarily have to hold. To show this we first assume that the function of the benefits of debt is identical for different firms in the sample; under this assumption, differences in optimal debt level and in optimal leverage are solely caused by different costs of financial distress. If we assume that the costs of financial distress at debt level D, C(D), have the following properties

$$C'(D) > 0, \quad C''(D) > 0,$$

thus displaying progressive growth, and allow for different cost functions for the two firms A and B, $C_A(D)$ and $C_B(D)$, higher optimal debt level does not necessarily imply higher expected costs of financial distress at optimal debt level. The following graph gives an illustration:

60 See *Bar-Or* (2000) p. 48, table 5.5..

Graph I

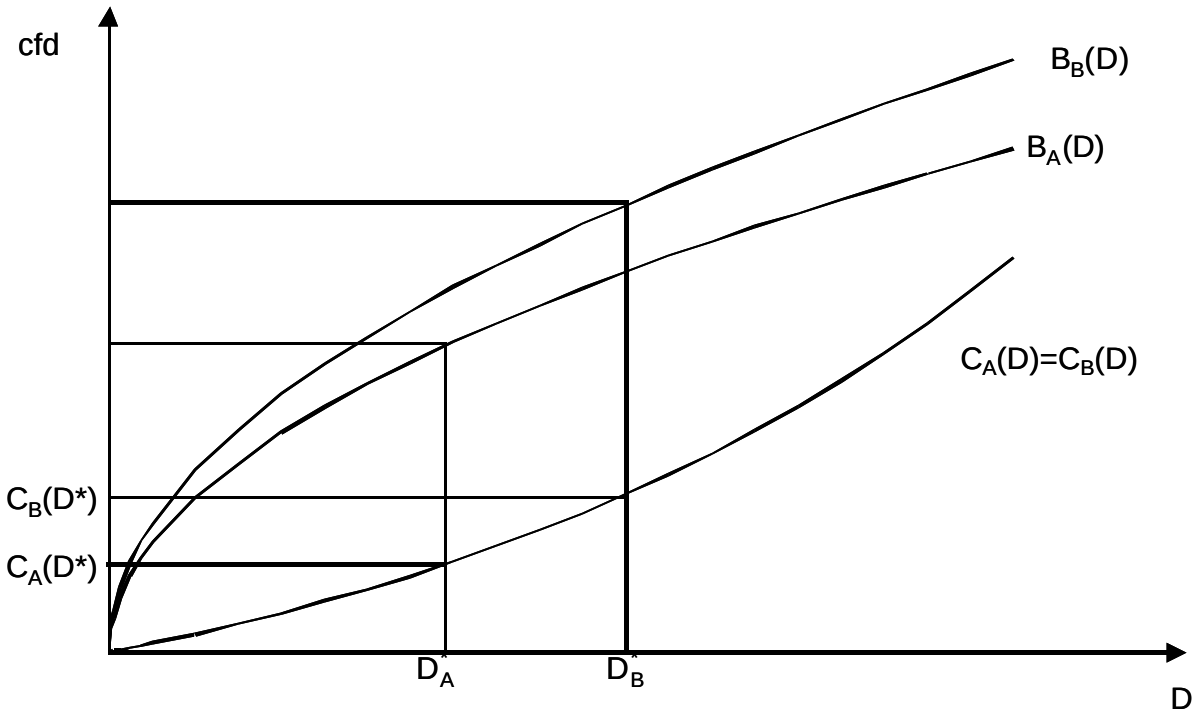


In this example $C''_B(D) > C''_A(D)$ holds and with identical benefits of debt, firm B's optimal debt level is lower than firm A's: $D_B^* < D_A^*$. But as costs of financial distress grow faster for firm B than for firm A when increasing D, the absolute amount of costs of financial distress at the optimal debt level may well be higher for firm B than for firm A despite the lower optimal debt level: $C_B(D^*) > C_A(D^*)$. If we denote the optimal leverage ratio L* by $L^* = \frac{D^*}{V(D^*)}$ (where $V(D^*)$ is the maximal firm value at optimal debt level D*), the situation just described may also imply the optimal leverage ratio of firm B to be smaller than the one of firm A despite B's higher costs of financial distress at optimal debt: $L_B^* = \frac{D_B^*}{V_B(D^*)} < L_A^* = \frac{D_A^*}{V_A(D^*)}$,.[61] Thus the validity of *Bar-*

61 Whether $D_B^* < D_A^*$ leads to $L_B^* < L_A^*$ also depends on the relation of the firm values at optimal debt levels: $L_B^* < L_A^*$ is equivalent to $\frac{D_B^*}{D_A^*} < \frac{V_B(D^*)}{V_A(D^*)}$. As $V(D^*)$ depends on the value of the firm under all equity financing V^E (and thus on a variable that is independent from debt and leverage ratio), differences in size between A and B may become important. For our purpose here it is sufficient to show that $C_B(D^*) > C_A(D^*)$ and $L_B^* < L_A^*$ is at least possible: For different firms with different cost functions of debt, costs of financial distress at optimal debt do not necessarily have to increase in optimal leverage ratios.

Or´s major hypothesis crucially depends on how realistic the implicit assumption of identical (or at least similar) cost functions of debt over different firms is for the sample under consideration. Whereas there are some arguments in favour of similar costs of financial distress within a single industry[62], for a firm sample over different industries it seems to be a rather strong assumption.

Graph II



Now let us consider the other polar case and assume the costs of financial distress to be identical over different firms and allow for different functions of the benefits of debt. Graph II shows the optimal amount of debt, the costs of financial distress and the benefits of debt at debt level D, B(D), where the benefits are assumed to have the following properties:

$$B'(D) > 0, \quad B''(D) < 0$$

As the cost function of debt is identical for both firms, *Bar-Or´s* modified hypothesis has to hold: Costs of financial distress of different firms are increasing with optimal debt levels. Thus the empirical test of this hypothesis may actually suffer from some "joint hypothesis" problem: *Bar-Or's* hypothesis states that the calculated FDC measure is a good proxy for expected costs of financial distress and that the costs of financial distress are similar over the different firms in the sample analyzed. Due to the reasons

62 One may for instance argue that asset specifity, intangible assets and growth opportunities are

discussed above the second part of the hypothesis may be dependent on the sample composition.

4.3 Data and results

We obtain all our data from the DATASTREAM database. We restrict our investigation on the DAX100 companies. Unfortunately the complete set of required data was available for only 49 of these firms.[63]

Table X reports the descriptive statistics for our financial distress cost estimates. The first three columns of Table X contain the FDC I measures whereas columns four to six contain the FDC II measures. It turns out that the mean and median financial distress costs for our whole sample are –when compared to *Bar-Or* (2000) – very high. The mean ex ante costs of financial distress (FCD I) are 28,64% - 33,83% of firm value, depending on the fade factor. The median ratio lies between 44,13% and 46,67%. As expected, a higher fade factor and therefore a more conservative DCF valuation leads to lower costs of financial distress.

Table X. Descriptive Statistics of FDC measures

FDC measure	I	I	I	II	II	II
Fade factor	75%	50%	25%	75%	50%	25%
Mean	0.2864	0.3045	0.3383	0.3643	0.3913	0.4384
Median	0.4413	0.4495	0.4667	0.5972	0.6068	0.6257
Std. Dev.	0.4073	0.3920	0.3682	0.6892	0.6543	0.5971
Obs.	46	46	46	46	46	46

Bar-Or also reports high "preliminary" costs of financial distress estimates for all firms of his sample of 20 % (mean) and 25 % (median) of the firm value at conservative growth assumptions.[64] After performing the industry-specific analysis and deducting the average FDC value of the lowest levered quintile (unlevered benchmark) from the average FDC values of each of the remaining four levered quintiles, his adjusted costs of financial distress for the highest levered quintile are still above 45% for certain

more or less homogenous in a given industry.

63 We further decided to exclude three extreme outliers: Firstly, Babcock has a book to market ratio below –1 whereas the median book to market ratio is about 0.28 for all other firms. Secondly, Krones has a book to market ratio of 8.8 and was also excluded as an outlier. Thirdly, SAP has calculated financial distress costs (FDC1) of more than –1,200% and an interest coverage ratio above 307. We additionally decided to exclude firms where we obtained a negative equity value $, E^{D}_{i,t}$.

We also run our analyses for the sample that includes the above outliers. Interestingly, inclusion of outliers leads to higher adjusted R^2 and mostly stable other coefficients.

industries.[65] For the average leverage firm in his sample, Bar-Or reports an FDC value of 8% of firm value.

Before interpreting our finding, we present the FDC estimates for different leverage quintiles; due to the low number of observations in our sample we were not able to perform this analysis for different industries separately. So our estimates refer to the entire sample of firms. Table XI shows the FDC I measure over the different leverage quintiles at a fade factor of 50%.

Table XI. Costs of Financial Distress according to leverage quantiles

Leverage quantile	0 - 20%	20 - 40%	40 - 60%	60 -80%	80 - 100%
Mean	-0.0884	0.3698	0.2222	0.4478	0.6146
Median	-0.0961	0.5200	0.2870	0.5819	0.6617
Obs.	10	9	9	9	9

Costs of financial distress in table XI rise almost monotonously with (optimal) leverage. In the lowest leverage quintile, FDC I estimates are negative and increase to over 60% of firm value in the highest leverage quintile. This result seems to support our joint hypothesis from above even for the inter-industry-sample: expected costs of financial distress seem to increase with higher optimal levels of debt over different firms.

Regarding our absolute FDC values, we have to admit that they seem to be much too high as estimates for the absolute costs of financial distress: even under conservative growth assumptions (75 % fade factor) we obtain a mean of 28.6 % of firm value and a median of 44 % as costs of financial distress over the entire sample. Table XI also shows that performing the same adjustment as proposed by *Bar-Or* (so called differencing methodology, i. e. subtracting the mean FDC of the lowest leverage quintile from the mean FDC of each of the four remaining levered quintiles) would yield even higher values for FDC as the mean of the lowest quintile is negative.

We try to assess the magnitude of this cost by relating our estimate to the average leverage ratio in our sample and thus approximate the costs in per cent of debt outstanding. Using the average leverage based on the calculated firm values at a 75 % fade factor[66], which is 27.9 %, this yields financial distress costs of $\frac{0.286}{0.279}$ = 102,5 % of

64 See *Bar-Or* (2000) p. 15.

65 See *Bar-Or* (2000) tables 5.2. and 5.3..

66 Note that the FDC-measure is also related to the calculated firm value and not to the market capitalization.

debt. Our estimates represent the average cost of financial distress for a an average level of debt. If the properties of the cost function of debt imply that marginal costs of financial distress are higher than average costs our numerical results would suggest that on average a firm would have marginal costs of debt up to substantially more than 100 % of debt at the optimal debt level. Comparing this number and the 28.6 % of firm value from above with the theoretical and empirical magnitude of debt related tax benefits[67] our estimate would mean that the sample firms are far beyond their optimal leverage. Consequently this part of our findings casts doubt either on the model´s ability to correctly quantify the absolute magnitude of costs of financial distress or on our input data.

In order to explore the second question we finally analyzed if *Bar-Or's* key assumption, that analysts do not consider costs of financial distress in their earnings estimates, holds for our sample. If the assumption is true, EPS estimates should be biased. Analogous to *Bar-Or*, we subtract the EPS estimates for *t=1* (1/1/2000) and *t=2* (1/1/2001) from the realized EPS of these years and divide the result into the realized earnings:

$$\frac{EPS_{i,t} - EPSE_{i,t}^{IBES}}{EPS_{i,t}} \tag{6}$$

Under the above assumption, this relative deviation should be negative and its absolute value should increase with rising leverage .[68] Our analysis fails to give a clearcut result: using the one year and the two year forward analyst estimates and measuring mean as well as median deviations, we obtain different signs. None of the specifications yields a result that is statistically different from zero. Thus we are not able to support the hypothesis with our limited dataset.

On the other hand, the results shown in Table XI seem to support the basic hypothesis about the relation between leverage and costs of financial distress at optimal debt levels: the calculated FDC values increase in leverage. To further analyze the linkage between leverage and our FDC estimates we first analyze the following simple regression equations for *FDC I* and FDC *II*:

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67 For US data *Graham* estimated average tax benefits of roughly 10 % of firm value. See e. g. *Graham* (2000) p. 1903.

68 See *Bar-Or* (2000), pp. 21.

$$FDC_{i,t=0}^{I-or-II} = \alpha + \beta \bullet LEV_{i,t=0} + \varepsilon \qquad (7)^{69}$$

$$FDC_{i,t=0}^{I-or-II} = \alpha + \beta \bullet \ln(LEV_{i,t=0}) + \varepsilon \qquad (8)\ ,$$

Table XII reports the results for the FDC I measure:

Table XII. Regression results for the simple Bar-Or regression model

Dependent Variable: FDC_1				
Method: Least Squares				
Sample(adjusted): 1 49				
Included observations: 49 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.093695	0.274736	-0.341038	0.7346
LEV	0.910292	0.415192	2.192460	0.0333
R-squared	0.172765	Adjusted R-squared		0.155164

Dependent Variable: FDC_1				
Method: Least Squares				
Sample(adjusted): 1 49				
Included observations: 49 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.744009	0.166935	4.456872	0.0001
LOG(LEV)	0.435813	0.252545	1.725684	0.0910
R-squared	0.260050	Adjusted R-squared		0.244307

Regression coefficients of the leverage variable are positive and statistically significant at the 5 % and 10 % confidence level; with adjusted R^2 of 15.5 % and 24.4 % respectively, the explanatory power of the model also seems to support the above hypothesis.

We may use the results of this analysis to provide an additional estimate for the costs of financial distress for the average leverage firm in our sample. Substituting the average leverage of 0.279 into the first regression equation gives us a predicted FDC I-value: $FDC = 0.0937 + 0.9103 * 0.279 = 16\%$. This estimate is substantially higher than the estimate for the average leverage of 8% reported by *Bar-Or*.[70] Again relating this cost

69 *Bar-Or* proposes the same specification on his page 54, but he uses his net FDC measure derived from subtracting the mean FDC of the lowest leverage quintile in each industry from each individual FDC value in the same industry.

70 Unfortunately we were not able to reconstruct this result from the data published by *Bar-Or*. See *Bar-Or* (2000) p. 38.

to the amount of debt yields a cost estimate of $\frac{0.16}{0.279} = 57.44\%$ and thus confirms our above concerns of a too high FDC-estimate.

Finally we analyze whether our FDC estimates are affected by additional variables which should have an impact on costs of financial distress according to financial theory. Analogous to *Bar-Or* we regress our FDC measure on leverage, the ratio of R&D expenditures to sales, a proxy for earnings growth, two volatility proxies – one for the volatility of returns and the other for the volatility of operating earnings – a proxy for firm size and a proxy for the complexity of the capital structure. Again we expect coefficients of the leverage variables to be significantly positive. Firms with high R&D expenditures relative to sales are companies with specialized products which should experience higher costs of financial distress. We also expect higher costs of financial distress for firms with high earnings growth since a large fraction of their value consists of future earnings which could be lost in distress. Our hypotheses for the two volatility proxies are not that clearcut: On the one hand higher volatility could result in higher costs of financial distress due to a higher distress probability, but on the other hand it could also increase the value of the equity as a call option on the assets.[71] For the impact of size upon costs of financial distress *Bar-Or* also offers two different hypotheses: Large firms on the one hand should not be as vulnerable to distress as smaller firms, but small firms on the other hand might exhibit higher earnings volatility and therefore higher equity option values. Finally, for firms with complex capital structures (i.e. with a high number of different debt classes), he hypothesizes high costs of financial distress, as these firms will spend more time in distress while creditors renegotiate.[72] In this paper we specify the following regression model:

$$\begin{Bmatrix} FDC^{I}_{i,t=0} \\ \text{or} \\ FDC^{II}_{i,t=0} \end{Bmatrix} = \alpha + \beta_1 LEV_{i,t=0} + \beta_2 VOL\_RET_{i,t=0} + \beta_3 VOL\_RoA_{i,t=0} + \beta_4 \begin{Bmatrix} ASS_{i,t=0} \\ \text{or} \\ SALES_{i,t=0} \end{Bmatrix} + \beta_5 ICOV_{i,t=0} + \beta_6 BTM_{i,t=0} + \varepsilon \tag{9}$$

71 *Bar-Or* argues that his FDC measure cannot be isolated from this option value and should therefore be interpreted as *"net effect of expected distress costs and that option value"*. *Bar-Or*(2000), p. 20.

72 See *Bar-Or* (2000), pp. 43.

Here, $LEV_{i,t=0}$ is the leverage of firm i at the valuation date *t=0*, defined as $LEV_{i,t=0} = \frac{L_{i,t=0}}{(L_{i,t=0} + MC_{i,t=0})}$.[73] We expect $\beta_1 > 0$. $VOL\_RET_{i,t=0}$ and $VOL\_RoA_{i,t=0}$ are the standard deviations of the monthly stock return and on the return on assets[74] respectively. We will not hypothesize on the signs of β_2 and β_3. $ASS_{i,t=0}$ and $SALES_{i,t=0}$ are alternatively used as proxies for firm size, where the former represents total assets and the later total sales of firm *i* in *t=0*. Here, too, the coefficient sign could be positive or negative. $ICOV_{i,t=0}$ denotes the interest coverage before taxes and $BTM_{i,t=0}$ is the book value per share divided by the share price. We expect $\beta_5 < 0$ as a higher coverage of interest expenses with operative earnings should lower expected costs of financial distress. At last, we hypothesize $\beta_6 < 0$ because a low book to market ratio is typical for high growth potential or intangible assets which again points to high expected costs of financial distress.[75]

Table XIII shows our results:

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73 Our leverage definition therefore slightly deviates from *Bar-Or* (who uses only long-term debt. However, when using *Bar-Or's* leverage definition, our results do not materially change.

74 Returns are measured for each firm i from 1997-2002. As RoA can only be calculated annually, we only have a very limited number of observations for the calculation of the standard deviation. The $VOL\_RoA_{i,t=0}$ variable should thus be interpreted with caution.

75 See e.g. *John* (1993), pp. 91.

Table XIII. Regression results for adapted Bar-Or (2000) regression model

Regression model as specified in equation (9). [76]

FDC I and FDC II are dependent variables measuring costs of financial distress as a percentage of firm value and equity value respectively. Fade factors apply to the mid-term growth rate in the underlying valuation model. LEV is a total liabilities to total assets. VOL_RET is defined as standard deviation of monthly stock returns. VOL_ROA is the standard deviation of return on assets. ASS is total assets. ICOV is defined as cash flow over interest charges. BTM is book value per share divided by share price. Also, the *t-statistic* of the *t*-test of equality of the coefficients to zero is reported.

Results for Ordinary Least Squares Regressions						
FDC measures and fade factors	Dependent Variables					
	75%		50%		25%	
	FDC I	FDC II	FDC I	FDC II	FDC I	FDC II
Independent Variables						
Intercept	**0.144769**	**0.393515**	**0.179967**	**0.405181**	**0.245524**	**0.433555**
t-stat	*0.435327*	*0.563721*	*0.556077*	*0.613505*	*0.794456*	*0.72747*
LEV	**0.801375*** **	**1.48928*** **	**0.744052*** **	**1.401119*** **	**0.644532*** **	**1.252269*** **
t-stat	*4.006556*	*5.001821*	*3.922168*	*4.937743*	*3.525599*	*4.709567*
VOL_RET	**-1.884754**	**-6.22842**	**-1.791971**	**-5.801203**	**-1.655331**	**-5.090873**
t-stat	*-0.622438*	*-0.868708*	*-0.604031*	*-0.853372*	*-0.577186*	*-0.827913*
VOL_ROA	**4.461144**	**9.2769***	**4.452574***	**8.968943***	**4.434047***	**8.425102***
t-stat	*1.612609*	*1.708108*	*1.65081*	*1.74233*	*1.7145*	*1.805392*
ASS	**1.60E-12**	**4.29E-12**	**1.40E-12**	**3.85E-12**	**1.06E-12**	**3.16E-12**
t-stat	*0.916953*	*1.394303*	*0.792181*	*1.304026*	*0.584725*	*1.144824*
ICOV	**-0.031565*** **	**-0.044972*** **	**-0.031458*** **	**-0.043801*** **	**-0.030946*** **	**-0.041492*** **
t-stat	*-3.036399*	*-2.683941*	*-3.111117*	*-2.7223*	*-3.120255*	*-2.740883*
BTM	**0.024225**	**-0.39281**	**-3.111117**	**-2.7223**	**0.052569**	**-0.24302**
t-stat	*0.097307*	*-0.807109*	*0.156517*	*-0.720229*	*0.251009*	*-0.599527*
adj. R^2	0.411075	0.4099	0.405983	0.412544	0.385224	0.412713
incl obs	46	46	46	46	46	46
other	White estim.	White estim.	White estim.	White estim.	White estim.	White estim.

In all our regressions, the coefficient of the leverage variable is positive and significant at the 1 % level. At the same time, the interest coverage ratio has – as expected – a significantly (5 % level) negative impact on financial distress costs. Volatility of return on assets is positive and significant (10 % level) in most regressions while the other variables are insignificant. The adjusted R^2 is about 40 % across all regressions.

Our findings therefore resemble the results of *Bar-Or*, especially concerning the impact of leverage on costs of financial distress. Moreover, the regression results are stable

76 * significant at the 10 % confidence level.
** significant at the 5 % confidence level.
** significant at the 1 % confidence level.

with respect to changes in the fade factor. Without reporting, we additionally included cash and marketable securities divided by assets as independent variables. As leverage is defined as gross debt, we would expect firms with more cash on hand to have lower ex ante costs of financial distress. Although our cash coefficient is negative in most regressions, it is always statistically insignificant. We therefore do not report the results of these additional regressions in detail.

5 Conclusions

The major goal of this paper was to estimate ex post and ex ante costs of financial distress for German firms and to compare these estimates with the ones obtained from US studies. Indeed we get substantially different results when applying the *Opler/Titman* (1994) and the *Bar-Or* (2000) research design on our databases:

- Using the *Opler/Titman* approach to analyze ex post costs of financial distress we are unable to document any interaction effect between economic distress and high leverage. On the contrary, our results even suggest that highly levered firms outperform their lower levered competitors in industry downturns. As we rely on industry adjusted revenues as a performance measure[77] (i.e. before any cost savings are incorporated), the possible argument that financial distress increases managements bargaining power versus other stakeholders may not convincingly serve as an explanation here. Consequently, further research is needed to analyze the following questions regarding possibles sources of indirect costs of financial distress:
  - Comparing German and US firms, are there differences in customer loyalty and potentially thus in customer-driven sales losses during a financial distress ?
  - Are there differences in firm competitiveness on product markets which may account for different competitor driven sales losses between German and US firms?

  The question related to the third possible source of revenue losses may be answered at least in part by looking at the results of our study: Our findings do not suggest that managers of highly levered firms respond to industry downturns by aggressively lowering prices in order to gain additional market share without

77 As reported above our stock return based and Ebit-growth based models lack explanatory power.

looking at margins.[78] If this were the case, we would have observed a negative interaction dummy in our Ebit based model.

Finally we refer to the standard excuse for German empirical researchers: Our database is much smaller than *Opler/Titman's*. They have up to fourteen different industries in distress per year whereas our study has to rely at the maximum on four distressed industries (1993, DD5); in all other years with distressed industries, there is only one such industry available. So the differences in our results may in part also be explained by the fact that our sample has to rely on different industries in distress with different indirect costs of distress due to asset specifity, losses in customers etc.[79] Different points in time when the industry downturn occurred may also account for the differences. Although some of our results are in line with those of *Opler/Titman´s* (1994) study, we finally have to stress that the explanatory power of our model is substantially lower.

- Concerning ex-ante costs of financial distress, we also obtain substantially different results than our reference study *Bar-Or* (2000). Our estimates for these costs are higher than the ones reported in his study; the magnitude of our estimates (28.6 % mean; 44 % median) raises doubts on the model's ability to correctly quantify expected costs of financial distress for our sample: According to our estimates the sample firms face average financial distress costs of 28.6 % of their firm value. Using a simple regression analysis we estimate the costs of financial distress for the firm with the average leverage in our sample to be around 16 %. When searching for explanations for these results and for the differences to *Bar-Or's* estimates (20 % "preliminary" average costs of financial distress, 8 % costs for the average leverage firm), one has to note that we only have a comparably small sample containing 49 firms. Furthermore, one might point out the differences in capital market development between Germany and the US: as analyst coverage is substantially lower for German stocks than for comparable US stocks, analysts´ earnings and growth rate estimates used in our German study may be subject to a higher degree of uncertainty than the ones used by *Bar-Or*. Thus the firm values derived from these estimates and subsequently our FDC values might be affected by this phenomenon.

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78 *Opler/Titman* introduce this manager-driven factor in order to explain sales *reductions* as managements´ response to financial distress. See *Opler/Titman* (1994) p. 1016.

79 *Opler/Titman* do not report which industry is in distress. *Opler/Titman* (1994) p. 1023, table II.

On the other hand the basic hypothesis concerning the impact of leverage on expected costs of financial distress could be supported for our sample. In any of several different specifications the influence of leverage on our FDC measure was positive and statistically significant.

References

Albrecht, J./Baetge, J./Jerschensky, A/Roeder, K. (1999) Risikomanagement auf der Basis von Insolvenzwahrscheinlichkeiten, DBa, 494 – 499.

Altman, E. I. (1984): A Further Empirical Investigation of the Bankruptcy Cost Question, in: Journal of Finance, Vol. 39, No. 4, 1984, pp. 1067 – 1089.

Andrade, G./Kaplan, S. N. (1998): How Costly is Financial (Not Economic) Distress? (Evidence from Highly Leveraged Transactions that Became Distressed), in: Journal of Finance 1998, Vol. 53, No. 5, 1998, pp. 1443 – 1493.

Ang, J. S./Chua, J. H./McConnell, J. J. (1982): The Administrative Costs of Corporate Bankcruptcy: A Note, in: Journal of Finance, Vol. 37, No. 1, 1982, pp. 219 – 226.

Baetge, J. (1980) Die Früherkennung negativer Entwicklungen der zu prüfenden Unternehmen mit Hilfe von Kennzahlen, Wpg. Vol. 33, 651 – 665.

Baetge, J. (2002) Die Früherkennung von Unternehmenskrisen anhand von Abschlusskennzahlen, BB Vol. 55, 2281 - 2287

Bar-Or, Y. D. (2000): An Investigation of Expected Financial Distress Costs, unpublished dissertation, Wharton 2000.

Betker, B. L. (1997): The Administrative Costs of Debt Restructurings: Some Recent Evidence, in: Financial Management, Vol. 26, No. 4, 1997, pp. 56 – 68.

Bhagat, S./Brickley, J. A./Coles, J.L (1994): The Costs of Inefficient Bargaining and Financial Distress (Evidence from Corporate Lawsuits), in: Journal of Financial Economics, Vol. 35, 1994, pp. 221 – 247.

Bolton, P./Scharfstein, D. (1990) A Theory of Predation based on Agency Problems in financial Contracting, AER Vol. 80, 93 – 106

Bradley, M./Jarrell, G./Kim, E. (1984) On the Existence of an Optimal Capital Structure: Theory and Evidence, JoF, Vol 39 , pp. 857 - 878

Bronars, S./Deere D. (1991) The Threat of Unionization, the Use of Debt and the Preservation of Shareholder Wealth, QJoE Vol. 106 pp. 231 – 254.

Campbell, S. V. (1997): An Investigation of the Direct Costs of Bankruptcy Reorganization for Closely Held Firms, in Journal of Small Business Management, Vol. 35, No. 3, 1997, pp. 21 – 29.

Campello, M. (2003) Capital Structure and Product Markets Interactions: Evidence from Business Cycles, in JoFE Vol. 68, pp. 353 – 378.

Chen, A. H. (1979): A Theory of Corporate Bankrupcty and Optimal Capital Structure, in: *Bicksler, J. L.* (ed.): Handbook of Financial Economics, Amsterdam et al. 1981, pp. 275 – 291.

Chen, G. M./Merville L. J. (1999): An Analysis of the Underreported Magnitude of the Total Indirect Costs of Financial Distress, in: Review of Quantitative Finance and Accounting, Vol. 13, 1999, pp. 277 – 293.

Cuttler, D. M./Summers, L. H. (1988): The Costs of Conflict Resolution and Financial Distress: Evidence from the Texaco-Pennzoil Litigation, in: RAND Journal of Economics, Vol. 19, No. 2, 1988, pp. 157 – 172.

Dasgupta, S./Sengupta, K. (1993) Sunk Investment, Bargaining and Choice of Capital Structure, IER Vol. 34, 203 – 220.

Denis, D./McConnell, J. (2003) International Corporate Governance, JoFQA Vol. 38, pp. 1 – 36.

Drukarczyk, J. (1991) Secured Debt, Bankruptcy and the Creditors Bargain Model, International Review of Law and Economics, Vol. 11 No. 2, pp. 203 – 221.

Drukarczyk, J./Schmidt, H./Schüler, A./Honold, D. (1997): Corporate Governance in Germany, Baden-Baden 1997.

Feidicker, M. (1993) Kreditwürdigkeitsprüfung – Entwicklung eines Bonitätsindikators, Düsseldorf

Fudenberg, D./Tirole, J. (1986) A “signal-jamming” Theory of Predation, Rand JoE Vol 17, 366 – 376.

Gebhardt, G. (1980) Insolvenzprognosen aus aktienrechtlichen Jahresabschlüssen, Wiesbaden.

Gessner, V./Rhode, B./Strate, M./Ziegert, S. (1978) Die Praxis der Konkursabwicklung in der Bundesrepublik Deutschland, Bundesministerium der Justiz (Hrsg.), Köln

Graham, J. (2000) How big are the Tax Benefits of Debt?, JoF Vol. 55, 1901 - 1941

Jensen, M. (1989) The Eclipse of the Public Corporation, HBR Vol. 5, 61 – 74.

John, A. (1993) Accounting Measures of Corporate Liquidity, Leverage and Costs of Financial Distress, FM Vol. 22, 91 – 102.

Kahl, M. (2002) Economic Distress, Financial Distress and Dynamic Liquidation, Journal of Finance, Vol. 57, No. 1, pp. 135 - 168

Kim, E. H. (1978): A Mean-Variance Theory of Optimal Capital Structure and Corporate Debt Capacity, in: Journal of Finance, 1978, pp. 45 – 63.

Kraus, A./Litzenberger, R. H. (1973): A State-Preference Model of Optimal Financial Leverage, in: Journal of Finance, Vol. 28, No. 4, 1973, pp. 911 – 922.

Morris, J. (1982) Taxes, Bankruptcy Costs and the Existence of an Optimal Capital Structure, Journal of Financial Research Vol. 5 Nr. 3, pp. 285 – 299.

Opler, T. C./Titman, S. (1994): Financial Distress and Corporate Performance, in: Journal of Finance, Vol. 49, No. 3, 1994, pp. 1015 – 1040.

Philosophov, L. V./Philosophov, V. L. (2002): Corporate Bankruptcy Prognosis: An Attempt at a Combined Prediction of the Bankruptcy Event and Time Interval of Its Occurrence, Working Paper, Moscow Committee of Bankruptcy Affairs 2002.

Pulvino, T. (1998) Do Asset Fire Sales Exist?: An empirical Investigation of commercial Aircraft Transactions, JoF Vol. 53, pp. 939 – 978.

Rajan, R./Zingales, L. (1995) What do we know about Capital Structure?. JoF Vol. 50, pp. 1421 – 1460.

Shleifer, A./Vishny, R. (1992) Liquidation Values and Debt Capacity: a Market Equilibrium Approach, JoF Vol. 47, 1343 – 1366

Shumway, T. (2001): Forecasting Bankruptcy More Accurately: A Simple Hazard Model, in: Journal of Business, Vol. 74, Iss. 1, 2001, pp. 101 – 124.

Titman, S./Tsyplakov, S. (2002) A dynamic Model of Optomal Capital Structure, Working Paper, McCombs School of Business

Warner, J. B. (1977): Bankruptcy Costs: Some Evidence, in: Journal of Finance, Vol. 32, No. 2, 1977, pp. 337 – 348.

Weiss, L. A. (1990): Bankruptcy Resolution (Direct Costs and Violation of Priority Claims), in: Journal of Financial Economics, Vol. 27, 1990, pp. 285 – 314.

White, M. (1989) The Corporate Bankruptcy Decision, JoEP Vol. 3, 121 – 151.

Zur Linden, E. (1975) Konkursrisiko und optimale Kapitalstruktur: ein wahrscheinlichkeitstheoretisches Modell, Diss. Mannheim