# When is Bankruptcy Threat Bad News? Risk and Return Analysis of Firms Announcing Bankruptcy in the US and Germany

*Draft, August 2008*


**Abstract**

This empirical study analyzes the value destruction in US and German firms prior and around their bankruptcy announcement and makes a matched sample comparison between the two bankruptcy codes. The dataset consists of 1160 US and 116 German firms, having filed for bankruptcy between 1999 and 2007. Different market and balance sheet based data are used to explain the divergent stock reaction around the bankruptcy announcement. The event study, regression results, and the matched sample comparison show that equity holders do not necessarily fare better under a debtor friendly procedure. Not only do they suffer more often from bankruptcy announcements, but they also lose more and accumulate these losses faster than their German counterparts. Importantly, the results suggest larger value destruction in the USA due to agency and bankruptcy costs.



Keywords: Bankruptcy, Bankruptcy Announcements, Bankruptcy Law, Default Risk, International Comparison

JEL Classification: G33, G38

# 1 Introduction

One often reads that the need of a state imposed bankruptcy code bases on the assumption that frictions in the market preclude efficient recontracting of distressed firms (Davydenko and Franks, 2004). Acharya, Sundaram, and John (2006) show that debtor friendly bankruptcy codes may result in inefficient going-concerns, while creditor friendly procedures result in inefficient liquidations. An economically efficient bankruptcy code should in contrast preserve good firms and liquidate bad firms by minimizing the costs and the distortions in the ex ante behavior of the stakeholders (Gilson, 1995). The question, which insolvency code is better, has thus been an active area of study. Franks, Nyborg, and Torous (1996) compare the US code with that of Germany and the UK. White (1996) and Kaiser (1996) study Britain, France, Germany and the UK, and LoPucki and Triantis (1994) and Packer and Ryser (1992) study the US and Canadian and the Japanese procedures respectively. The topic has grown even more important with the acceptance of the new EU members and the process of harmonization of the different insolvency codes. Of interest are generally the costs of financial distress, the size of creditors' recovery rates, the possibility of super priority financing, the type of firm management during reorganization, and the violation of the absolute priority rule.

This article complements the above mentioned literature by focusing on the explanation of the abnormal returns around the insolvency announcement for 1160 US and 116 German firms between 1999 and 2007.[1] In the first step, an event study is performed to measure and analyze the evolvement of the abnormal returns for different time frames around bankruptcy. In the second step, the magnitude of these returns is explained in a multivariate analysis separately for each country. In order to enable an unbiased comparison between Germany and the US, a matched sample for both countries is discussed throughout the analysis. The resulting empirical evidence shows that there are considerable differences between Germany and the USA and suggest that a debtor friendly bankruptcy code such as the one in the USA may not be that preferable for shareholders after all.

There have been two studies, which use a similar methodology. Armstrong and Riddick (2000) gather a sample of 278 bankrupt firms from 6 of the G7 Countries and compare their stock behavior starting three years before the bankruptcy announcement. They find that the abnormal returns of countries with similar bankruptcy law evolve similarly. Gutierrez, Ollala, and Olmo (2005) look at a sample of 248 firm from the UK, Germany, France, and Spain and try to explain inter country difference in the stock behavior prior to bankruptcy based on country specific dummy variables reflecting the orientation of the financial system, the credit friendliness of the bankruptcy law, and the efficiency of the legal system.

The following empirical study goes further in several respects. First, it gives economic and firm specific reasons for the long term and short term behavior of the stock of bankrupt firms prior and around the announcement. Second, it compares the German and the US bankruptcy codes both by analyzing the evolvement of the abnormal returns as well as by performing separate multivariate regressions explaining the magnitude of those returns for each country.

[1] The abnormal return of a stock is measured as the difference between the realized return and the expected return for a given period, typically a trading day. Section 3 offers a discussion on how to measure the expected return and how to cumulate the abnormal returns for a given time frame.

Third, having a much larger sample of bankrupt firms allows for an unbiased matched sample comparison between Germany and the USA.

The main finding is that shareholders do not necessarily fare better under Chapter 11. It is in contrast to the general expectations, as the US bankruptcy code is more debtors friendly and gives more chances for survival than Insolvenzordnung (Franks, Nyborg and Torous, 1996). That is why it is being entered much more frequently by debt holders (e.g. Povel, 1999).[2] And true enough; on the first glance this seems to be the case. A descriptive analysis of both samples confirms that there are considerably more bankruptcies in the USA and that the emergence rate is almost three times as high. However, a detailed analysis of the abnormal returns shows that US firms not only lose more value in the year prior to default (-91% compared to - 77% in the matched sample), but they also accumulate these losses at a much faster pace. This shows that not only are shareholders in the US not compensated for the more frequent bankruptcy announcements by a lower loss on their stock, but they also lose hope much faster that their company will recover from financial distress in the year prior to the announcement.

This result is not unexpected if one considers the findings of the current literature. Bebchuk (2002) shows for instance that deviations from the absolute priority rule [APR], a major distinction between the debtor friendly US and creditor friendly German bankruptcy codes, aggravates ex ante risk shifting with the effect that equity holders bear the agency costs. He makes therefore a considerable departure from the prior literature advocating the positive ex ante effect of the deviations from APR (Povel, 1999; Berkovitch and Israel, 1999). Another reason can be found in Brunner and Krahnen (2008). They argue that under creditor friendly bankruptcy codes there is a better coordination among banks, which makes pre bankruptcy workouts more probable. Both results suggest that equity holders in Germany will not hold the event of bankruptcy for as probable as in the USA, because the projects of the distressed firms will be on average relatively less risky and there will be a higher probability of an out of court solution.

In the second step, the magnitude of the abnormal returns is explained using a multivariate analysis for each country separately. In order to test the main hypothesis that the nature of the abnormal returns is different, multivariate tests are performed for the combined matched sample of German and US firms. Additionally, a nonparametric test for the matched sample is performed as a robustness check. It is astonishing to see that there is much more order in the US case. There are more significant market and balance sheet based coefficients that explain not only the long term loss in the 261 event window, but also the loss in centered 21 and 7 days around bankruptcy.

The variable of greatest interest for this analysis is the probability of default measured using the Black-Scholes-Merton [BSM] model. The main hypothesis is that the probability of default has a twofold effect on the equity returns of a firm. First, there is an immediate effect in the sense that an efficient market punishes companies threatened by default with a higher discount from the market price. Hence, there will be less value left to destroy. Second, there is the long term effect of the direct and indirect bankruptcy and agency costs that are actually

[2] Claessens and Klapper (2005) show that relative to the companies in the economy there are almost 3.5 more bankruptcy announcements in the US than in Germany.

incurred around the event of bankruptcy and thereby reduce the value further. To see that both effects are consistent with rational expectations, note that when calculating the return of a bankrupt firm, the probability of default and the costs associated with it are present both in the numerator as well as the denominator. It is an easy exercise to show that depending on the magnitude of these costs, the probability of default may have either a positive or a negative effect on the equity returns. Therefore, by analyzing the probability of default and including it in the analysis of the stock returns of bankrupt firms, one may gain an insight into the importance of these costs for each country. This insight has importance for the borrowing and lending decisions of international firms and contributes to the discussion whether bankruptcy risk is a systematic risk (Dichev, 1998; Vassalou and Xing, 2004).

Additionally, tests have been performed to show that the BSM-model is a good way to measure the probability of default. Their results show that it is more difficult to tell a bankrupt firm in Germany one year before the bankruptcy announcement than it is in the US. This is in line with the argument above that bankruptcy is a more common event in the USA, but as such it may also lead to more troubles for shareholders: one year prior to the event bankrupt firms in the US look considerably worse than their German counterparts.

The paper continues as follows: Section 2 gives a short theoretical background of what is being done in the empirical part. It starts with a discussion of the differences between the German and the US bankruptcy codes, as they remain in the center of attention for the whole study and then presents the main hypotheses. The data and methodology, the magnitude and evolvement of the abnormal returns are presented in section 3. Section 4 starts with a descriptive overview of key balance sheet and market based ratios, determines the best measure for the probability of default, and finishes with the multivariate analysis. Section 5 concludes.

# 2 The Economics of Bankruptcy

## 2.1 Key features and differences of the US and German bankruptcy codes

The two major bankruptcy procedures in the US are Chapter 7 and Chapter 11. Chapter 7 is the liquidation provision under which a trustee is appointed by court to oversee the liquidation of the company, and Chapter 11 allows the firm to remain in operation by giving at the same time substantial rights to the directors to propose a reorganization plan. As the majority of the used sample has filed under Chapter 11, it will remain in the focus of the following discussion.

In 1994 an important change was made in the German bankruptcy code. The former distinction between Konkursordnung and Vergleichsordnung was abolished and a new uniform insolvency code was introduced. The aim of the reform is to improve the efficiency of the bankruptcy procedure in Germany. This step was needed for it is well documented that the declaration of insolvency meant almost certain death under the old codex. Franks, Nyborg, and Torous (1996) find that due to the comparatively large amount of secured claims in Germany most German firms were liquidated even before the bankruptcy proceedings were

opened. Landfermann (1994) and Breuer (2003) show that more than 70% of the bankruptcy petitions were rejected, because the value of the assets left in the firm could not cover the legal costs.

The new legal framework, Insolvenzordnung, became effective as of 1. January 1999 and has two important implications: preferred creditors do not exist and there is an automatic stay on all claims for three months after the bankruptcy announcement. In this way the former dominant position of the creditors is considerably weakened and the firms should be presented with a better chance of survival.[3] Despite the reform there are still considerable differences between Chapter 11 and Insolvenzordnung. In the following it is discussed how this differences are expected to affect the behavior of the abnormal returns around bankruptcy.

The **"**debtor in possession" position of the management in the US is the first crucial difference to Germany. Despite the possibility of a debtor remaining in possession under Insolvenzordnung, in the vast majority of cases the control rights of the firm go over to an administrator designated by the creditors or the court.[4] Hence, there is little doubt that the incentive of a German manager to file is small, since it is connected with losing control and most importantly their job (Armstrong and Riddick, 2003; Franks, Nyborg, and Torous, 1996). In the US on the other hand, in 50% of the cases the existing management remains in control and in the majority of the remaining cases, new management is appointed by the shareholders (Gilson, 1989). Thus, the executives of the firm can look at the decision to file as a strategic move as described by Franks and Torous (1989), and Giammarino (1989). This difference is aggravated by the fact that unlike Chapter 11 the German codex requires a specific reason for declaring insolvency, which further makes strategic default unlikely.[5]

The practice to break the Absolute Priority in the US is another wedge between the two procedures. Many studies have been dedicated to the efficiency of this practice. Baird (1991), Povel (1999), and Berkovitch and Israel (1999) show that the violation of the AP rule improves the managements' ex ante decisions in terms of filing at the right time and in terms of dealing with underinvestment (White, 1989 and Gertner and Scharfstein 1991). However, Franks, Nyborg, and Torous (1996) note that it may be preferable for the bankruptcy process to discourage recontracting and minimize the deviations from absolute priority. This is explained by the fact that the market participants anticipate a possible recontracting and this influences both their borrowing and lending as well as their investing decisions. It may also induce overinvestment under Chapter 11, because due to their limited liability the debtors may receive part of the benefits of the investment without bearing all the costs. They are further

[3] The most prominent example for the success of the new insolvency code is Herlitz. The company filed for bankruptcy in 2002 under the new code and successfully restructured itself only seven months after the bankruptcy announcement.

[4] According to Statistisches Bundesamt, a "debtor in possession" (Eigenverwaltung) has been allowed in only in 0.6% of the bankruptcy cases since 1999.

[5] This could be over-indebtedness, insolvency, and imminent insolvency (§16 in connection with §§17-19 InsO). The latter option is part of the new reform and gives both the owners and the creditors the right, but not the obligation, to file for bankruptcy if existing, not necessary due yet payment obligations are going to fail with predominant probability. Such a criterion is expected to raise the incentives of the management to go sooner for the protection of the insolvency law which, as White (1996) points out, improves the probability of survival. There can be considerable doubt however whether a bankruptcy petition by the less informed creditors has a positive effect on the efficiency of the code. This view supported by Armstrong and Riddick (2003) is naturally connected with the management's resistance against the decision to file.

able to extract residual cash flow and private benefits in the case of continuation, which is obviously not possible under liquidation (Bebchuk, 2002). As these arguments rely on the idea of strategic bankruptcy filing, they are only strengthened by the above mentioned differences. It can therefore be expected that if the latter strain in the literature is correct, debtor friendly bankruptcy procedures may have negative ex ante effects on the risk taking behavior. This will lead to higher agency costs, which are eventually born by the equity holders and will be reflected in greater losses prior to the announcement. The effect would be reversed if debtor friendly bankruptcy codes reduced agency costs.

Furthermore it may be questionable whether the newly introduced automatic stay on all creditor claims for three months in Germany together with a more realistic chance to offer a restructuring plan is enough of a resemblance to Chapter 11. On the one hand, it gives the administrator a much broader scope of action and much more time to restructure the firm. As Kaiser (1996) points out, the criticism of the previous code was mainly turned against the issue of the secured creditors being able to repossess their assets and so accelerate the closure of the firm. On the other hand, three months can hardly be compared to the unlimited stay on all claims under Chapter 11. Franks, Nyborg, and Torous (1996) note that a short automatic stay on all claims provides time for information to be exchanged, but the concentration of power in the hands of the debtor in possession in the USA, allows her to use her power in order to extract surplus from other parties and hence discourages disclosure. This argument adds to the claim that more firms enter Chapter 11 out of strategic reasons. It is therefore not astonishing that there are comparatively more successful restructurings in the USA. However, an analysis of the abnormal returns will show, in how far the shareholders benefit from this decision.

All these differences suggest that the German and the US sample will be very different in nature. It is to be expected that the German firms will be “worse” in the sense that bankruptcy is seen as the last opportunity, when none others are left. The prior empirical evidence seems to confirm this. Kaiser (1996) documents that virtually all reorganizations in Germany occur out of court. This finding is on the first sight astonishing, as the German code is known for its creditor friendliness. Brunner and Krahnen (2008) point out however that it is exactly the creditor friendliness of a bankruptcy code that induces coordination among banks with the effect of more out of court pre-bankruptcy workouts.

In the USA this is not the case. As discussed above, Chapter 11 may be seen as a strategic move, which may sometimes even guarantee a competitive advantage by providing easier access to fresh financing. Therefore, it can be well expected that the costs of the tradeoff between the strategic component and the faster speed and lower cost of a private workout will be borne by the equity holders.

To sum up, the traditional expectation would be that firms filing for Chapter 11 in the US will lose less around the event of bankruptcy than their German counterparts, as the market would expect a recovery with higher probability. The arguments above show however that this need not necessarily be the case, because there may be higher agency costs associated with bankruptcy in the US.

Much less problematic is the claim that bankruptcy announcement will be worse news in Germany. If the market truly expects a workout with a higher probability and places more hope in the firm, it will punish an obviously defaulting firm more severely because the expec-

tations towards it were higher in the first place. Following these lines of thinking, suggests looking at the determinants of a successful workout in Germany. These may give an idea of what went wrong, so that there was no private workout after all. Recently, there has been some empirical evidence on the determinants of successful restructurings outside the bankruptcy process. Gilson, John, and Lang (1990) show that US firms with more intangible assets, a greater fraction of bank debt, and fewer lenders are more likely to restructure their debt privately. In a similar study for the German market Jostarndt and Sautner (2007) find that companies with higher leverage, more bank debt and higher going concern values are more likely to restructure. These results suggest that firms with a higher fraction of bank debt in Germany will be punished harder by the market. Not being able to renegotiate with the banks, conveys a negative signal, because the initial reorganization expectations (mirrored in an initial higher valuation) towards such firms were higher. Therefore, after measuring the abnormal returns and checking whether there are significantly different patterns between Germany and the US, the multivariate analysis in section 4 will additionally control for the fraction of bank debt in the German case.

## 2.2 Testable Hypotheses

One of the main ideas in the following analysis is that bankruptcy risk one year prior to default can explain a part of the risk and the return patterns of defaulting firms around the bankruptcy announcement and it can be used to compare different bankruptcy codes. There are several reasons why this approach may yield fruitful results. A high default risk has at least two effects on the evolvement of the stock price before and around bankruptcy. As will be argued below, one of them is positive and the other negative and the bankruptcy environments could be compared depending on which one predominates.

The positive effect is obvious. A high default risk one year prior to the announcement already mirrors low stock price levels and therefore leads to less value destruction in the remaining year. It is due to the immediate reaction connected with the worse prospects of the firm with respect to going concern.[6]

The second effect is long term and negative: high default risk one year before the bankruptcy announcement additionally triggers higher value destruction in this remaining year. First, it is caused by indirect bankruptcy costs. These are costs resulting from the negative publicity of the threat of possible bankruptcy (Altman, 1984). A higher probability of default makes not only equity holders feel insecure, but also other important stakeholders such as business partners, employees and customers. Suppliers would offer a payment deferral under more rigorous conditions, employees would start looking for other jobs with the best being the first to go, customers would fear that long term obligations such as after sales services would not be met. The natural consequence is a decrease in the revenues and further deteri-

[6] This effect is strengthened by the fact that with higher default risk it is more likely that the firm will incur the direct legal and administrative costs associated with the bankruptcy process. The existing empirical evidence on the US market by Warner (1977), Ang, Chua, and McConnell (1982), and Weiss (1990) seems to agree that the influence of these costs for large firms is not so high due to economies of scale. It is to be considered however that direct bankruptcy costs in the range of 5.3% of the firm value as estimated by Warner (1977) for the USA may not be directly applicable to the German sample.

oration of the operating business activities. The opportunity costs of the management from not being able to concentrate on the operating activities further add to the value deterioration.

Second, agency costs may further contribute to the long term effect. To help intuition, one may consider the classical risk shifting problem described by Jensen and Meckling (1976) and Myers (1977). Being protected by limited liability, the owners of the firm can raise their expected profit by undertaking riskier projects. Their incentives to do so are especially high, when the firm is threatened by default. In this case they bare all the benefits from higher risk, but transfer its costs to the debt holders. The latter are rational and take this fact into account. In the end, the agency costs are born by the equity holders, which is mirrored in the lower stock price valuation of the firm. As Bebchuk (2002) argues, risk shifting will be even more pronounced in the case of violations of the APR as under Chapter 11.

Summing up, the effect of bankruptcy and agency costs on the equity returns will be negative, because once they are a fact, they are no longer taken merely with a probability into the pricing. Thus, further value reduction occurs.

The following hypothesis suggests how bankruptcy risk could be used to characterize the bankruptcy environment.

**Hypothesis 1**: *If bankruptcy is inefficient and is associated with direct and indirect bankruptcy costs as well as agency costs, the probability of default may have a different effect on equity returns under different bankruptcy environments.*
*(i) Under bankruptcy codes, which are associated with high bankruptcy and agency costs, the probability of default will be negatively correlated with the equity returns.*
*(ii) Otherwise, the correlation will be positive.*

To see that Hypothesis 1 is perfectly consistent with rational expectations, consider the following simple example. There exists a leveraged firm with cash flows of $R1 = \{CF1,0\}$ in $t = 1$ and $R2 = \{CF2,0\}$ in $t = 2$. The high states appear with probability $\beta_1$ and $\beta_2$ respectively. If the firm defaults on its payment in $t = 1$, it announces bankruptcy and incurs bankruptcy costs $K$. $K$ may include direct and indirect bankruptcy costs as well as agency costs. For simplicity assume that the firm owes an $\varepsilon > 0$ close to 0.[7] The following corollary corresponds to Hypothesis 1.

**Corollary 1.** *(i) The probability of default can have a positive or a negative effect on the return in the last year to bankruptcy.*
*(ii) High direct and indirect bankruptcy costs as well as high agency costs make the negative effect more likely.*

**Proof.** (i) Note that the return at the bankruptcy date can be represented as

$$return = \frac{price_{t=1}}{price_{t=0}} = \frac{CF2(1-\beta_2) - K}{CF1(1-\beta_1) + CF2(1-\beta_2) - \beta_1 K}.$$

[7] Neglecting the amount owed by the firm is only for clarity of exposition. It is an easy exercise to check that, including it in the analysis brings no qualitative change.

Denote the numerator with $N$ and the denominator with $D$.

$$\frac{\partial return}{\partial \beta_1} = \frac{N_{\beta_1} D - N D_{\beta_1}}{D^2}$$

Note that $N_{\beta_1} D - N D_{\beta_1}$ can be rewritten as

$$N_{\beta_1} D - N D_{\beta_1} = \left[ \left( (1 - \beta_2) - \frac{\partial \beta_2}{\partial \beta_1} (1 - \beta_1) \right) CF2 - K \right] (CF1 + K).$$

To see the result, consider the two extremes.
Case 1: $\frac{\partial \beta_2}{\partial \beta_1} = 0$ (no correlation).

$$\frac{\partial return}{\partial \beta_1} = \frac{[(1 - \beta_1) CF2 - K](CF1 + K)}{D^2} > 0$$

Case 2: $\frac{\partial \beta_2}{\partial \beta_1} = 1$.

$$\frac{\partial return}{\partial \beta_1} = \frac{-K(CF1 + K)}{D^2} < 0$$

Hence, there exists a correlation $\frac{\partial \beta_2}{\partial \beta_1}^*$, for which the effect of the probability of default is exactly zero.
(ii) To see the result, consider the case when $\frac{\partial \beta_2}{\partial \beta_1} = \frac{\partial \beta_2}{\partial \beta_1}^*$. Obviously, exogenously increasing $K$ makes the effect negative, and reducing $K$ makes it positive. ■

In particular, it may be expected that the probability of default has a negative effect in the USA and a positive in Germany. The intuition behind this argument bases on the discussion in the previous section. First, bankruptcy is a more probable event in the USA than it is in Germany, because the management in the USA may announce bankruptcy out of strategic reasons and because an out of court workout is more common in Germany. Therefore, however bad news financial distress in Germany may be, indirect bankruptcy and agency costs will be of less importnace. The reason is that the second effect will come into play only when it becomes clear that a workout cannot be reached. As this is typically the case shortly before the announcement, it will not be present or very weak in Germany, so that the positive effect will predominate. Following the same logic, in the USA the negative effect may be stronger. As such an argument cannot be entirely checked in a multivariate analysis, an additional event study is needed to characterize the development of the returns prior to bankruptcy. Obviously, the results may further depend on the method for measuring bankruptcy risk. The

method used in this study is bases on the Black and Scholes Merton approach (e.g. Hillegeist et al., 2004). A thorough discussion and empirical support for using this approach is offered in section 4 and in the appendix.

Having stated the main hypothesis, it further makes sense to look at more traditional ways to characterize the value destruction around bankruptcy. The following hypothesis bases on the traditional way of identifying bankruptcy (e.g. Altman, 1968; Ohlson, 1980) and is therefore not discussed in detail.

**Hypothesis 2**: *Coefficients from balance sheet data measuring leverage, profitability, and size can explain a further part of the value loss.*

In accordance with the literature, it is to be expected that equity holders of highly leveraged firms and firms paying higher average interest will lose more. Furthermore, equity holders of more profitable firms will lose less, because firms with good operating business are more likely to restructure successfully and emerge from bankruptcy.

Size pays tribute to the "too big to fail"-effect. However, it is not obvious that it should have a positive sign, as there may be also other mechanisms at work. For instance, on the one hand it may be easier for a larger firm to renegotiate privately with its creditors (Gilson, John, and Lang, 1990). On the other hand, such a firm would normally also have a larger number of creditors. This makes the coordination among them harder and thereby hinders the efficient reallocation of the company's assets towards more profitable activities (Eberhard, Moore, and Roenefeld, 1990; Franks, Nyborg, and Torous, 1996). In their study on market valuation of bankrupt firms, Gutierrez, Olalla, and Olmo (2005) seem to find evidence for the latter effect. They have a negative sign for Size.

It was mentioned above that there may be higher expectation towards an out of court workout in Germany. The following hypothesis reflects this argument.

**Hypothesis 3**: *(For German sample only): The high fraction of bank debt has a negative impact on long term value loss. It indicates unsuccessful attempts to renegotiate bank credit despite the interest of the bank in doing so and thus signals a bad firm to the market.*

Inevitably, the question on whether the filing form plays an important role needs to be touched upon as well. This issue has been addressed in the following hypothesis. Again, its underlying logic is in the previous section.

**Hypothesis 4**: *The filing form/reason matters for the market valuation of bankrupt firms. Chapter 7 filings lead to higher value destruction in the USA; Filings under "imminent insolvency" lead to less value destruction in Germany.*

The first step before the multivariate analysis is an event study to analyze the information effect that the announcement of bankruptcy has on the firm's equity returns in Germany and the US. This step is necessary for two reasons. First, it will give an idea about how the dynamics of the stock price differ in Germany and the USA one year prior to bankruptcy. Second, it will provide evidence on which Hypothesis 1 can step upon.

# 3 Measuring the Abnormal Returns: an Event Study

## 3.1 Data and Methodology

The sample constitutes of US and German firms, which have gone bankrupt between 1/1/1999 and 7/12/2007. Four types of data have been collected for each firm: the filing date, market and balance sheet data starting in 1992, and press articles starting one year before the announcement until 7/12/2007. The source for balance sheet and market data are Thomson Financial's Datastream and Worldscope. As these data are not available for firms no longer listed, it was further amended by manually extracting the necessary information from the annual statements, which are available for download from the SEC-Edgar database. Information regarding the date of bankruptcy and the fate of the firm after the announcement was inferred from the press. The main sources in this case were LexisNexis and Factiva, but also the internet service provider bankruptcydata.com. The latter specializes on collecting information regarding bankrupt US firms.

A company was taken into consideration if it has filed for bankruptcy and not if it is only in financial distress or there have simply been rumors about its filing. The German sample totals 116 firms and the US sample 1160 firms. Full balance sheet and market data, which could be used in the multivariate analysis were however available only for approximately 70% of the firms for both samples.

Apart from a comparison of the full samples of bankrupt German and US firms, a matched sample has been further used to minimize the selection bias of having firms going bankrupt under different bankruptcy procedures. The matching technique used is a mixture of matching on the propensity score and caliper matching, a variant of the nearest neighborhood matching (here) without replacement (Rosenbaum and Rubin, 1983; Smith and Todd, 2005; Heckman, Ichimura, and Todd, 1997).[8] In particular, for each bankrupt firm from the German sample it is attempted to find a corresponding firm from the US sample. The matching is done in three dimensions. The first matching criterion is the probability of default. Since this measure is composed of different firm specific data, a parallel can be drawn to the propensity score.[9] After adjusting for currency differences, Total Assets was taken as the second criterion for finding a match for the German firms.[10] In case there were more firms left as a matching candidate, a third criterion, industry, was applied. Due to the limited number of firms, which suffice the first two criteria, only the first digit of the SIC-code industry classification is considered. Proceeding in this way, matches were found for 58 of the German companies.

[8] Caliper matching, a variant of nearest neighborhood matching without replacement, imposes a tolerance on the maximum distance $\|P_i - P_j\| < \varepsilon$ allowed. This is one way to impose a common support condition. Treated firms for which no matches can be found within the caliper are excluded from the analysis.

[9] Rosenbaum and Rubin (1983) prove that when the potential outcomes of non participation $Y_0$ are independent of program participation conditional on the observed attributes $X$, they are also independent of participation conditional on the propensity score $\Pr(D = 1|X)$ (i.e. propensity score matching combines groups with different values of $X$ but the same values of $\Pr(D = 1|X)$). Note that the conditional participation probability can be estimated using a parametric method, such as logit or probit, or semi-parametrically using a method that converges faster than the nonparametric rate and that the dimensionality of the matching problem is reduced by matching on the univariate propensity score.

[10] The exchange rate at the end of the fiscal year is considered, when adjusting for currency differences.

INSERT TABLES 1a), b)

Table 1 gives a descriptive summary of the data for each year between 1999 and 2007. Not surprisingly, one can see that there has been a peek in bankruptcy announcements in 2001 and 2002 both for the US and Germany. This coincides with the US recession from the same period, the burst of the technology bubble, and the unsecure political situation combined with low consumer sentiment at that time (e.g. Nofsinger, 2005). There is a reduction in the insolvencies in both countries since 2002, which may reflect the relative stable economic environment in that period. It is important to note that the accumulation of bankruptcies in 2001-2002 may lead to a bias when analyzing the determinants of value destruction in section 4. According to Lang and Stulz (1992) there exists a contamination effect in the sense of a negative stock reaction to a bankruptcy announcement for firms in the same industry. The effect is especially large for highly leveraged firms, whose stock returns are highly correlated. As will be seen, high leverage is a common trait for most German and US firms in this sample and a high correlation of the stock returns is especially given in 2001-2002. One may therefore expect that 2001 and 2002 will play a significant role in the multivariate analysis later on.

Panel A in Table 1 shows further that 95% of the US firms in the sample filed for creditor protection under Chapter 11. 20% were however eventually liquidated. For 30% there is either no information available, or they are still under Chapter 11 protection, 10% (not seen in the table) have been acquired and the rest 34% have emerged either private or public. Panel B gives similar information about Germany. It is interesting to see that approximately one fourth of the firms filing for insolvency have chosen the new option "imminent insolvency" with it being the second most common reason for bankruptcy protection. It is also amazing to see that there have been identified 10 times less publicly listed firms in Germany that have gone bankrupt. This low rate is in line with the finding of Claessens and Klapper (2005) that relative to the firms in the economy there are almost 3.5 times more filings in the USA compared to Germany and the lower market capitalization in Germany. More importantly, it is evidence for the arguments in the previous section that the German code makes insolvency less attractive for debtors than Chapter 11. As expected, there are considerably less recoveries in Germany than in the US in relative terms and the average recovery time is approximately 60% longer.[11] This gives reasons to be careful when comparing USA with Germany, as the conjecture that the German sample is comparable only to the "worse" US firms seems to be confirmed.

INSERT TABLES 2a), b)

In Table 2 there are some additional statistics regarding the distribution of the sample in different industries using the US-SIC code classification. Not surprisingly, given the technology bubble in the early 2000's, it can be seen many of the bankrupt firms are in a technology related sector. For Germany the picture is highly comparable.

[11] This table makes an exception by reporting calendar and not trading days.

***Matched sample***

Table 1b) and 2b) summarize the results for the matched sample. It can be seen that in both cases the distribution of firms across industry and year of default is pretty much comparable to the overall samples both across industries and filing years. 20.7% of the US firms from the matched sample are liquidated compared to 20.2% from the overall sample. What is important to see, is that 19% of the firms in the matched sample successfully emerged from bankruptcy, compared to the original 34%. In contrast, the recoveries in Germany are representative for the overall sample: 10.3% compared to 12%. These findings confirm that US firms entering bankruptcy are more viable than their German counterparts. Before judging the debtor friendliness of this procedure however, one should look at the abnormal returns and see if shareholders eventually truly are better off. This will only then be the case, if the more frequent bankruptcies in the US are compensated with lower shareholder losses.

## 3.2 Measuring the Abnormal Returns of Illiquid Assets

### 3.2.1 Time Frames

The abnormal returns in this study are measured not only for the event window around the bankruptcy date, but also for the last year prior to the bankruptcy announcement. In a related event study Clark and Weinstein (1983) show that equity holders lose a substantial pie of equity value in the month prior to the bankruptcy announcement. The greatest loss seems to be in the +/-3 day event window around the announcement date for their sample. This finding can be compared to the one by Aharony, James and Swary (1980). They discover that bankrupt firms accumulate losses for equity holders starting as far as four to six years prior to the bankruptcy event. Rimbey, Born and Anderson (1995) confirm and extend these results with a different sample. They are further able to show that the market can differentiate between firms that are virtually valueless and ones that are viable for restructuring. In contrast to previous studies, Frino, Jones, and Wong (2007) do not find evidence for an announcement effect for their sample of Australian firms.

Two event windows are chosen to measure the announcement effect of insolvency for this sample: the standard +/-3 days, but also +/-10 trading days around the event. There are a number of reasons for taking a broader time frame. First, bankruptcies are rarely unexpected (Altman, 1968; Platt and Platt 1990). There may be rumors and speculations about the announcement in the days preceding it, making a shorter time frame inappropriate. A much longer one may on the other hand mix in the effect of events such as failed renegotiations or refinancing attempts thereby making the isolation of bankruptcy announcement difficult. Second, the stock of many firms is suspended from trading immediately after a bankruptcy announcement. Sometimes it takes only hours to resume trading, but at other times it may require several days (Clark and Weinstein, 1983). This problem is aggravated by the fact that the announcement may come at the end of the trading day, so that a reaction can be expected the next day at the earliest.

The chosen time frame for analyzing the long term value destruction of bankruptcy announcement is 250 days prior the event and 10 days after it. Looking at such a broad horizon obviously takes into account many other different events, which may have happened in the

year prior to the announcement. This is also the aim. Not only does it allow comparability to the above mentioned studies for measuring the long term loss for equity holders, but it also gives the chance to look beyond the short term shock and to try to identify more fundamental sources for the long term value destruction. This is by far more substantial for equity holders in absolute terms. Therefore, it is in the center of analysis when comparing the two bankruptcy codes and is a main contribution of this paper.

### 3.2.2 Aggregating the Abnormal Returns of Illiquid Assets

As it is standard in the literature, the market model is used to measure the abnormal returns [AR] of bankrupt firms.[12] The expected return of a firm is measured the following way:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t}$$

where $\alpha_i$ and $\beta_i$ are the parameter of the market model estimated by OLS using historical data. In order to take into account the effect of corporate actions such as dividend payments or increase in share capital it is further considered appropriate to use the Total Return Index $TRI_{i,t}$ available in Thomson Fiancial's Datastream, and not the stock price to calculate the daily return $R_{i,t}$. The former can be compared to a performance index normalized at 100 at the time of the company's IPO. The daily return of CDAX and S&P500 are used to approximate the German and US market returns $R_{m,t}$ respectively.

Despite its common use, there is a considerable caveat to the market model. Scholes and Williams (1977) argue that in reality there are not many securities, which are so liquid that they are priced continuously.[13] It is thus false to expect equal intervals between the daily returns. This fact may bias the test statistics, as there is an endogeneity problem. The error terms are correlated with the dependent variable causing the measured variances to be overstated and the measured covariances be understated.[14] In particular, the alphas of the OLS regression will be upward and the betas downward biased. For frequently traded securities there will be exactly the opposite effect. The following consistent estimators are suggested by Scholes and Williams (1977):

$$\widehat{\alpha_i} \equiv \frac{1}{T-2}\sum_{t=2}^{T-1} R'_{i,t} - \widehat{\beta_i}\frac{1}{T-2}\sum_{t=2}^{T-1} R'_{m,t} \qquad \text{and:} \qquad \widehat{\beta_i} \equiv \frac{\beta_i^- + \beta_i + \beta_i^+}{1+2\widehat{\rho_m}},$$

where:

$$\beta_i^- \equiv \frac{Cov(R'_{m,t}, R'_{m,t-1})}{Var(R'_{m,t-1})}, \quad \beta_i^+ \equiv \frac{Cov(R'_{m,t}, R'_{m,t+1})}{Var(R'_{m,t+1})}, \quad \text{and:} \quad \rho'_m \equiv \frac{Cov(R'_{m,t}, R'_{m,t-1})}{Std(R'_{m,t})Std(R'_{m,t-1})}.$$

The bias is therefore larger, the more infrequently the security is traded compared to the market. The proposed coefficients are advantageous in two ways. On the one hand, they can

[12] For a detailed discussion on the possibilities to measure the abnormal returns see MacKinlay (1997) and Brown and Warner (1985).

[13] The following discussion is based on Scholes and Williams (1977).

[14] In the case of too frequent trading, there is exactly the opposite effect.

be easily computed, and on the other, they do not depend on the specific assumptions regarding the probability distribution and the sequence of non-trading days $\{S\}$.

Although it has been argued that the adjusted betas do not significantly alter the aggregate outcome, the method of Scholes and Williams is used in this study (Jain, 1986).[15] The rationale is that around bankruptcy some assets are quite illiquid, and some are more liquid than the average due to speculations and sell offs. Using the correction of Scholes and Williams (1977) thus makes sure that there is no bias in the market model, which may influence the results in the multivariate analysis.[16]

Finally, before discussing the method for aggregating the abnormal returns it is essential to determine the estimation period for the calculation of the above parameters. The method used is the following. On the first date for which the parameters need to be determined (day -250), the window [-500,-251] is taken. For day -249, the window is [-499,-250], and so on. In other words, for each day there is an updating of the parameters using the previous 250 observations. The idea is to use as recent data as possible as troubled securities are prone to changing their correlation with respect to the market as they approach bankruptcy.

The method used to aggregate the abnormal returns is proposed by Ritter (1991). The idea is to aggregate the abnormal returns geometrically. The Buy and Hold Abnormal Returns [BHAR] thus look the following way:

$$BHAR_T = \prod_{t=1}^{T}\left(1 + AR_{i,t}\right) - 1.$$

Built in this way, the BHAR have the advantage that they are restricted to -1 and represent the result of a buy and hold strategy. In the next step, to check for significance, one further needs to build the average over the whole sample:

$$ABHAR = \frac{1}{N}\sum_{i=1}^{N} BHAR_{i,t}.$$

## 3.4 BHAR for USA and Germany

Table 3a) shows the full sample results of the event study for three different time frames. Displayed below the BHAR-values are a number of nonparametric tests such as the one sample and two sample mean comparison tests, checking respectively if the BHAR's are significantly different from zero and if the means of the German and US samples for each period are equal. It has been further tested whether the medians of the German and US samples are equal. The results of two sample Wilcoxon rank-sum tests are also presented.

Panel A and B show that both in Germany and the USA the firms accumulate significant value reduction in the last year prior to insolvency. This result is not surprising and confirms the previous findings in the literature. However, the average value loss of 81,63% for the USA is on the one hand more than the average 51% found by Clark and Weinstein (1983) for

[15] For robustness reasons, all tests were calculated also using the simple market model. It turns out that there are no significant differences. All results can be seen in the appendix.

[16] Note that if the security is as liquid as the market, the Scholes and Williams coefficients are just the same as the OLS coefficients.

the last year and also larger than the 61% found by Armstrong and Riddick (2000) for the last three years prior to insolvency. This may be due to the considerably larger sample in this case. As is shown later however, it is not due to the fact that there have been many bankruptcies around the technology bubble in 2001-2002. Germany shows a similar picture. There is a mean value reduction of 79.6%. It is not significantly different from the mean of the US sample and, again, it is larger than the 43% found by Gutierrez, Olalla, and Olmo (2005) for the three years prior to insolvency and slightly larger than the 77% for the last year prior to the announcement reported by Armstrong and Riddick (2000).[17]

It is important to comment on the evolvement of the BHAR. It is striking to see how much faster the losses are accumulated in the USA. A possible explanation may be the argument of Brunner and Krahnen (2008) that under a more creditor friendly procedure, a pre-bankruptcy bail out is considered more probable. This gives hope for the shareholders and is responsible for the losses in the Germany to accumulate at a later period. Striking to see is also that the median loss in the US of 96% is significantly greater at the 1% level than the 86% loss in Germany. As discussed above, these results are disappointing from shareholder view. They show that the shareholders in the US are not only not compensated for the more frequent bankruptcies by smaller loss on their stock, but in the year prior to insolvency, they also have less hope for their firm recovering from it financial troubles.

These results are backbone of the argument to use the probability of default as a distinction variable between both countries. As explained above, default risk has a twofold effect on equity returns. The immediate effect punishes the company by an immediate discount from its stock price, thereby leaving less for the company to lose. The long term effect is due to indirect bankruptcy and agency costs. If bankruptcy is better expected in the US and if there is value destruction resulting from the threat of bankruptcy, then one can expect that the long term effect will have a further dominating influence in the USA. A high probability of default will therefore indicate higher shareholder losses.

Looking at the shorter horizons, there is clear evidence that although in many cases anticipated, the bankruptcy announcement brings new information to the market in both countries. German firms loose more on average in the 21 days (48% compared to 35%) as well as in the 7 days event windows (41% compared to 25%). These differences are significantly different at the 1% level, but are in contrast to the values of the medians and cannot be confirmed by the 21 day event window. They show however that bankruptcy is important news in both countries, which leads to significant value destruction in the days around the announcement.

One simple robustness check taking only the bankruptcy announcements after the year 2002 confirms the results. The mean average *BHAR_261* loss for the US sample is 84% compared to 70% in the German case.[18] The median values are -95% and -71% respectively. Both means and medians are significantly different at the 1% level. The average *BHAR_21* are 39%(GER) and 44%(USA) and the median values are 46% and 58% respectively. The differences are not statistically significant. For the *BHAR_7* one observes the same picture: the means are 38% (GER) and 39% (USA) and the medians 31% and 36% respectively, again not statistically different. The development of the *BHAR* also confirms the above arguments. 150

[17] Just as in the US case, both references use significantly smaller samples.
[18] BHAR_# denotes the #-days event window.

days before the announcement the average loss for the US sample is 34%, whereas there is a gain for the German sample of 5%.

INSERT TABLE 3a), b)

***Matched sample***

Table 3b) displays the development of the BHAR's for the matched sample. Just as before Panel A contains the medians and Panel B contains the mean values. A number of nonparametric tests are presented under the BHAR-values.

In accordance with the above findings, in the long run event window one observes that US companies lose more value than their matched German counterparts not only in terms of median (-96% vs. -82%), but also on average (-91% vs. -77%). These differences are significant at the 1% level. One should recall that in the non-matched sample German and US samples seemed to lose equally on average in the long run, with the median loss of US companies however being significantly higher. In the 21 day event windows the differences in terms of mean and median are not statistically significant (means-52% vs. -52%; medians: -67% vs. -45%), which is the same finding as in the full sample. Interestingly, similarly to the general case, the German sample loses an average of 45% opposed to 29% for the US sample (significant at 1%) in the 7 days event window. On the other hand, in terms of median there seems to be no difference. All in all, these results confirm that bankruptcy announcement is always bad news and that US shareholders actually fare worse despite the more debtor friendly bankruptcy code.

INSERT TABLE 4

For completeness, Table 4 contains the abnormal returns for the bankrupt US and GER samples, reflecting a buy-and-hold strategy starting five, four, three, two, and one year prior to the bankruptcy filing respectively. Reported is the number of bankrupt securities available at the beginning of each buy-and-hold strategy, the number of securities with negative buy-and-hold abnormal returns at the end of each year, as well as the mean and median BHAR at the end of each year. One can see that the results from above are confirmed again. Further, in line with the findings in the literature, firms that are about to go bankrupt start accumulating negative returns in many cases five years prior to the announcement. One can see however that US firms accumulate more losses and they are accumulated much faster than from their German counterparts.

Summing up, the results in this section have provided evidence that bankruptcy is leads to more and faster destruction of value in the USA than in Germany. Further robustness checks looking at the simple and not abnormal returns also yield the same results. This gives support to Hypothesis 1 that the value destruction will have different causes. With this in mind, one can turn to the multivariate analysis.

# 4 Multivariate Analysis of the Abnormal Returns

## 4.1 Variables and Methodology

### 4.1.1 Measuring the Probability of Default

***Score Models***

The traditional way to measure the probability of default is to use score models such as the ones of Altman (1968) and Ohlson (1980). A frequently mentioned disadvantage of the score models however is that they do not capture the volatility of the assets. A firm in the high-tech sector may thus have the same score as one in the food & beverage business, it will, however, have a higher probability of default due to its higher volatility (Crosbie and Bohn, 2003). Another critique is that market based data are very much neglected in such models. Even though Altman uses a market based leverage ratio, Hillegeist et. al (2004) come to the conclusion that it does not sufficiently capture the information efficiency of the market reflected in the stock price. Thus, it cannot reflect the true expectation about the probability of default of a firm. Further applies the standard argument that balance sheet data reflect only past information under the assumption of going concern, from which the future prospects of a firm can hardly be visible. [19]

***The Black and Scholes-Merton Model***

Given the above disadvantages, the default risk model used in this study is the Black-Scholes-Merton model [BSM]. Unlike the score models, BSM has a theoretical ground to stand on and uses not only the market value of equity, but also the market value and the volatility of the assets.

BSM dates back to Merton (1974) and the idea that equity can be compared to a European call option.[20] The underlying are the assets $V_A$ of the firm and the maturity $T$ is the maturity of the debt of the firm. The strike price is the face value of debt $X$. The equity holders will exercise their option and repay $X$ to the debt holders at $T$ if $V_A>X$. Otherwise, due to their limited liability, they will step back from the firm and leave it to the debt holders. If one assumes away bankruptcy costs, then this is a plausible model of what happens in bankruptcy, and one can use an option pricing model to reverse engineer $V_A$ and its volatility $\sigma_A$. Including bankruptcy costs does not change the prediction of a structural model such as this one (Reisz and Reisz, 2004). As the name of the model suggest, the option pricing model used to recover $V_A$ and $\sigma_A$ is that of Black-Scholes-Merton. The central assumption is that the assets of the firm follow a geometric Brownian motion with drift $\mu$ and volatility $\sigma_A$; $dz$ is a as usual the Wiener process. Leaving out the details for the appendix, the BSM probability of default obtains the following simple form:

[19] A detailed discussion on the mentioned score models and the Black and Scholes-Merton model is offered in the appendix.

[20] The following option pricing discussion is based on Merton (1974). How to use Merton's model to get the probability of default and why this is the best measure of default risk, is described in detail in e.g. Crosbie and Bohn (2003) and Hillegeist et al. (2004).

$$p_t = N\left[-\frac{ln\frac{V_A}{X} + \left(\mu - \frac{\sigma_A}{2}T\right)}{\sigma_A\sqrt{T}}\right]$$

There are a couple important advantages of this formula. On the one hand, it uses market data to determine the market value of the assets and their volatility. These variables are important, since the company goes bankrupt if the value of debt is higher than the value of the assets. In contrast to the score models it gives, on the other hand, a theoretical based measure of the probability of default. It is not only easy to interpret, but it is also more plausible than a score, based on indicators of the viability of the firm, and it is more difficult to manipulate compared to a model using entirely balance sheet data.

As in any other model, there are, however, some caveats that one should be aware of. As discussed above, it is not true for instance that the ownership of the firm goes over frictionless to the debt holders. There are in many cases private negotiations between the creditors and the debt holders, which often result in workouts outside the bankruptcy process (Gertner and Scharfstein, 1991; Gilson, John, and Lang, 1990). Conversely, the debt holders may declare bankruptcy out of strategic reasons under Chapter 11, if they are short on liquidity or have a problem repaying the short term debt. On the one hand, both practices may therefore dilute the explanatory power of the BSM-model. On the other hand, for this analysis this is an advantage, because the BSM model is independent of a specific bankruptcy law, so that it can be used in a comparison between Germany and the USA.

The log normality assumption of the firm's assets is another downside of the model, aggravated by the fact that the bankruptcy announcement is also a random variable (Hillegeist et al., 2004). In reality it holds that the firm will adjust its leverage ratio so that it optimally meets its liquidity needs. This contradicts the implicit assumption of the BSM-model of constant debt *X*. It is further questionable, how to calculate *X* itself. The KMV approach described by Crosbie and Bohn (2003) is to take the short term liabilities plus one half of the long term liabilities. This study follows the approach of Hillegeist et al. (2004) and takes the total liabilities.[21] Indeed, the empirical tests in the following subsection prove that this is a good way to measure the probability of default for the gathered US and German samples. For further empirical evidence on the advantage of the BSM model the reader is referred to Crosbie and Bohn (2003), Hillegeist et al. (2004), Chan-Lau, Jobert, and Kong (2004) and Gropp, Vesala, and Vulpe (2002).

### 4.1.2 Approximation of the Probability of Default

Even though it is not an explicit purpose of this study to determine the best measure for the probability of default, this issue can hardly be omitted. Extending the sample of US and German bankrupt firms with the non-bankrupt companies included in the CDAX and S&P 500 Composite index respectively, a logit regression model with robust standard errors is used to determine the best method for predicting bankruptcy between 1999 and 2007 as dis-

[21] The assumption that all liabilities mature in one year is clearly violated in practice. Hillegeist et al. (2004) find, however, that this specification is better suited to measure the probability of default. As is reported later in the paper, the same finding was made for these samples of bankrupt firms.

cussed in Section 2. The rolling window approach proposed by Hillegeist et al. (2004) has been used. Source for the market and balance sheet data is again Thomson's Financial Datastream and Worldscope. The dependent variable in the logit regression is Bankruptcy. It takes the value of one, if the firm has gone bankrupt in the respective year and is zero otherwise. Firms with missing balance sheet data are omitted in both extended samples. As the approach used is very similar to the one of Hillegeist et al. (2004), the results are not discussed in detail, since they only confirm their findings. The main purpose of the analysis is mainly to show that the BSM model performs well in explaining bankruptcy for the given sample. It is also interesting to see that this fact holds not only for the US, but also for the German sample, which has not been documented before.

INSERT TABLE 5

Table 5 shows the outcome of the regression, comparing it to the original coefficients of Altman (1968) and Ohlson (1980) and also to the ones of Hillegeist et al. (2004).[22] It can be seen that the balance sheet models still do a relatively good job in explaining the probability of default. It is however striking that not only the significance of the coefficients varies in time, but also that there is sometimes a change in the sign of the effect as in the case of *NI/TA*, *FFO/TL*, *OENEG*, *S/TA,* and *Size*. This finding is not surprising given the arguments above that the balance sheet models lack a theoretical background and gives further support to the intention not to use a score model as a predictor of bankruptcy. As mentioned, balance sheet data will be included in the analysis, but only because they are easily available and it can intuitively be assumed that they have explanatory power.

More interesting to see is how the BSM performs.[23] It turns out that, if added to the score models as an explanatory variable, it is significant at the 1% level for the US sample and significant at least at the 5% level for the German sample. It further notably increases the Pseudo $R^2$ in all cases for the score models. If tested on its own, the BSM-probability is always significant at the 1% level and exhibits the predicted positive sign. [24]

An interesting finding is that all model specifications seem to perform better for the US sample. This supports the conjecture from the previous section that it is more difficult to predict bankruptcy in Germany than in the USA one year ahead and give further intuition for Hypothesis 1. Still, all significant coefficients have the same sign both for Germany and the USA.

### 4.1.3 Balance Sheet Data and Other Variables

[22] The original Z-Score model has been estimated using MDA analysis. For better comparison with the logit model, the signs of the Altman's coefficients have been switched. Note also that unlike Hillegeist et al. (2004), the BSM_Prob values are not taken in percent.

[23] Annual rate is the annual bankruptcy rate in the preceding year. It has not been taken into account in this study, as the aim is to isolate the predictive power of the BSM-probability. Further analyses for each separate year between 1999 and 2007 have also been performed. The results are highly comparable.

[24] Further tests were performed using short term liabilities plus one half of the long term liabilities instead of total liabilities for the "strike price" *X*. Although the results are highly comparable, the mean and median values of the probability of default are lower than in the case of total liabilities. The same finding was made using total debt for *X*. It further turns out that it does not play a big difference for the multivariate analysis, which measure is used for *X*. All these results are not reported in the paper, but are available upon request.

Having shown that the BSM model not only has a persuasive theoretical background, but also performs well empirically, the BSM-probability can be used as an indicator for the bankruptcy and agency costs. It is further advisable to check if some balance sheet coefficients can also play a role in explaining the loss for equity holders prior and around bankruptcy.

In particular two leverage measures are considered: The broadest definition of total liabilities to total assets [*TL/TA*] and total debt to total assets [*TD/TA*] as a more appropriate ratio (Rajan and Zingaels, 1995).

Fraction of bank debt [*Fraction Debt*] measured as total debt to total liabilities is considered important for the German sample. According to Hypothesis 3, it is to be expected that firms with a higher fraction of bank debt will lose more on average, because of their inability to renegotiate with banks, despite the expectations of the market for their doing so.

To measure the profitability, EBITDA to total assets (*EBITDA/TA*) and its scaled change (*d_EBITDA*) have also been considered. Further, size is measured as the natural logarithm of the total asses.

A related issue is how fast the company has grown in the previous years. The scaled change of total assets measured as $d\_TA = (TA_t - TA_{t-1})/(|TA_t| + |TA_{t-1}|)$ can be interpreted in two ways. First, companies with negative *d_TA* have reduced their assets in the year prior to the insolvency year. Therefore such companies must have started losing value for their shareholders before the analyzed 250 days, so that the loss in the 250 days to insolvency will be less. Second, a high positive change in *d_TA* may indicate that the company has grown inefficiently in the previous years (as during the technology bubble) so that a bigger crash can be expected in the case of bankruptcy (Jensen, 2005). Both reasons suggest a negative sign for *d_TA*.

It further makes sense to include a number of control variables, which may also explain some of the variability of the multivariate results. One such variable is *NASDAQ* for the US and Neuer Markt for the German sample. Both variables are dummies that take the value of one if a company was listed on the respective segment on the stock exchange. The variables may be significant due to the technology bubble in 2001 and 2002. The hypothesis is that firms in these market segments experience higher value destruction. It is backed by the empirical evidence of Lang and Stulz (1992) that there is a contagion effect of bankruptcy. Companies in the same sector, which is marked by high competition and correlation of the market returns, are prone to lower market valuation if a firm from the same business goes bankrupt.

Some sector dummies based on the US SIC code classification are also considered. The sectors used are SIC 3 and SIC 7, since many of the bankrupt companies come from these two market segments.[25]

The liquidity issue for the US sample is addressed by checking in Thomson's Financial Datastream if the company was traded OTC or not. The dummy used is *OTC*, which takes the value of one if the security was traded over the counter. Regretfully, there is no such information in Datstream for the German firms.

[25] SIC3 means companies that have a SIC code starting with the digit 3. It further turns out that SIC1 also has a significant effect for the US sample.

The variable market to book ratio [*MTB*] is expected to give an indication whether companies with an initial higher market valuation 250 days before the bankruptcy announcement have lost more on average or not. A positive sign of this variable would mean that firms with worse initial valuation have also performed worse in the days before and around the bankruptcy announcement.

In this connection it is interesting to see whether there is a different reaction in the case of penny stocks. A security is defined as penny stock, if its price is weakly less than one 250 trading days before the bankruptcy announcement. In such cases the greatest value destruction has obviously happened beforehand and the security may be the subject of speculations. If the dummy variable *penny_stock* takes the value of one for a particular firm, it may thus be expected that the value loss for equity holders has a different pattern and that a bankruptcy announcement may even have a positive effect.

The dummies *Chapter* 7 for the US sample and *Imminent* for the German sample pay tribute to Hypothesis 4. Chapter 7 takes the value of one if a particular firm has filed for liquidation under *Chapter* 7, and *Imminent* is unity, if the firm has filed under the new possibility "Imminent Insolvency" of the German code. The expectation is that companies filing under Chapter 7 will experience greater value destruction. The prediction power of this variable may however be limited. As already seen, 30% of the companies with known destiny in this sample have been eventually liquidated. Only 5% have originally filed for Chapter 7. Similar doubts may be expressed about the variable *Imminent*. On the one hand, the idea of this new possibility to file for bankruptcy is to give more incentives for distressed firms to file earlier and have a greater chance of recovery. On the other hand, the empirical evidence in the previous section shows that only one fourth of the recovered firms have originally filed using this filing reason out of the three possible.

## 4.2 Descriptive Statistics

Table 6 gives a descriptive overview with data one year prior to bankruptcy over the German and the US sample comparing them to non bankrupt firms from the S&P500 and CDAX indices respectively. Nonparametric tests concerning the differences in mean in median are presented in the appendix.[26] Both the German and the US bankrupt firms are significantly smaller than the typical index firm. The average size of a bankrupt public German firm (€245 mil.) is almost one seventh of its US counterpart ($1.7 bil.) not correcting for the currency differences. It is however only one half of its size, if the medians are taken ($118 mil. And €56 mil.). These findings are not surprising given the fact that one can find similar ratios comparing the S&P and CDAX non bankrupt firms.

INSERT TABLE 6 a), b)

A brief look at the market to book ratios [*MTB*] confirms again the observation that one year before bankruptcy it is more difficult to identify a troubled firm in Germany than it is in

[26] Tests statistics are presented for different sample pairs: bankrupt-non bankrupt, mathched-not matched, bankrupt German/US-non bankrupt German/US, etc.

the US. The *MTB* ratios in Germany are not statistically different both in terms of median (1.3 and 1.4) as well as in terms of average (2.2 and 2.8) for bankrupt and non bankrupt firms. In the USA the situation is completely different with bankrupt firms having a median *MTB* of 0.3 compared to 2.7 for the median S&P500 firm. However, it is to be noted that the standard deviation of the US sample is very large with many highly negative *MTB*-ratios present.

A similar picture is conveyed by the BSM-probabilities. Both 250 days as well as 10 days before the bankruptcy announcement, the average bankrupt US firm has a significantly higher probability of default than its German counterpart. For both time periods and samples the probability of default is significantly higher than for the S&P500 and CDAX firms, which was to be expected given the results from above.

As the different profitability and liquidity measures and are not central in this study, they will not be discussed in detail. A brief look tells us that they are highly comparable between both countries, both for the bankrupt and non bankrupt samples. The goodness of their predictive power for bankruptcy, i.e. whether the differences between the bankrupt and non bankrupt samples are significant, can be inferred from Table 5 from the previous section.

More attention will be turned to the different leverage measures. If the ratios of the non bankrupt samples are compared to the ones presented by Rajan and Zingales (1995) [R&Z], there are no big contradictions to be found.[27] One difference is that, contrary to common belief, non bankrupt companies in both countries seem to be equally leveraged if *TL/TA* is taken (ca. 0.6). Looking at *TD/TA* as a leverage indicator tells the same story (0.22-0.24 for GER and US), which is almost the same result as in Rajan and Zingales (1995). The composition of debt seems to be an interesting issue. Both this sample and R&Z, but also a study performed by Gertler and Glichrist (1994), show that German firms have almost twice as much short term debt in relative terms compared to the US. Non bankrupt US companies further seem to have more bank debt, but the difference is not as big as found by R&Z.

Taking a closer look at the bankrupt samples, *TL/TA* once again suggests that is more difficult to tell a troubled firm in Germany. Bankrupt German firms are only slightly more leveraged than typical CDAX firms. Not so in the US; bankrupt companies have a median leverage of 0.9 compared to 0.6 for the median S&P500 firm. *TD/TA* supports the latter finding. It further shows that troubled German firms have considerably more total debt on average (0.3) than not troubled companies (0.2), suggesting that this is a better leverage ratio, when identifying troubled companies.[28] *Short/Total Debt* is another measure, which requires mentioning. It seems support to the theory of Barnea, Haugen, and Senbet (1980) that more short term debt signals a bad company.[29] In Germany and in the USA bankrupt firms have significantly more short term debt. Again the contrast is greater in the USA. The case of *Fraction of Bank*

[27] As noted by Tirole (2006), measures of leverage vary across different studies for several reasons. First, leverage depends on the sample (small/large or private/publicly listed companies). Second, studies that report nonweighted means are likely to report higher leverage than those that compute weighted averages. Another reason is that studies differ in the period they cover.

[28] Rajan and Zingales (1995) offer a detailed discussion on the advantages and disadvantages of the different leverage ratios.

[29] See also Hart and Moore (1998). They observe that assets tend to be matched with liabilities. Long term loans are often used for fixed assets acquisition and short term loans are used for working capital purposes (payroll, inventories, and seasonal imbalances).

*Debt* is just the same. In both countries bankrupt firms have more bank debt: 0.6 and 0.4 compared to 0.4 and 0.3 respectively for USA and Germany. With this descriptive statistics in mind, the attention can be finally turned to the regression results.

## 4.3 Regression Results

The method used for the multivariate analysis is simple OLS with robust standard errors. Despite the timeframe from 1999-2007, this is not a panel regression, since each firm is considered only once. The dependent variable is the BAHR. BHAR261 signify a start of the buy and hold period 250 days before the announcement, BHAR21 and BHAR7: 10 and 3 days before the announcement respectively. For the US sample a dummy for 2001 and 2002 each is included in order to take into account the specific effect of these years. For the German sample only 2002 is considered, since 2001 turns out to have no significance.

Panel A of Table 7 displays the results for the US sample. Model 1 is the complete specification and takes into account all hypotheses. Models 2, 3, and 4 are variations thereof isolating Hypothesis 1 and Hypothesis 2, Hypothesis 1 and the control variables, and Hypothesis 1 respectively. The first column is always the most important one for each model. It displays the regression results for the 261 days event windows. The other two columns represent the results for the 21 days and 7 days event windows.

INSERT TABLE 7

The most interesting result is that in line with expectations, the BSM-probability is significant at the 1% level. It has a negative sign for all long term specifications, suggesting that firms with high probability of default experience a higher value reduction. According to Hypothesis 1(i) this may be because indirect bankruptcy and agency costs are higher. Interestingly, all short term specifications also show that the same relationship. This is difficult to explain, as it would be more appropriate to look at the BSM probability 10 and 3 days before the event respectively. It turns out however these probabilities are insignificant in the short term event windows. Looking at Model 4 for robustness sake shows that, even if taken on its own, the BSM-probability significantly explains a good deal of the variation in the equity loss for all time horizons.

In connection with Hypothesis 2, an interesting finding is that balance sheet data seem to have some explanatory power mainly for the long term horizon. *TD/TA* seems to be the most stable significant variable, having a positive sign both for Model 1 and 2 for all event windows. The empirical literature suggests that firms that are more highly leveraged have a higher probability of restructuring (Gilson, John, and Lang, 1990; Jostarndt and Sautner, 2007). This could be an explanation for the positive effect in this case, since the majority of cases have filed under Chapter 11. As discussed earlier, unlike the German code, Chapter 11 allows for strategic default, so that market participants may still hold higher leverage for a positive sign.

*EBITDA/TA* does not have a persuasive effect. It is significant at the 1% level for the 7 days event windows and at the 10% level for the 261 days, but only for Model 2. The estimated effect is positive, confirming intuition that more profitable firms should experience

fewer losses. The scaled change *d_EBITDA* is significant at 1% in the long horizon: firms with less reduction in their operating business perform better.

Because of high correlation with *TD/TA*, *TL/TA* was not included in the regression, but instead the Common Equity to Total Liabilities ratio [*E/TL*]. Despite its significance at the 5% level, E/TL plays minor role in explaining the equity loss. It does not have persuasive significance for the 21 and 7 days event windows, and the coefficient is relatively close to zero. The negative sign may be explained just the same way as the positive sign of *TD/TA*.

When explaining the equity loss in the last year prior to insolvency, Size proves to be an important factor. Larger firms do not lose as much as their smaller bankrupt counterparts. "Too big to fail" may be one reason, but as suggested by Gilson, John, and Lang (1990), for larger firms it is also easier to renegotiate with their creditors.

The *MTB* is significant at the 1% level for all variations and horizons. It seems that firms with higher valuation one year prior to insolvency lose less around bankruptcy. In connection with the negative sign of the default probability, this result suggests that the immediate effect of higher default risk is not the crucial one in the USA, when comparing the shareholder loss of defaulted companies.

Looking at the control variables, it is not surprising that the less liquid OTC traded firms perform significantly worse in all cases. The same is true for SIC3 and SIC7 firms. This was to be expected, because the firms gone bankrupt as a consequence of the burst of the technology bubble were mainly listed under these SIC codes. SIC1 firms however, loose less under all model specifications and horizons. The recession years 2001 and 2002 further explain some of the variations in the long term. Firms, declaring bankruptcy in these years, also destroy more value for their shareholders. Surprisingly however, 2001 has a positive effect in the 21 and 7 days event windows.

The last hypotheses, Hypothesis 4, also seems to find some confirmation. The minority of firms in this sample that declare bankruptcy under Chapter 7 is valued significantly worse by the market in the 261 and 21 event windows.

It is not surprising that explaining the abnormal returns in the German sample turns out to be a much tougher business. Again, the primary focus is on the 261 days event window. In accordance with Hypothesis 3, a high fraction of bank debt in firms that declare bankruptcy is a bad signal to the market. However, in 2002 the very same effect is reversed and firms with a higher fraction of bank debt performed relatively better. It astonishes that after checking the descriptive statistics of the firms having filed for bankruptcy in 2002 and those from 2002 that were listed on Neuer Markt, there turns out to be no difference at all from the overall sample regarding the fraction of bank debt.[30] The positive effect in 2002 remains therefore unexplained.

Most importantly however, Hypothesis 1(ii) is confirmed in the German sample. The probability of default has a significant positive effect. Firms with a higher probability of default experience less value reduction. As seen earlier, bankruptcy is a much rarer event in Germany and it appears to be harder for market participants to foretell it compared to the US. A brief reference with Table 6 shows that the average and median levels of the BSM-probability are much higher in the US both 250 days as well as 10 days before the an-

[30] Please refer to the appendix.

nouncement. The very low levels in Germany suggest that the threat of bankruptcy is not as clearly realized by the stakeholders or, as the previous evidence suggests, there is greater hope that it will be avoided. Hence, there is less time for indirect bankruptcy costs and agency costs to accumulate, making the effect of the probability of default positive. A quick reference with the probability of default measured 10 days before the announcement in the 21 and 7 days event windows yields comparable results. Unlike the US case, the variable is significant in this case confirming the positive effect. Similarly to the US however, it remains unexplained why the BSM probability measured 250 days before the event would have a significant negative effect for the short term horizons.

With reference to the example at the beginning, it is again important to note that the above results do not mean that there is no immediate effect in the USA. The low MTB ratio combined with the relatively high probability of default, which was after all extracted from the market prices, suggest that bankrupt firms in the US have already experienced a significant value reduction. In contrast to Germany however, bankruptcy does not seem to be such a big surprise and bankruptcy and agency costs therefore seem to play a bigger role.

Turning to Hypothesis 2, it seems that it has no solid base in Germany. Apart from *Fraction Debt*, only *TD/TA* and *Size* seem to have some questionable significance. More highly leveraged firms seem to be given more chance by the market, at least in the long horizon, and smaller firms display less value reduction. The latter is another difference to the US and repeats the results of Gutierrez, Olalla, and Olmo (2005) who have performed their tests on Spain, Germany, France, and the UK. It appears that in Europe, smaller firms, possibly with fewer creditors, are able to persuade better that they can emerge from bankruptcy.

For completeness sake, it is interesting to see that Neuer Markt and 2002 both have a highly significant negative effect on the performance of the German sample. There is no evidence for Hypothesis 4 however that firms making use of the new insolvency reason "imminent insolvency" fare better than the rest. This is not surprising, because Table 1 already showed that the few firms that were able to reorganize did not necessarily file using this reason.

***Matched sample***

INSERT TABLE 8

A short look at a combined regression for the matched sample case shows the same qualitative results. One can see that in the 261 days event window in the USA the probability of default has a significant negative effect, whereas there is an altogether positive effect in Germany. In the short term event windows the effect is still visible, but not as strong as for the long term.

Performing all mentioned tests with the simple returns instead of the abnormal returns yields qualitatively the same results. The probability of default in the US case remains significantly negative at the 1% level, and is significantly positive at the 5% level for the German case. It further turns out that all other variables remain significant at least at the same significance level.

The following section is dedicated to further robustness checks.

## 4.4 Nonparametric robustness tests

A final test for the validity of Hypothesis 1 is performed for robustness reasons. A nonparametric approach suggested by Acharya, Sundaram and John (2006) has been adopted. It relies on pooling the German with the matched US firms according to the value of the probability of default. The pool is divided into five quintiles based on the BSM probability one year before the event [*BSM_Prob*]. Quintile 5 represents the highest value of *BSM_Prob* and Quintile 1 the lowest. As the aim is to measure the influence of the probability of default on the BHAR's, the mean and median values of *BHAR261* are measured for each quintile. Under Hypothesis 1 the probability of default has a positive effect in Germany and a negative in the USA. Thus, the difference in BHAR's between German and US firms should be growing for higher quintiles. In other words, if one takes the difference in *BHAR261* between Geramny and the USA in a given quintile and subtracts from this difference the difference in *BHAR261* from a lower quintile, then this "difference of differences" as Acharya, Sundaram, and John (2006) call it, should be positive.

INSERT TABLE 9

Table 9 presents the results. One can see that as predicted by Hypothesis 1 the difference of differences is positive and growing for higher quintile. The mean Q2-Q1 is only 2% and the mean Q5-Q4 reaches 20%. An exception makes Q3-Q2 with a negative difference of differences of -3%. On the whole however, the results are consistent with the prediction of Hypothesis 1. One can therefore conclude that the results from the analysis of the abnormal returns in the previous section are confirmed. A debtor friendly bankruptcy procedure such as chapter 11 does not necessarily make shareholders better off. It seems that not only do they suffer more frequently from bankruptcy announcements, but they also lose more from agency conflicts and problems resulting from indirect bankruptcy costs than their German counterparts.

# 5 Conclusion

Using a dataset of 1160 bankrupt US and 116 bankrupt German this study empirically analyzes the abnormal returns of a buy and hold strategy for three different event windows: one starting 250 days before the announcement and ending 10 days after it, as well as for 21 and 7 days event windows centered around the bankruptcy filing. It has been documented that US firms lose a median of 94% which is significantly greater than the 86% of German firms. These results are confirmed after taking into account bankruptcies only after 2002 and bankruptcies based on a matched sample of German and US firms. More strikingly, it further turns out that in the US the losses are accumulated much faster, indicating that German shareholders place more hope in the pre-bankruptcy recovery of financially distressed firms. These findings seem to confirm recent discussion in the literature that shareholders are not necessarily better off under a more debtor friendly bankruptcy code (Bebchuk, 2002; Krahnen, 2008):

not only do they suffer more often from bankruptcy filings, but they are also not compensated by relatively lower losses on their investments.

In order to test the hypothesis that there is more value destruction resulting from indirect agency and bankruptcy costs in the USA, a multivariate analysis is performed separately for both countries and for a combined matched sample of German and US companies. One of the main hypotheses is that the abnormal losses in the USA and Germany will be of different nature and that this could be shown by analyzing the probability of default. It has been shown that, depending on the bankruptcy and agency costs, the probability of default may have a positive or a negative effect on the equity returns. The regression results confirm that default risk has a different significant effect in both countries. In particular, its effect in the USA is negative. In Germany it is positive. It has been hypothesized that the negative effect is not dominant in the German sample, because the German bankruptcy code predisposes for out of court workouts. A bankruptcy is therefore rather unexpected by the market and it is therefore less likely to trigger high agency and indirect bankruptcy costs. Nonparametric tests on the matched sample also confirm these findings.

Another interesting result in the paper is the identification of different firm specific market and balance sheet data for the explanation of the long term and short term abnormal losses around bankruptcy. To bolster these findings, rich non parametric evidence has been presented on the differences in mean and medians for different balance sheet and market based coefficients between bankrupt and non-bankrupt US and German firms. The paper further provides information on the post bankruptcy fate of the companies in the sample and shows that the Black and Scholes Merton model performs well also for this sample of bankrupt German and US firms.

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# Tables

**Table 1a): Filing types and fate of the bankrupt companies for the full sample of bankrupt US and German firms between 1999 and 2007.**

Panel A of the table presents the filing types and the fate of the bankrupt companies for the full sample of 1160 bankrupt US firms and 116 bankrupt German firms. All firms in the sample have announced bankruptcy between 1999 and 2007. As expected, there is a peek in the bankruptcy announcements in 2001 and 2002. 95% of the firms in the US have chosen Chapter 11, 20% have been subsequently liquidated. 34% have emerged either private or public. For the remaining 40% there is no information or they are still under Chapter 11. Panel B of the table presents similar statistics for Germany. Again there is a peek in 2001 and 2002. Insolvency seems to be the most common filing reason and there are the recovery rate in Germany is only 12%. Additionally, German firms seem to spend 60% more time in bankruptcy than US firms.

Panel A: USA

| | | | | liquidated | | emerged private | | emerged public | |
|---|---|---|---|---|---|---|---|---|---|
| Year | All | Chapter 11 | Chapter 7 | N | days in Ch. 11 | N | days in Ch. 11 | N | days in Ch. 11 |
| 1999 | 112 | 109 | 3 | 28 | 524 | 25 | 479 | 12 | 452 |
| 2000 | 155 | 148 | 7 | 28 | 712 | 37 | 670 | 13 | 605 |
| 2001 | 260 | 252 | 8 | 65 | 533 | 33 | 601 | 31 | 471 |
| 2002 | 204 | 189 | 15 | 41 | 416 | 47 | 371 | 30 | 382 |
| 2003 | 162 | 148 | 14 | 30 | 473 | 28 | 359 | 37 | 402 |
| 2004 | 96 | 87 | 9 | 15 | 602 | 13 | 319 | 24 | 329 |
| 2005 | 83 | 83 | 0 | 13 | 398 | 20 | 341 | 18 | 376 |
| 2006 | 59 | 54 | 5 | 12 | 264 | 5 | 211 | 12 | 215 |
| 2007 | 29 | 27 | 2 | 2 | 97 | 2 | 108 | 2 | 111 |
| | 1160 | 1097 | 63 | 234 | | 210 | | 179 | |
| | | 95% | | 20% | | 18% | | 15% | |

Panel B: GER

| Year | All | insolvency | imminent insolvency | overindebted ness | insolvency and overindebtedness | imminent insolvency and overindebtedness | Recovered | reason was imminent isolvency | Days until confirmation of plan |
|---|---|---|---|---|---|---|---|---|---|
| 1999 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | - |
| 2000 | 4 | 2 | 2 | 0 | 0 | 0 | 1 | 1 | 317 |
| 2001 | 23 | 12 | 5 | 2 | 3 | 1 | 2 | 0 | 1032 |
| 2002 | 47 | 25 | 12 | 6 | 3 | 1 | 6 | 1 | 951 |
| 2003 | 13 | 8 | 3 | 0 | 1 | 1 | 2 | 2 | 824 |
| 2004 | 9 | 6 | 0 | 1 | 0 | 2 | 1 | 0 | 720 |
| 2005 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | - |
| 2006 | 10 | 4 | 1 | 2 | 1 | 1 | 2 | 0 | 192 |
| 2007 | 6 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | - |
| | 116 | 61 | 26 | 14 | 9 | 6 | 14 | 4 | |
| | | | | | | | 12% | | |

**Table 1b): Filing types and fate of the bankrupt companies for the matched sample of bankrupt US and German firms between 1999 and 2007.**

Panel A of the table presents the filing types and the fate of the bankrupt companies for the matched sample of 58 bankrupt US firms and 58 bankrupt German firms. The matching is done along three dimensions: BSM-default probability, total assets, and industry classification. Similarly to the full sample, there is a peek in the bankruptcy announcements in 2001 and 2002. 98% of the firms in the US have chosen Chapter 11, 21% have been subsequently liquidated, but only 19% have emerged either private or public. For the remaining there is no information or they are still under Chapter 11. Panel B of the table presents similar statistics for Germany. Again there is a peek in 2001 and 2002. Insolvency seems to be the most common filing reason and there are the recovery rate in Germany is only 10%.

Panel A: USA

| | | | | liquidated | | emerged private | | emerged public | |
|---|---|---|---|---|---|---|---|---|---|
| Year | All | Chapter 11 | Chapter 7 | N | days in Ch. 11 | N | days in Ch. 11 | N | days in Ch. 11 |
| 1999 | 7 | 7 | 0 | 1 | 311 | 1 | 857 | 1 | 92 |
| 2000 | 7 | 7 | 0 | 0 | - | 1 | 258 | 2 | 488 |
| 2001 | 15 | 15 | 0 | 4 | 408 | 1 | n.a. | 0 | - |
| 2002 | 11 | 10 | 1 | 0 | - | 1 | 144 | 1 | n.a. |
| 2003 | 10 | 10 | 0 | 5 | 206 | 1 | 33 | 0 | - |
| 2004 | 3 | 3 | 0 | 0 | - | 0 | - | 0 | - |
| 2005 | 5 | 5 | 0 | 2 | 35 | 1 | 667 | 1 | 39 |
| 2006 | 0 | 0 | 0 | 0 | - | 0 | - | 0 | - |
| 2007 | 0 | 0 | 0 | 0 | - | 0 | - | 0 | - |
| | 58 | 57 | 1 | 12 | | 6 | | 5 | |
| | | 98% | | 21% | | 10% | | 9% | |

Panel B: GER

| Year | All | insolvency | imminent insolvency | overindebtedness | insolvency and overindebtedness | imminent insolvency and overindebtedness | Recovered | reason was imminent isolvency | Days until confirmation of plan |
|---|---|---|---|---|---|---|---|---|---|
| 1999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 2000 | 2 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 317 |
| 2001 | 8 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | - |
| 2002 | 24 | 12 | 7 | 2 | 2 | 1 | 1 | 0 | 837 |
| 2003 | 9 | 5 | 2 | 0 | 1 | 1 | 1 | 1 | 550 |
| 2004 | 7 | 5 | 0 | 1 | 0 | 1 | 1 | 0 | 720 |
| 2005 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 2006 | 3 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 167 |
| 2007 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | - |
| | 58 | 30 | 15 | 6 | 4 | 4 | 6 | 2 | |
| | | | | | | | 10% | | |

**Table 2 a): Sector distribution of the bankrupt companies for the full sample of bankrupt US and German companies.**

The table reports the number of firms in the sample by broad industry group. The sample consists of 1160 bankrupt US firms and 116 bankrupt German firms. All firms in the sample have announced bankruptcy between 1999 and 2007. SIC# denotes all companies having a SIC code starting with the respective digit. Apparently there is a peek in the bankruptcy filings in 2001-2002. This coincides with the burst of the technology bubble, which is also mirrored in the fact that 43% of the filings are in the Hi-tech dominated SIC3 and SIC7 sectors.

| Panel A: USA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | SIC 1 | SIC 2 | SIC 3 | SIC 4 | SIC 5 | SIC 6 | SIC 7 | SIC 8 | SIC 9 |
| 1999 | 7 | 14 | 25 | 14 | 22 | 9 | 11 | 9 | 0 |
| 2000 | 5 | 16 | 29 | 20 | 37 | 10 | 21 | 17 | 0 |
| 2001 | 7 | 27 | 53 | 47 | 38 | 10 | 65 | 13 | 0 |
| 2002 | 10 | 22 | 48 | 42 | 13 | 8 | 43 | 17 | 0 |
| 2003 | 8 | 20 | 37 | 19 | 21 | 8 | 38 | 9 | 0 |
| 2004 | 5 | 14 | 30 | 12 | 16 | 3 | 14 | 1 | 0 |
| 2005 | 2 | 10 | 27 | 15 | 7 | 4 | 14 | 3 | 0 |
| 2006 | 2 | 13 | 18 | 6 | 7 | 2 | 7 | 3 | 0 |
| 2007 | 3 | 2 | 11 | 3 | 5 | 1 | 1 | 2 | 0 |
| | 49 | 138 | 278 | 178 | 166 | 55 | 214 | 74 | 0 |
| US sample | 4.25% | 11.98% | 24.13% | 15.45% | 14.41% | 4.77% | 18.58% | 6.42% | 0.00% |
| S&P 500 | 6.21% | 18.04% | 23.65% | 12.02% | 10.42% | 19.44% | 8.82% | 1.40% | 0.00% |

| Panel B: GER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | SIC 1 | SIC 2 | SIC 3 | SIC 4 | SIC 5 | SIC 6 | SIC 7 | SIC 8 | SIC 9 |
| 1999 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 2001 | 0 | 1 | 2 | 1 | 4 | 2 | 12 | 1 | 0 |
| 2002 | 1 | 1 | 8 | 2 | 7 | 8 | 20 | 0 | 0 |
| 2003 | 0 | 2 | 3 | 0 | 2 | 4 | 2 | 0 | 0 |
| 2004 | 0 | 0 | 3 | 1 | 0 | 2 | 2 | 1 | 0 |
| 2005 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 |
| 2006 | 0 | 4 | 0 | 1 | 0 | 3 | 1 | 1 | 0 |
| 2007 | 0 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 0 |
| | 1 | 10 | 20 | 7 | 14 | 22 | 38 | 4 | 0 |
| GER sample | 0.86% | 8.62% | 17.24% | 6.03% | 12.07% | 18.97% | 32.76% | 3.45% | 0.00% |
| CDAX | 1.98% | 12.96% | 26.85% | 5.69% | 11.38% | 15.87% | 21.43% | 3.84% | 0.00% |

**Table 2 b): Sector distribution of the bankrupt companies for the matched sample of bankrupt US and German companies.**

The table reports the number of firms in the matched sample by broad industry group. The sample consists of 58 bankrupt US firms and 58 bankrupt German firms. All firms in the sample have announced bankruptcy between 1999 and 2007. The matching is done along three dimensions: BSM-default probability, total assets, and industry classification. SIC# denotes all companies having a SIC code starting with the respective digit. Apparently there is a peek in the bankruptcy filings in 2001-2002. This coincides with the burst of the technology bubble, which is also mirrored in the fact that 43% of the filings are in the Hi-tech dominated SIC3 and SIC7 sectors.

| Panel A: USA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | SIC 1 | SIC 2 | SIC 3 | SIC 4 | SIC 5 | SIC 6 | SIC 7 | SIC 8 | SIC 9 |
| 1999 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 0 |
| 2000 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 1 | 0 |
| 2001 | 0 | 2 | 3 | 3 | 1 | 0 | 5 | 1 | 0 |
| 2002 | 0 | 0 | 4 | 2 | 2 | 1 | 2 | 0 | 0 |
| 2003 | 0 | 0 | 5 | 0 | 2 | 1 | 2 | 0 | 0 |
| 2004 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 |
| 2006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 4 | 16 | 10 | 9 | 4 | 11 | 3 | 0 |
| US sample | 1.72% | 6.90% | 27.59% | 17.24% | 15.52% | 6.90% | 18.97% | 5.17% | 0.00% |
| S&P 500 | 6.21% | 18.04% | 23.65% | 12.02% | 10.42% | 19.44% | 8.82% | 1.40% | 0.00% |

| Panel B: GER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | SIC 1 | SIC 2 | SIC 3 | SIC 4 | SIC 5 | SIC 6 | SIC 7 | SIC 8 | SIC 9 |
| 1999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2001 | 0 | 0 | 1 | 1 | 2 | 0 | 4 | 0 | 0 |
| 2002 | 0 | 0 | 4 | 0 | 4 | 6 | 10 | 0 | 0 |
| 2003 | 0 | 1 | 2 | 0 | 2 | 4 | 0 | 0 | 0 |
| 2004 | 0 | 0 | 3 | 1 | 0 | 1 | 1 | 1 | 0 |
| 2005 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2007 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 2 | 13 | 5 | 8 | 14 | 15 | 1 | 0 |
| GER sample | 0.00% | 3.45% | 22.41% | 8.62% | 13.79% | 24.14% | 25.86% | 1.72% | 0.00% |
| CDAX | 1.98% | 12.96% | 26.85% | 5.69% | 11.38% | 15.87% | 21.43% | 3.84% | 0.00% |

**Table 3a): BHAR's for the full sample of bankrupt US and German firms**

The table reports BHAR's for the full sample of 1160 bankrupt US and 116 bankrupt German firms, resulting from a buy and hold strategy for the event windows [-250;10], [-10;10], and [-3;3]. -# denotes the # day before the bankruptcy announcement. +# denotes the # day after the bankruptcy announcement. Apparently US firms accumulate not only significantly higher losses in the year prior to default, but accumulate those at a much faster pace. To check for significance in the differences between the German and the US sample, the p-values of the median, ranksum, 1- and 2-sample mean comparison tests are presented.

| MEDIAN | USA | GER | USA | GER | USA | GER |
|---|---|---|---|---|---|---|
| Days to Insolvency | Median BHAR | Median BHAR | Median BHAR | Median BHAR | Median BHAR | Median BHAR |
| -249 | -0.60% | -0.36% | | | | |
| -240 | -5.94% | -1.19% | | | | |
| -230 | -10.48% | -2.42% | | | | |
| -220 | -15.08% | -4.10% | | | | |
| -210 | -17.73% | -9.00% | | | | |
| -200 | -22.61% | -13.99% | | | | |
| -190 | -27.06% | -13.24% | | | | |
| -180 | -30.93% | -17.37% | | | | |
| -170 | -35.95% | -15.60% | | | | |
| -160 | -40.11% | -18.95% | | | | |
| -150 | -43.46% | -21.07% | | | | |
| -140 | -45.79% | -27.74% | | | | |
| -130 | -48.03% | -34.80% | | | | |
| -120 | -52.51% | -37.55% | | | | |
| -110 | -56.29% | -40.59% | | | | |
| -100 | -59.86% | -43.76% | | | | |
| -90 | -63.24% | -41.76% | | | | |
| -80 | -66.43% | -47.86% | | | | |
| -70 | -70.06% | -48.58% | | | | |
| -60 | -72.96% | -52.05% | | | | |
| -50 | -75.22% | -51.32% | | | | |
| -40 | -78.25% | -57.77% | | | | |
| -30 | -79.28% | -59.82% | | | | |
| -20 | -84.27% | -64.93% | | | | |
| -19 | -84.46% | -65.07% | | | | |
| -18 | -84.57% | -65.10% | | | | |
| -17 | -84.47% | -65.60% | | | | |
| -16 | -84.94% | -69.73% | | | | |
| -15 | -85.65% | -69.43% | | | | |
| -14 | -85.58% | -70.31% | | | | |
| -13 | -85.86% | -72.24% | | | | |
| -12 | -86.33% | -74.02% | | | | |
| -11 | -86.57% | -73.60% | | | | |
| -10 | -87.00% | -74.18% | -4.94% | -0.58% | | |
| -9 | -87.16% | -75.29% | -6.08% | -4.86% | | |
| -8 | -87.44% | -73.72% | -8.12% | 1.16% | | |
| -7 | -87.87% | -75.16% | -11.25% | -4.39% | | |
| -6 | -88.09% | -75.83% | -12.89% | -6.95% | | |
| -5 | -88.71% | -77.46% | -17.43% | -13.23% | | |
| -4 | -88.67% | -78.09% | -17.14% | -15.63% | | |
| -3 | -89.16% | -78.28% | -20.71% | -16.38% | -3.97% | -3.63% |
| -2 | -89.39% | -78.44% | -22.37% | -17.01% | -5.98% | -4.35% |
| -1 | -89.92% | -80.48% | -26.25% | -24.84% | -10.68% | -13.37% |
| 0 | -91.64% | -83.51% | -38.85% | -36.51% | -25.95% | -26.82% |
| 1 | -92.80% | -85.90% | -47.38% | -45.73% | -36.27% | -37.46% |
| 2 | -93.21% | -85.53% | -50.32% | -44.31% | -39.83% | -35.81% |
| 3 | -93.74% | -86.35% | -54.22% | -47.43% | -44.56% | -39.42% |
| 4 | -93.85% | -86.26% | -55.02% | -47.12% | | |
| 5 | -93.61% | -86.70% | -53.25% | -48.78% | | |
| 6 | -93.99% | -86.90% | -56.05% | -49.55% | | |
| 7 | -93.98% | -86.86% | -56.01% | -49.42% | | |
| 8 | -94.00% | -87.37% | -56.11% | -51.38% | | |
| 9 | -94.19% | -87.10% | -57.50% | -50.35% | | |
| 10 | -94.19% | -86.44% | -57.49% | -47.81% | | |
| | p-value | | p-value | | p-value | |
| median ($H_0$: same median) | | | | | | |
| | 0.000 | | 0.111 | | 0.001 | |
| ranksum ($H_0$: same distribution) | | | | | | |
| | 0.000 | | 0.625 | | 0.009 | |

| MEAN | USA | GER | USA | GER | USA | GER |
|---|---|---|---|---|---|---|
| Days to Insolvency | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR |
| -249 | -0.56% | -0.61% | | | | |
| -240 | -4.08% | 1.70% | | | | |
| -230 | -7.01% | 0.38% | | | | |
| -220 | -12.32% | -0.65% | | | | |
| -210 | -14.74% | -1.92% | | | | |
| -200 | -19.30% | -2.48% | | | | |
| -190 | -21.68% | -4.44% | | | | |
| -180 | -24.59% | -7.79% | | | | |
| -170 | -28.73% | -12.64% | | | | |
| -160 | -32.00% | -12.09% | | | | |
| -150 | -35.07% | -15.15% | | | | |
| -140 | -36.45% | -19.97% | | | | |
| -130 | -38.29% | -22.99% | | | | |
| -120 | -41.86% | -26.39% | | | | |
| -110 | -44.43% | -28.94% | | | | |
| -100 | -47.50% | -31.62% | | | | |
| -90 | -50.88% | -34.58% | | | | |
| -80 | -53.36% | -38.93% | | | | |
| -70 | -56.16% | -42.48% | | | | |
| -60 | -58.66% | -43.62% | | | | |
| -50 | -60.47% | -45.00% | | | | |
| -40 | -62.74% | -49.45% | | | | |
| -30 | -65.50% | -52.08% | | | | |
| -20 | -68.28% | -56.26% | | | | |
| -19 | -68.59% | -56.49% | | | | |
| -18 | -68.98% | -57.44% | | | | |
| -17 | -69.29% | -57.31% | | | | |
| -16 | -69.62% | -58.08% | | | | |
| -15 | -70.08% | -59.11% | | | | |
| -14 | -70.60% | -59.55% | | | | |
| -13 | -71.03% | -60.47% | | | | |
| -12 | -71.59% | -60.84% | | | | |
| -11 | -71.86% | -61.02% | | | | |
| -10 | -72.24% | -61.76% | -2.30% | -2.35% | | |
| -9 | -72.81% | -62.14% | -4.28% | -3.34% | | |
| -8 | -73.20% | -62.40% | -5.65% | -4.00% | | |
| -7 | -73.53% | -62.76% | -6.84% | -4.90% | | |
| -6 | -73.93% | -63.49% | -8.23% | -6.78% | | |
| -5 | -74.39% | -64.24% | -9.85% | -8.70% | | |
| -4 | -74.82% | -65.76% | -11.37% | -12.56% | | |
| -3 | -75.30% | -67.29% | -13.05% | -16.48% | -3.55% | -6.10% |
| -2 | -75.84% | -67.66% | -14.96% | -17.42% | -5.67% | -7.16% |
| -1 | -76.28% | -68.54% | -16.50% | -19.66% | -7.39% | -9.67% |
| 0 | -78.74% | -76.18% | -25.16% | -39.19% | -16.99% | -31.63% |
| 1 | -80.44% | -79.74% | -31.14% | -48.26% | -23.62% | -41.83% |
| 2 | -80.73% | -79.56% | -32.16% | -47.80% | -24.75% | -41.31% |
| 3 | -80.80% | -79.36% | -32.40% | -47.29% | -25.02% | -40.74% |
| 4 | -81.07% | -79.19% | -33.35% | -46.85% | | |
| 5 | -81.06% | -79.39% | -33.34% | -47.37% | | |
| 6 | -81.45% | -79.38% | -34.71% | -47.34% | | |
| 7 | -81.42% | -79.63% | -34.59% | -47.99% | | |
| 8 | -81.35% | -79.43% | -34.34% | -47.48% | | |
| 9 | -81.44% | -79.60% | -34.68% | -47.91% | | |
| 10 | -81.63% | -79.66% | -35.32% | -48.08% | | |
| | p-value | p-value | p-value | p-value | p-value | p-value |
| 1-sample-mean comp. ($H_0$: BHAR=0) | | | | | | |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2-sample-mean comp. ($H_0$: BHAR_US=BHAR_GER) | | | | | | |
| | 0.387 | | 0.176 | | 0.001 | |

**Table 3b): BHAR's for the matched sample of bankrupt US and German firms**

The table reports BHAR's for the matched sample of 58 bankrupt US and 58 bankrupt German firms, resulting from a buy and hold strategy for the event windows [-250;10], [-10;10], and [-3;3]. -# denotes the # day before the bankruptcy announcement. +# denotes the # day after the bankruptcy announcement. The matching is done along three dimensions: BSM-default probability, total assets, and industry classification. Apparently US firms accumulate not only significantly higher losses in the year prior to default, but accumulate those at a much faster pace. To check for significance in the differences between the German and the US sample, the p-values of the median, ranksum, 1- and 2-sample mean comparison tests are presented.

| MEDIAN | USA | GER | USA | GER | USA | GER |
|---|---|---|---|---|---|---|
| Days to Insolvency | Median BHAR250 | Median BHAR250 | Median BHAR21 | Median BHAR21 | Median BHAR7 | Median BHAR7 |
| -249 | -1.09% | -1.12% | | | | |
| -240 | -8.51% | -2.23% | | | | |
| -230 | -14.98% | -2.80% | | | | |
| -220 | -20.84% | -1.93% | | | | |
| -210 | -25.30% | -6.95% | | | | |
| -200 | -27.48% | -7.95% | | | | |
| -190 | -29.69% | -6.08% | | | | |
| -180 | -36.37% | -2.77% | | | | |
| -170 | -36.43% | -2.04% | | | | |
| -160 | -41.51% | -4.60% | | | | |
| -150 | -50.02% | -8.11% | | | | |
| -140 | -50.32% | -21.83% | | | | |
| -130 | -54.76% | -24.93% | | | | |
| -120 | -54.65% | -23.28% | | | | |
| -110 | -63.31% | -31.78% | | | | |
| -100 | -65.95% | -31.58% | | | | |
| -90 | -71.75% | -35.73% | | | | |
| -80 | -75.48% | -39.06% | | | | |
| -70 | -76.08% | -40.26% | | | | |
| -60 | -71.92% | -44.75% | | | | |
| -50 | -74.98% | -47.02% | | | | |
| -40 | -78.05% | -47.84% | | | | |
| -30 | -83.45% | -46.84% | | | | |
| -20 | -86.33% | -53.41% | | | | |
| -19 | -87.63% | -49.50% | | | | |
| -18 | -87.50% | -56.50% | | | | |
| -17 | -86.54% | -49.86% | | | | |
| -16 | -87.02% | -53.81% | | | | |
| -15 | -87.39% | -51.04% | | | | |
| -14 | -87.67% | -64.32% | | | | |
| -13 | -87.20% | -65.31% | | | | |
| -12 | -88.48% | -66.66% | | | | |
| -11 | -89.39% | -68.44% | | | | |
| -10 | -89.29% | -67.86% | -1.48% | 3.50% | | |
| -9 | -89.70% | -60.67% | -7.88% | 26.65% | | |
| -8 | -91.29% | -65.48% | -5.72% | 11.17% | | |
| -7 | -91.23% | -68.07% | -15.79% | 2.81% | | |
| -6 | -90.83% | -69.11% | -24.01% | -0.54% | | |
| -5 | -90.47% | -71.06% | -22.94% | -6.81% | | |
| -4 | -91.20% | -72.71% | -20.68% | -12.14% | 2.93% | -5.72% |
| -3 | -93.06% | -74.84% | -16.79% | -18.99% | 7.97% | -13.07% |
| -2 | -93.97% | -74.61% | -22.74% | -18.25% | 0.25% | -12.28% |
| -1 | -95.04% | -75.24% | -38.20% | -20.27% | -19.81% | -14.44% |
| 0 | -95.08% | -80.55% | -46.94% | -37.38% | -31.15% | -32.81% |
| 1 | -95.27% | -82.89% | -56.94% | -44.89% | -44.12% | -40.87% |
| 2 | -96.39% | -82.93% | -63.13% | -45.04% | -52.16% | -41.03% |
| 3 | -95.85% | -85.51% | -60.61% | -53.34% | -48.89% | -49.94% |
| 4 | -95.91% | -86.14% | -68.06% | -55.38% | | |
| 5 | -96.16% | -85.44% | -65.48% | -53.11% | | |
| 6 | -96.43% | -85.91% | -68.34% | -54.64% | | |
| 7 | -96.19% | -84.35% | -66.91% | -49.60% | | |
| 8 | -96.12% | -83.70% | -68.17% | -47.53% | | |
| 9 | -96.28% | -84.21% | -66.75% | -49.16% | | |
| 10 | -96.25% | -82.94% | -66.51% | -45.07% | | |
| p-value | | | p-value | | p-value | |
| median ($H_0$: same median) | | | | | | |
| 0.000 | | | 0.853 | | 0.577 | |
| signrank ($H_0$: same distribution) | | | | | | |
| 0.000 | | | 0.370 | | 0.355 | |

| MEAN | USA | GER | USA | GER | USA | GER |
|---|---|---|---|---|---|---|
| Days to Insolvency | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR | Mean BHAR |
| -249 | 0.20% | -2.01% | | | | |
| -240 | -8.77% | 1.71% | | | | |
| -230 | -8.14% | -1.14% | | | | |
| -220 | -15.23% | 0.76% | | | | |
| -210 | -17.54% | 2.36% | | | | |
| -200 | -21.42% | 3.78% | | | | |
| -190 | -26.69% | 4.90% | | | | |
| -180 | -29.58% | 5.25% | | | | |
| -170 | -33.41% | 0.73% | | | | |
| -160 | -34.89% | 3.06% | | | | |
| -150 | -39.37% | -2.04% | | | | |
| -140 | -42.31% | -8.21% | | | | |
| -130 | -44.98% | -11.55% | | | | |
| -120 | -47.52% | -15.60% | | | | |
| -110 | -52.94% | -18.09% | | | | |
| -100 | -57.25% | -18.62% | | | | |
| -90 | -60.53% | -21.98% | | | | |
| -80 | -64.60% | -28.40% | | | | |
| -70 | -65.00% | -33.09% | | | | |
| -60 | -68.19% | -35.44% | | | | |
| -50 | -70.43% | -35.87% | | | | |
| -40 | -71.80% | -39.65% | | | | |
| -30 | -75.64% | -41.17% | | | | |
| -20 | -78.93% | -45.48% | | | | |
| -19 | -79.42% | -45.31% | | | | |
| -18 | -80.39% | -47.03% | | | | |
| -17 | -79.87% | -46.72% | | | | |
| -16 | -80.23% | -48.28% | | | | |
| -15 | -80.72% | -49.81% | | | | |
| -14 | -80.64% | -51.08% | | | | |
| -13 | -80.78% | -52.36% | | | | |
| -12 | -81.84% | -52.93% | | | | |
| -11 | -82.30% | -53.22% | | | | |
| -10 | -82.89% | -53.31% | -5.89% | -0.66% | | |
| -9 | -83.25% | -53.23% | -8.43% | -0.47% | | |
| -8 | -84.28% | -53.64% | -12.10% | -1.35% | | |
| -7 | -84.76% | -53.60% | -14.25% | -1.26% | | |
| -6 | -85.28% | -54.35% | -19.32% | -2.85% | | |
| -5 | -85.47% | -55.34% | -21.86% | -4.97% | | |
| -4 | -85.67% | -57.68% | -23.99% | -9.94% | -1.69% | -1.69% |
| -3 | -86.48% | -59.62% | -25.33% | -14.07% | -3.42% | -6.20% |
| -2 | -88.44% | -60.08% | -26.16% | -15.06% | -4.49% | -7.27% |
| -1 | -89.68% | -60.28% | -30.74% | -15.47% | -10.42% | -7.73% |
| 0 | -89.72% | -71.90% | -42.23% | -40.21% | -25.28% | -34.73% |
| 1 | -89.49% | -76.94% | -44.59% | -50.93% | -28.33% | -46.43% |
| 2 | -90.53% | -76.28% | -45.53% | -49.54% | -29.54% | -44.91% |
| 3 | -90.66% | -76.34% | -44.74% | -49.66% | -28.53% | -45.05% |
| 4 | -90.90% | -76.83% | -50.11% | -50.69% | | |
| 5 | -90.85% | -76.88% | -51.34% | -50.81% | | |
| 6 | -91.04% | -76.74% | -52.54% | -50.51% | | |
| 7 | -90.98% | -77.25% | -52.05% | -51.59% | | |
| 8 | -90.91% | -77.12% | -52.71% | -51.32% | | |
| 9 | -91.26% | -77.41% | -52.39% | -51.93% | | |
| 10 | -91.16% | -77.21% | -51.81% | -51.50% | | |
| p-value | | p-value | p-value | p-value | p-value | p-value |
| 1-sample-mean comp. ($H_0$: BHAR=0) | | | | | | |
| 0.000 | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2-sample-mean comp. ($H_0$: BHAR_US=BHAR_GER) | | | | | | |
| 0.000 | | 0.966 | | 0.014 | | |

**Table 4: Long term abnormal returns for the bankrupt US and GER samples**

The table reports abnormal returns for the bankrupt US and GER samples, reflecting a buy-and-hold strategy starting five, four, three, two, and one year prior to the bankruptcy filing respectively. Reported is the number of bankrupt securities available at the beginning of each buy-and-hold strategy, the number of securities with negative buy-and-hold abnormal returns at the end of each year, as well as the mean and median BHAR at the end of each year.

Panel A: USA

| | | Year -1 | Year -2 | Year -3 | Year -4 | Year -5 |
|---|---|---|---|---|---|---|
| 1 year prior to bankruptcy | count | 862 | | | | |
| | <0 | 97.56% | | | | |
| | Mean | -81.60% | | | | |
| | Median | -94.19% | | | | |
| 2 years prior to bankruptcy | count | 753 | 802 | | | |
| | <0 | 99.20% | 90.97% | | | |
| | Mean | -90.34% | -46.86% | | | |
| | Median | -97.77% | -61.61% | | | |
| 3 years prior to bankruptcy | count | 640 | 679 | 701 | | |
| | <0 | 96.56% | 90.43% | 75.46% | | |
| | Mean | -91.73% | -61.53% | -29.21% | | |
| | Median | -98.70% | -76.46% | -40.77% | | |
| 4 years prior to bankruptcy | count | 562 | 597 | 614 | 636 | |
| | <0 | 96.09% | 88.61% | 77.36% | 66.35% | |
| | Mean | -92.14% | -64.43% | -39.41% | -14.49% | |
| | Median | -99.03% | -82.02% | -58.01% | -26.32% | |
| 5 years prior to bankruptcy | count | 489 | 520 | 536 | 556 | 564 |
| | <0 | 95.91% | 85.00% | 75.37% | 67.81% | 60.11% |
| | Mean | -91.54% | -60.26% | -36.20% | -19.10% | -10.93% |
| | Median | -99.12% | -76.74% | -50.81% | -23.05% | -24.24% |

Panel B: GER

| | | Year -1 | Year -2 | Year -3 | Year -4 | Year -5 |
|---|---|---|---|---|---|---|
| 1 year prior to bankruptcy | count | 98 | | | | |
| | <0 | 100% | | | | |
| | Mean | -79.66% | | | | |
| | Median | -86.44% | | | | |
| 2 years prior to bankruptcy | count | 74 | | | | |
| | <0 | 100% | 100% | | | |
| | Mean | -85.09% | -33.87% | | | |
| | Median | -91.63% | -43.18% | | | |
| 3 years prior to bankruptcy | count | 53 | | | | |
| | <0 | 100% | 88.68% | 62.26% | | |
| | Mean | -86.28% | -43.94% | -15.87% | | |
| | Median | -92.00% | -51.60% | -28.68% | | |
| 4 years prior to bankruptcy | count | 44 | | | | |
| | <0 | 100% | 97.73% | 79.55% | 63.64% | |
| | Mean | -86.10% | -49.36% | -29.72% | -2.29% | |
| | Median | -92.00% | -51.84% | -27.80% | -9.06% | |
| 5 years prior to bankruptcy | count | 38 | | | | |
| | <0 | 100% | 92.11% | 84.21% | 71.05% | 73.68% |
| | Mean | -87.48% | -54.59% | -38.84% | -24.53% | -16.63% |
| | Median | -92.68% | -61.35% | -38.49% | -24.99% | -19.39% |

**Table 5: Logit regression results for determining the default prediction ability of Altman's (1968), Oholson's (1980) and the BSM model.**

The table presents Logit regression results for determining the default prediction ability of Altman's (1968), Oholson's (1980) and the BSM model. The coefficients of the regression are compared to the original ones and the ones of Hillegeist et al. (2004). The dependent variable is Bankruptcy, taking the value of one if a company has gone bankrupt. Both samples of 1160 bankrupt US and 116 bankrupt German firms are extended by the firms present in the S&P500 and CDAX indices respectively. *WC/TA* denotes working capital to total assets, *RE/TA*: retained earnings to total assets, *VE/TL*: market cap to total liabilities, *S/TA*: sales to total assets, *BSM_Prob* is the probability of default based on the Black and Scholes Merton model, Size is the natural logarithm of total assets, *TL/TA*: total liabilities to total assets, *CL/CA*: current liabilities to current assets, *NI/TA*: net income to total assets, *FU/TL* is pre-tax income plus depreciation and amortization divided by total liabilities; *INTWO* is a dummy variable equal to one if the cumulative net income over the previous two years is negative, and zero otherwise; *OENEG* is an dummy variable equal to one if owners' equity is negative, and zero otherwise; $CHIN = (NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$ is the scaled change in net income. The results show that the BSM probability of default one year before bankruptcy is always a highly significant measure when explaining default. It is to be noted that unlike in Hillegeist et al. (2004), the BSM probability is not measured in percent. The score models perform well, however the significance, sign, and magnitude of their coefficients is not as stable as those of the BSM-model.

| Altman (1968) | N | Pseudo R² | WC/TA | RE/TA | EBIT/TA | VE/TL | S/TA | BSM_Prob | Const |
|---|---|---|---|---|---|---|---|---|---|
| Original Coefficients | 66 | NA | -1.20 | -1.40 | -3.30 | -0.60 | -1.00 | | |
| Hillegeist et al. | 89,826 | 0.06 | -0.08 | 0.04 | -0.10 ** | -0.22 *** | 0.06 | | -4.34 *** |
| USA (1999-2007) | 4,279 | 0.49 | -2.70 *** | -7.32 *** | -2.29 | -0.02 | 0.56 *** | | -2.21 *** |
| | 4,262 | 0.59 | -2.26 *** | -3.99 | -4.32 * | -0.02 ** | 0.58 *** | 24.97 *** | -2.61 *** |
| GERMANY (1999-2007) | 3,963 | 0.04 | -0.68 | 0.96 | -1.70 | -0.01 *** | -0.04 | | -4.04 *** |
| | 3,921 | 0.07 | -0.39 | 1.17 | -1.93 | -0.01 *** | -0.02 | 5.67 *** | -4.24 *** |

| Ohlson (1980) | N | Pseudo R² | Size | TL/TA | WC/TA | CL/CA | NI/TA | FU/TL | INTWO | OENEG | CHIN | BSM_Prob | Const |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Original Coefficients | 2,163 | 0.84 | -0.41 *** | 6.03 *** | -1.43 ** | 0.08 | -2.37 ** | -1.83 *** | 0.29 | -1.72 *** | -0.52 *** | | -1.32 |
| Hillegeist et al. | 89,643 | 0.10 | 0.04 *** | 0.08 *** | 0.01 *** | -0.01 | 1.20 ** | 0.18 *** | 0.01 *** | 1.59 *** | -1.10 *** | | -5.91 *** |
| USA (1999-2007) | 4,345 | 0.80 | -1.50 *** | 1.86 *** | -2.89 *** | 0.21 * | 0.35 | -0.11 | 2.76 *** | -0.06 | -0.94 *** | | 17.38 *** |
| | 4,236 | 0.83 | -1.56 *** | 1.30 *** | -2.83 *** | 0.24 ** | 0.40 | -0.14 | 2.41 *** | 0.15 | -1.06 *** | 17.38 ** | 18.32 *** |
| GERMANY (1999-2007) | 3,721 | 0.11 | -0.09 | 0.25 | -0.96 | -0.28 | -0.15 | -0.06 ** | 1.96 *** | 0.05 | 0.05 | | -4.29 *** |
| | 3,631 | 0.13 | -0.12 | 0.20 | -1.01 | -0.36 | -0.13 | -0.12 ** | 1.82 *** | -0.12 | -0.03 | 4.82 *** | -3.83 *** |

| BSM | N | Pseudo R² | BSM_Prob | Annual Rate | Const |
|---|---|---|---|---|---|
| Hillegeist et al. | 78,100 | 0.12 | 0.27 *** | 0.54 *** | -3.77 *** |
| USA (1999-2007) | 5,142 | 0.33 | 47.41 *** | | -2.24 *** |
| GERMANY (1999-2007) | 5,453 | 0.03 | 4.59 *** | | -4.02 *** |

**Table 6 a): Descriptive statistics: full sample**

The table reports key balance sheet and market based coefficients for the full sample of bankrupt US and German companies compared to the ones of the S&P500 and CDAX firms for the period 1999-2007. The weighted average is taken in accumulating the observations over the years. The coefficients estimated by Rajan and Zingales (1995) are additionally are presented. The mean, median, and the standard deviation are presented for each variable. The appendix provides additional tests whether the means and the medians in Germany and the USA are significantly different.

| | | | | | | | | | | R&Z (1995) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | USA | GER | | | | USA | GER | USA | GER |
| | | | 1999-2007 | 1999-2007 | | | | 1999-2007 | 1999-2007 | 1991 | 1991 |
| Total Assets | bankrupt firms | mean | 1,668,567 | 245,055 | BSM_Prob_ 250 | bankrupt firms | mean | 19.9541% | 5.0147% | | |
| | | median | 117,703 | 55,715 | | | median | 2.5283% | 0.0031% | | |
| | | stdev | 15,800,000 | 827,794 | | | stdev | 0.2935 | 0.1147 | | |
| | S&P 500/ CDAX firms | mean | 37,161,785 | 9,713,391 | | S&P 500/ CDAX firms | mean | 0.0760% | 0.7909% | | |
| | | median | 8,378,774 | 157,151 | | | median | 0.0000% | 0.0000% | | |
| | | stdev | 111,677,982 | 59,386,739 | | | stdev | 0.0058 | 0.0432 | | |
| MTB | bankrupt firms | mean | 0.1372 | 2.1793 | BSM_Prob_ 10 | bankrupt firms | mean | 52.5287% | 22.1606% | | |
| | | median | 0.2984 | 1.3283 | | | median | 58.5155% | 14.3071% | | |
| | | stdev | 27.8633 | 18.3932 | | | stdev | 0.3698 | 0.2211 | | |
| | S&P 500/ CDAX firms | mean | 4.1809 | 2.7609 | | S&P 500/ CDAX firms | mean | 0.0763% | 1.4964% | | |
| | | median | 2.7093 | 1.4318 | | | median | 0.0000% | 0.0000% | | |
| | | stdev | 15.0329 | 39.0732 | | | stdev | 0.0054 | 0.0655 | | |
| S/TA | bankrupt firms | mean | 1.2462 | 1.2100 | Fraction of Bank Debt | bankrupt firms | mean | 0.5504 | 0.3862 | | |
| | | median | 0.9342 | 0.7539 | | | median | 0.6133 | 0.3801 | | |
| | | stdev | 1.4793 | 1.9823 | | | stdev | 0.2814 | 0.2845 | | |
| | S&P 500/ CDAX firms | mean | 0.8763 | 1.1549 | | S&P 500/ CDAX firms | mean | 0.3904 | 0.3377 | 0.4644 | 0.2736 |
| | | median | 0.7201 | 1.0446 | | | median | 0.4039 | 0.2973 | | |
| | | stdev | 0.7392 | 1.2227 | | | stdev | 0.2731 | 0.7468 | | |
| WC/TA | bankrupt firms | mean | -0.5066 | 0.1113 | Short/Total Debt | bankrupt firms | mean | 0.4162 | 0.6180 | | |
| | | median | -0.0362 | 0.1380 | | | median | 0.3074 | 0.6842 | | |
| | | stdev | 2.9277 | 0.4498 | | | stdev | 0.3733 | 0.3237 | | |
| | S&P 500/ CDAX firms | mean | 0.1459 | 0.2201 | | S&P 500/ CDAX firms | mean | 0.2442 | 0.5128 | 0.2492 | 0.5025 |
| | | median | 0.1058 | 0.2170 | | | median | 0.1512 | 0.4783 | | |
| | | stdev | 0.1939 | 0.3207 | | | stdev | 0.2594 | 0.3966 | | |
| CL/CA | bankrupt firms | mean | 1.1202 | 0.9001 | TL/TA | bankrupt firms | mean | 1.1086 | 0.6580 | | |
| | | median | 4.8692 | 0.7743 | | | median | 0.8651 | 0.6562 | | |
| | | stdev | 36.7273 | 0.8069 | | | stdev | 1.0199 | 0.4604 | | |
| | S&P 500/ CDAX firms | mean | 0.7935 | 0.7739 | | S&P 500/ CDAX firms | mean | 0.6035 | 0.6043 | 0.6610 | 0.7200 |
| | | median | 0.6981 | 0.6011 | | | median | 0.6070 | 0.6199 | | |
| | | stdev | 0.5827 | 1.3659 | | | stdev | 0.2248 | 0.3528 | | |
| EBITDA/TA | bankrupt firms | mean | -0.5899 | -0.1966 | E/TL | bankrupt firms | mean | 0.2664 | 1.8824 | | |
| | | median | -0.0771 | -0.0460 | | | median | 0.0939 | 0.5239 | | |
| | | stdev | 2.2027 | 0.5309 | | | stdev | 1.7034 | 3.4370 | | |
| | S&P 500/ CDAX firms | mean | 0.1383 | 0.0752 | | S&P 500/ CDAX firms | mean | 1.1544 | 1.9211 | 0.5159 | 0.4192 |
| | | median | 0.1337 | 0.1013 | | | median | 0.6469 | 0.6057 | | |
| | | stdev | 0.1339 | 0.4608 | | | stdev | 3.4345 | 11.0289 | | |
| NI/TA | bankrupt firms | mean | -1.0393 | -0.3081 | TD/TA | bankrupt firms | mean | 0.6893 | 0.3095 | | |
| | | median | -0.2534 | -0.0929 | | | median | 0.5362 | 0.2551 | | |
| | | stdev | 4.0517 | 0.5666 | | | stdev | 0.8240 | 0.4220 | | |
| | S&P 500/ CDAX firms | mean | 0.0495 | -0.0361 | | S&P 500/ CDAX firms | mean | 0.2490 | 0.2146 | 0.2970 | 0.1970 |
| | | median | 0.0482 | 0.0178 | | | median | 0.2322 | 0.1545 | | |
| | | stdev | 0.1368 | 0.3207 | | | stdev | 0.1839 | 0.2673 | | |

**Table 6 b): Descriptive statistics: matched sample**

The table reports key balance sheet and market based coefficients for the matched sample of 58 bankrupt US and 58 German companies compared to the ones of the S&P500 and CDAX firms for the period 1999-2007. The matching is done along three dimensions: BSM-default probability, total assets, and industry classification. The weighted average is taken in accumulating the observations over the years. The mean, median, and the standard deviation are presented for each variable. The appendix provides additional tests whether the means and the medians in Germany and the USA are significantly different.

| | | | USA 1999-2007 | GER 1999-2007 | | | | USA 1999-2007 | GER 1999-2007 |
|---|---|---|---|---|---|---|---|---|---|
| Total Assets | matched sample | mean | 174,411 | 170,214 | BSM_Prob _250 | matched sample | mean | 8.7130% | 8.9565% |
| | | median | 73,126 | 70,742 | | | median | 0.9909% | 0.9831% |
| | | stdev | 253,745 | 268,058 | | | stdev | 0.1337 | 0.1431 |
| | bankrupt firms | mean | 1,668,567 | 245,055 | | bankrupt firms | mean | 19.9541% | 5.0147% |
| | | median | 117,703 | 55,715 | | | median | 2.5283% | 0.0031% |
| | | stdev | 15,800,000 | 827,794 | | | stdev | 0.2935 | 0.1147 |
| MTB | matched sample | mean | 1.8725 | 2.0506 | BSM_Prob _10 | matched sample | mean | 53.5780% | 28.5428% |
| | | median | 0.5097 | 1.0790 | | | median | 53.4567% | 23.5965% |
| | | stdev | 6.5361 | 3.2414 | | | stdev | 0.3117 | 0.2255 |
| | bankrupt firms | mean | 0.1372 | 2.1793 | | bankrupt firms | mean | 52.5287% | 22.1606% |
| | | median | 0.2984 | 1.3283 | | | median | 58.5155% | 14.3071% |
| | | stdev | 27.8633 | 18.3932 | | | stdev | 0.3698 | 0.2211 |
| S/TA | matched sample | mean | 0.6053 | 0.5032 | Fraction of Bank Debt | matched sample | mean | 0.6053 | 0.5032 |
| | | median | 0.6903 | 0.4800 | | | median | 0.6903 | 0.4800 |
| | | stdev | 0.2911 | 0.2519 | | | stdev | 0.2911 | 0.2519 |
| | bankrupt firms | mean | 1.2462 | 1.2100 | | bankrupt firms | mean | 0.5504 | 0.3862 |
| | | median | 0.9342 | 0.7539 | | | median | 0.6133 | 0.3801 |
| | | stdev | 1.4793 | 1.9823 | | | stdev | 0.2814 | 0.2845 |
| WC/TA | matched sample | mean | -0.1370 | -0.0219 | Short/Total Debt | matched sample | mean | 0.4729 | 0.6233 |
| | | median | 0.0000 | 0.0000 | | | median | 0.3807 | 0.6934 |
| | | stdev | 0.6355 | 0.4709 | | | stdev | 0.3820 | 0.3405 |
| | bankrupt firms | mean | -0.5066 | 0.1113 | | bankrupt firms | mean | 0.4162 | 0.6180 |
| | | median | -0.0362 | 0.1380 | | | median | 0.3074 | 0.6842 |
| | | stdev | 2.9277 | 0.4498 | | | stdev | 0.3733 | 0.3237 |
| CL/CA | matched sample | mean | 1.6471 | 1.1416 | TL/TA | matched sample | mean | 0.6097 | 0.8087 |
| | | median | 1.1187 | 0.8440 | | | median | 0.7882 | 0.7505 |
| | | stdev | 1.4742 | 0.9878 | | | stdev | 0.6399 | 0.4893 |
| | bankrupt firms | mean | 1.1202 | 0.9001 | | bankrupt firms | mean | 1.1086 | 0.6580 |
| | | median | 4.8692 | 0.7743 | | | median | 0.8651 | 0.6562 |
| | | stdev | 36.7273 | 0.8069 | | | stdev | 1.0199 | 0.4604 |
| EBITDA/TA | matched sample | mean | -0.2315 | -0.1816 | E/TL | matched sample | mean | -0.0677 | 0.7399 |
| | | median | -0.0490 | -0.0395 | | | median | 0.0990 | 0.3174 |
| | | stdev | 0.4833 | 0.5638 | | | stdev | 1.5964 | 1.6878 |
| | bankrupt firms | mean | -0.5899 | -0.1966 | | bankrupt firms | mean | 0.2664 | 1.8824 |
| | | median | -0.0771 | -0.0460 | | | median | 0.0939 | 0.5239 |
| | | stdev | 2.2027 | 0.5309 | | | stdev | 1.7034 | 3.4370 |
| NI/TA | matched sample | mean | -0.4284 | -0.3007 | TD/TA | matched sample | mean | 0.6097 | 0.4406 |
| | | median | -0.2017 | -0.1075 | | | median | 0.5336 | 0.3236 |
| | | stdev | 0.6252 | 0.5879 | | | stdev | 0.6399 | 0.5033 |
| | bankrupt firms | mean | -1.0393 | -0.3081 | | bankrupt firms | mean | 0.6893 | 0.3095 |
| | | median | -0.2534 | -0.0929 | | | median | 0.5362 | 0.2551 |
| | | stdev | 4.0517 | 0.5666 | | | stdev | 0.8240 | 0.4220 |

**Table 7, Panel A, Regression results for the US sample**

The table shows the regression results, explaining the BHAR's for the event windows [-250;10], [-10;10], and [-3;3] using the correction proposed by Scholes and Williams (1977). The dependent variable is the buy and hold abnormal return [BHAR] for the respective time frame. *TD/TA* denotes total debt to total assets, *E/TL* is common equity to total liabilities, *d_EBITDA* is the scaled change of EBITDA to total assets [*EBITDA/TA*]. Size is the natural log of total assets, *d_TA* is the scaled change of total assets, MTB is the market to book ratio, *BSM_Prob* is the default probability determined by the Black and Scholes Merton model is the default probability determined by the Black and Scholes Merton model 250 days before the announcement, *y_2001* and *y_2002* are dummies for 2001 and 2002 respectively, *penny_stock* is a dummy variable that is unity if the price of the company was lower than one 250 days before the bankruptcy announcement, *Chapter 7* is a dummy taking the value of one, if the company has filed under Chapter 7, *OTC* and *NASDAQ* are also dummies if the firms was traded OTC or on NASDAQ respectively, *SIC1*, *SIC3*, and *SIC7* are dummies denoting the sector the company was operating in. ***,** and * indicates coefficients significant at 1%, 5% and 10% levels, respectively. Model 2-4 are variations of Model 1. They isolate Hypotheses 1 and 2, 1 and 4, and 1 respectively.

| Panel A: USA | Model 1 | | | Model 2 | | | Model 3 | | | Model 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 |
| TD/TA | 0.0017 | 0.0095 ** | 0.0078 *** | 0.0042 *** | 0.0096 ** | 0.0086 *** | | | | | | |
| E/TL | -0.0001 ** | -0.0001 | -0.0001 | -0.0001 ** | 0.0000 | -0.0001 ** | | | | | | |
| EBITDA/TA | 0.0023 | 0.0076 | 0.0143 *** | 0.0051 * | 0.0068 | 0.0147 *** | | | | | | |
| d_EBITDA | 0.0021 *** | 0.0021 | 0.0023 | 0.0021 *** | 0.0022 | 0.0024 | | | | | | |
| d_TA | -0.0905 *** | -0.0288 | 0.1178 * | -0.0863 *** | -0.0335 | 0.1231 * | | | | | | |
| Size | 0.0113 *** | -0.0052 | 0.0001 | 0.0177 *** | 0.0093 | 0.0086 | | | | | | |
| MTB | 0.0001 *** | 0.0002 *** | 0.0002 *** | 0.0001 *** | 0.0002 *** | 0.0001 *** | | | | | | |
| BSM_Prob | -0.1745 *** | -0.1902 *** | -0.1334 ** | -0.1685 *** | -0.2764 *** | -0.1965 *** | -0.1634 *** | -0.1373 ** | -0.1305 ** | -0.1783 *** | -0.2344 *** | -0.2051 *** |
| y_2001 | -0.0564 *** | 0.0901 ** | 0.0746 ** | | | | -0.0604 *** | 0.0915 ** | 0.0755 ** | | | |
| y_2002 | -0.1034 *** | 0.0166 | -0.0370 | | | | -0.0892 *** | 0.0062 | -0.0518 | | | |
| penny_stock | 0.0421 * | -0.0152 | -0.0079 | | | | 0.0256 | -0.0108 | -0.0120 | | | |
| Chapter 7 | -0.0627 * | -0.1328 * | 0.0288 | | | | -0.0858 ** | -0.1522 ** | 0.0188 | | | |
| OTC | -0.2599 *** | -0.2783 *** | -0.1703 *** | | | | -0.2644 *** | -0.2507 *** | -0.1447 ** | | | |
| NASDAQ | -0.0899 | -0.1184 | -0.0530 | | | | -0.0800 | -0.0841 | -0.0197 | | | |
| SIC1 | 0.1121 ** | 0.2724 *** | 0.2179 ** | | | | 0.1055 * | 0.2871 *** | 0.2243 ** | | | |
| SIC3 | -0.0182 | -0.0978 *** | -0.0988 *** | | | | -0.0177 | -0.0986 *** | -0.0960 *** | | | |
| SIC7 | -0.0561 *** | 0.0085 | -0.0425 | | | | -0.0639 *** | 0.0054 | -0.0631 | | | |
| Const. | -0.6793 *** | -0.0626 | -0.0879 | -1.0240 *** | -0.4673 *** | -0.3420 *** | -0.5332 *** | -0.1469 *** | -0.1036 | -0.8094 *** | -0.3555 *** | -0.2391 *** |
| *N* | 675 | 708 | 708 | 675 | 708 | 708 | 706 | 743 | 743 | 706 | 743 | 743 |
| $R^2$ | 0.2662 | 0.1176 | 0.0872 | 0.1327 | 0.0491 | 0.0479 | 0.1777 | 0.0984 | 0.0612 | 0.0411 | 0.0259 | 0.0190 |
| *F* | 13.55 *** | 12.08 *** | 11.17 *** | 19.69 *** | 13.50 *** | 15.95 *** | 12.28 *** | 9.70 *** | 5.34 *** | 72.94 *** | 16.09 *** | 16.37 *** |
| *mean VIF* | 1.33 | 1.30 | 1.30 | 1.26 | 1.20 | 1.20 | 1.24 | 1.24 | 1.24 | 1.00 | 1.00 | 1.00 |

**Table 7, Panel B, Regression results for Germany:**

The table reports regression results, explaining the BHAR's for the event windows [-250;10], [-10;10], and [-3;3] using the correction proposed by Scholes and Williams (1977). The dependent variable is the buy and hold abnormal return [BHAR] for the respective time frame. *Long/Total Debt* is the fraction of long to total debt, *Fraction Debt* is the fraction of total debt to total liabilities, *FD_02* is an interaction term of the same fraction and y_2002, *TD/TA* denotes total debt to total assets, *E/TL* is common equity to total liabilities. Size is the natural log of total assets, *MTB* is the market to book ratio, *BSM_Prob* is the default probability determined by the Black and Scholes Merton model 250 days before the announcement and *BSM_Prob_10* is the default probability determined by the Black and Scholes Merton model 10 days before the announcement, *y_2002* is a dummy for 2002. "*Imminent*" is a dummy taking the value of one, if the company has filed under "imminent insolvency", and *Neuer Markt* is a dummy indicating if the company was traded on this market segment. ***,** and * indicates coefficients significant at 1%, 5% and 10% levels, respectively. Models 2-4 are variation of Model 1. Model 2 isolates Hypotheses 1 and 4, and Model 4 isolates Hypotheses 1.

| Panel B: GER | Model 1 | | | Model 2 | | | Model 3 | | | Model 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 |
| Long/Total Deb | 0.0857 | 0.0705 | -0.0461 | | | | 0.0872 | | | | | |
| Fraction Debt | -0.2306 * | -0.0470 | 0.2171 | | | | -0.2347 * | | | | | |
| FD_02 | 0.2566 * | -0.3566 | -0.4128 | | | | 0.2730 * | | | | | |
| TD/TA | 0.0929 ** | 0.0437 | -0.0122 | | | | 0.1029 ** | | | | | |
| E/TL | -0.0054 | 0.0061 | 0.0085 | | | | | | | | | |
| Size | -0.0102 | -0.0513 ** | -0.0381 | | | | | -0.0505 *** | -0.0404 ** | | | |
| MTB | -0.0003 | 0.0007 | 0.0015 | | | | | | | | | |
| BSM_Prob | 0.3707 * | -0.8087 ** | -0.5489 | 0.3448 * | -0.8728 *** | -0.4860 * | 0.3851 * | -0.8913 *** | -0.5008 * | 0.4971 ** | -0.5119 * | -0.1826 |
| BSM_Prob_10 | | 0.5403 ** | 0.31315 ** | | 0.44958 ** | 0.26319 * | | 0.52026 ** | 0.3197 ** | | 0.39297 * | 0.21509 |
| y_2002 | -0.1794 *** | 0.0398 | 0.0355 | -0.0859 ** | -0.1682 ** | -0.1365 ** | -0.1919 *** | -0.1514 ** | -0.1231 ** | | | |
| Imminent | 0.0553 | -0.0401 | -0.0027 | 0.0516 | -0.0484 | -0.0189 | 0.0609 | -0.0649 | -0.0322 | | | |
| Neuer Markt | -0.1257 *** | -0.1102 | -0.1336 ** | -0.1169 *** | -0.1025 | -0.1125 ** | -0.1308 *** | -0.1181 | -0.1250 ** | | | |
| Const | -0.5872 *** | 0.1312 | 0.0328 | -0.7344 *** | -0.3533 *** | -0.2950 *** | -0.7116 *** | 0.1913 | 0.1405 | -0.8232 *** | -0.4969 *** | -0.4211 *** |
| *N* | 80 | 92 | 92 | 90 | 102 | 102 | 80 | 102 | 102 | 90 | 102 | 102 |
| $R^2$ | 0.3956 | 0.1711 | 0.1877 | 0.2747 | 0.1197 | 0.1094 | 0.3858 | 0.1585 | 0.1522 | 0.1012 | 0.0596 | 0.0268 |
| *F* | 5.93 *** | 1.76 * | 2.09 ** | 7.04 *** | 3.07 ** | 2.62 ** | 7.50 *** | 3.45 *** | 3.69 *** | 4.29 ** | 1.97 * | 1.13 ** |
| *mean VIF* | 2.38 | 2.39 | 2.39 | 1.10 | 1.15 | 1.15 | 2.69 | 1.15 | 1.15 | 1.00 | 1.07 | 1.07 |

**Table 8: Regression results for the matched sample**

The table presents the regression results, explaining the BHAR's for the event windows [-250;10], [-10;10], and [-3;3] using the correction proposed by Scholes and Williams (1977). The matched sample consists of 58 bankrupt US and 58 bankrupt German firms. The matching has been done along three dimensions: the BSM-probability of default, total assets, and industry classification. The dependent variable is the buy and hold abnormal return [*BHAR*] for the respective time frame. *GER* is a dummy variable taking the value of one if the firm is German. *BSM_Prob* is the default probability determined by the Black and Scholes Merton model 250 days before the announcement and *BSM_GER* is an interaction term for Germany and *BSM_Prob*, *y_2002* is a dummy for 2002 and *y_2002_GER* is the respective interaction term for Germany. *Neuer Markt* is a dummy indicating if the company was traded on this market segment in the German case and *OTC* indicates if the company was traded OTC in the US case. ***,** and * indicates coefficients significant at 1%, 5% and 10% levels, respectively.

| | BHAR261 | BHAR21 | BHAR7 |
|---|---|---|---|
| BSM_Prob | -0.150164 *** | -0.798378 *** | -0.474936 |
| BSM_GER | 0.4147774 ** | 0.6569576 ** | 0.5915061 |
| y_2002 | -0.024781 | -0.107063 | -0.205072 * |
| y_2002_GER | -0.078786 | 0.1031554 | 0.188097 |
| OTC | -0.315804 *** | -0.499117 ** | -0.2734 *** |
| Neuer Markt | -0.131863 *** | -0.156054 | -0.223794 *** |
| GER | -0.103642 | -0.433983 * | -0.34516 *** |
| Const. | -0.594562 *** | 0.0286048 | 0.0019345 |
| *N* | 103 | 103 | 103 |
| $R^2$ | 0.4125 | 0.1563 | 0.1469 |
| *F* | 8.87 *** | 3.48 *** | 18.20 *** |

**Table 9: Nonparametric Inter-Quintile- Difference of Differences Tests**

The table reports the results of the Inter-Quintile- Difference of Differences Tests: A matched sample for the German firms has been constructed based on the caliper matching based on BSM_Prob_250, Total Assets and Industry. Then the resulting 58 firms per country are pooled in quintiles based on the probability of default with quintile 5 denoting the highest value and quintile 4, 3, 2, and 1 the progressive lower values. In panel A the differences in the means of BHAR261 are then computed for between German and matched US firms for each quintile. In panel B the difference of differences is calculated by computing the difference between mean BHAR_261 differences of high BSM_Prob_250 firms (Quintile n) and that of low BSM_Prob_250 firms (Quintile n-1) using the German sample and the matched US sample.

Panel A: Differences in mean and median BHAR261

| | Q5 | Q4 | Q3 | Q2 | Q1 |
|---|---|---|---|---|---|
| Median | 35.55% | 15.59% | 0.27% | 3.64% | 1.38% |
| Mean | 34.47% | 13.82% | -1.30% | 7.62% | 2.63% |

Panel B: Differneces of Differences

| | Q5-Q1 | Q5-Q4 | Q4-Q3 | Q3-Q2 | Q2-Q1 |
|---|---|---|---|---|---|
| Median | 34.17% | 19.96% | 15.32% | -3.37% | 0.022572 |
| Mean | 31.85% | 20.65% | 15.12% | -8.92% | 0.04993 |

# Appendix

Appendix A.1 Score Models vs. Black and Scholes-Merton

***Score Models***

Altman's (1968) Z-score is a prominent example of a score model using balance sheet data to approximate the probability of default. The underlying idea is to use practical coefficients, which are easy to calculate and to interpret. Altman proposes the following form for his model

$$Z = \beta_0 + \beta_1 \frac{WC}{TA} + \beta_2 \frac{RE}{TA} + \beta_3 \frac{EBIT}{TA} + \beta_4 \frac{V_E}{TL} + \beta_5 \frac{S}{TA},$$

where *Working Capital/Total Assets [WC/TA]* is supposed to measure the liquidity of the firm, *Retained Earnings/Total Assets [RE/TA]* reflects the cumulative profitability implicitly taking into account the company's age, *EBIT/Total Assts [EBIT/TA]* is the classical profitability measure, *Market Value Equity/Total Assets [$V_E$/TL]* is a market related leverage ratio, and *Sales/Total Assets [S/TA]* is an activity measure, which characterizes the ability of the firm to generate cash flows in a competitive environment.

Ohlson's O-Score is another well know score model (Ohlson, 1980). *Size* is there the natural logarithm of total assets normalized with the GDP price level index, *FU/TL* is pre-tax income plus depreciation and amortization divided by total liabilities; *INTWO* is a dummy variable equal to one if the cumulative net income over the previous two years is negative, and zero otherwise; *OENEG* is an dummy variable equal to one if owners' equity is negative, and zero otherwise; $CHIN = (NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$ is the scaled change in net income.

$$O = \beta_0 + \beta_1 Size + \beta_2 \frac{TL}{TA} + \beta_3 \frac{WC}{TA} + \beta_4 \frac{CL}{CA} + \beta_5 \frac{NI}{TA} + \beta_6 \frac{FU}{TL} + \beta_7 INTWO + OENEG + \beta_8 CHIN.$$

A frequently mentioned disadvantage of the score models is that they do not capture the volatility of the assets. A firm in the high-tech sector may thus have the same score as one in the food & beverage business, it will, however, have a higher probability of default due to its higher volatility (Crosbie and Bohn, 2003). Another critique is that market based data are very much neglected in such models. Even though Altman uses a market based leverage ratio, Hillegeist et. al (2004) come to the conclusion that it does not sufficiently capture the information efficiency of the market reflected in the stock price. It thus cannot reflect the true expectation about the probability of default of a firm. Further applies the standard argument that balance sheet data reflect only past information under the assumption of going concern, from which the future prospects of a firm can hardly be visible.

Despite these apparent disadvantages of such models, they are nevertheless very useful as a benchmark of what is thought important by practitioners and market participants. Even though some of the coefficients are proved to have varying significance and in some cases the effect even changes its sign (e.g. Hillegeist et. al, 2004), they yield plausible results and establish an easy link to related studies, such as ones analyzing the probability of restructuring

(Gilson, John, and Lang, 1990; Jostarndt and Sautner, 2007). Balance sheet based data will be therefore also used in this analysis. The idea is to have easily available data to approximate for effects such as capital structure, liquidity and profitability on the value destruction around the announcement of bankruptcy.

***The Black and Scholes-Merton Model***

Given the above disadvantages, the default risk model used in this study is the Black-Scholes-Merton model [BSM]. Unlike the score models, BSM has a theoretical ground to stand on and uses not only the market value of equity, but also the market value and the volatility of the assets.

BSM dates back to Merton (1974) and the idea that equity can be compared to a European call option.[31] The underlying are the assets $V_A$ of the firm and the maturity $T$ is the maturity of the debt of the firm. The strike price is the face value of debt $X$. The equity holders will exercise their option and repay $X$ to the debt holders at $T$ if $V_A>X$. Otherwise, due to their limited liability, they will step back from the firm and leave it to the debt holders. If one assumes away bankruptcy costs, then this is a plausible model of what happens in bankruptcy, and one can use an option pricing model to reverse engineer $V_A$ and its volatility $\sigma_A$. Including bankruptcy costs does not change the prediction of a structural model such as this one (Reisz and Reisz, 2004). As the name of the model suggest, the option pricing model used to recover $V_A$ and $\sigma_A$ is that of Black-Scholes-Merton. The central assumption is that the assets of the firm follow a geometric Brownian motion with drift $\mu$ and volatility $\sigma_A$; $dz$ is a as usual the Wiener process.

$$dV_A = \mu V_A dt + \sigma_A V_A dz. \tag{A.1}$$

The option pricing formula for a European call option is:

$$V_E = V_A N(d_1) - e^{-rt} X N(d_2), \tag{A.2}$$

where: $d_1 = \frac{ln\frac{V_A}{X} + \left(r + \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}}$, and: $d_2 = d_1 - \sigma_A\sqrt{T}$,

$V_E$ is the market value of equity, $r$ is the risk free rate and $N(.)$ is standard normal. The intuition is that the market value of equity is equal to the market value of the assets, multiplied with the risk neutral probability of repayment with respect to the underlying assets less the present value of debt multiplied with the risk neutral probability of repayment with respect to the risk free bond. According to Itô's lemma, in an arbitrage free market, it further holds:

$$\sigma_E V_E = \sigma_A V_A N(d_1) \tag{A.3}$$

[31] The following option pricing discussion is based on Merton (1974). How to use Merton's model to get the probability of default and why this is the best measure of default risk, is described in detail in e.g. Crosbie and Bohn (2003) and Hillegeist et al. (2004).

Equation (A.2) and (A.3) constitute a system of two nonlinear equations that are solved iteratively to get $V_A$ and $\sigma_A$. The method is comparable to the one used by traders to calculate the implicit volatility of an option. In particular, it is assumed that $T$ is 1 year, $r$ is the one year FIBOR/EURIBOR or the 12 month US interbank offered rate respectively, and $X$ is the book value of total liabilities. The volatility $\sigma_E$ is measured in two ways: once using the standard deviation over the last 250 trading days as in Hillegeist et al. (2004) and once using a GARCH(1,1) model.[32]

Having solved for $V_A$ and $\sigma_A$, the procedure of Hillegeist et al. (2004) is to calculate the expected growth rate of the firm's assets.[33]

$$\mu = max\left[\frac{V_A(t) - V_A(t-1)}{V_A(t-1)}, r\right].$$

It then holds for the probability of default:

$$p_t = Pr[V_A^t \leq X_t | V_A^0 = V_A] = Pr[lnV_A^t \leq lnX_t | V_A^0 = V_A].$$

Using (A.1) and applying Itô's lemma:

$$p_t = Pr\left[lnV_A^t + \left(\mu - \frac{\sigma_A}{2}T\right) + \sigma_A\sqrt{T}\varepsilon\right] \leq lnX_t$$

and rearranging terms yields:

$$p_t = Pr\left[-\frac{ln\frac{V_A}{X} + \left(\mu - \frac{\sigma_A}{2}T\right)}{\sigma_A\sqrt{T}} \geq \varepsilon\right].$$

The BSM model assumes that the assets of the firm are lognormally distributed. For the probability of default it therefore holds:

$$p_t = N\left[-\frac{ln\frac{V_A}{X} + \left(\mu - \frac{\sigma_A}{2}T\right)}{\sigma_A\sqrt{T}}\right]. \qquad \text{(A.4)}$$

There are a couple important advantages of formula (A.4). On the one hand, it uses market data to determine the market value of the assets and their volatility. These variables are important, since the company goes bankrupt if the value of debt is higher than the value of the assets. In contrast to the score models it gives, on the other hand, a theoretical based measure of the probability of default. It is not only easy to interpret, but it is also more plausible than a

[32] GARCH(1,1) is a standard way to measure stock volatility in option pricing models. It turns out however that there is no qualitative difference for the multivariate regression in section 4. The results reported in the main text are the ones obtained using the GARCH model.

[33] Note that the expected growth rate cannot rationally lie below the risk free rate.

score, based on indicators of the viability of the firm, and it is more difficult to manipulate compared to a model using entirely balance sheet data.

As in any other model, there are, however, some caveats that one should be aware of. As discussed above, it is not true for instance that the ownership of the firm goes over frictionless to the debt holders. There are in many cases private negotiations between the creditors and the debt holders, which often result in workouts outside the bankruptcy process (Gertner and Scharfstein, 1991; Gilson, John, and Lang, 1990). Conversely, the debt holders may declare bankruptcy out of strategic reasons under Chapter 11, if they are short on liquidity or have a problem repaying the short term debt. On the one hand, both practices may therefore dilute the explanatory power of the BSM-model. On the other hand, for this analysis this is an advantage, because the BSM model is independent of a specific bankruptcy law, so that it can be used in a comparison between Germany and the USA.

The log normality assumption of the firm's assets is another downside of the model, aggravated by the fact that the bankruptcy announcement is also a random variable (Hillegeist et al., 2004). In reality it holds that the firm will adjust its leverage ratio so that it optimally meets its liquidity needs. This contradicts the implicit assumption of the BSM-model of constant debt $X$. It is further questionable, how to calculate $X$ itself. The KMV approach described by Crosbie and Bohn (2003) is to take the short term liabilities plus one half of the long term liabilities. This study follows the approach of Hillegeist et al. (2004) and takes the total liabilities.[34] Indeed, the empirical tests in section 4 prove that this is a good way to measure the probability of default for the gathered US and German samples. For further empirical evidence on the advantage of the BSM model the reader is referred to Crosbie and Bohn (2003), Hillegeist et al. (2004), Chan-Lau, Jobert, and Kong (2004) and Gropp, Vesala, and Vulpe (2002).

[34] The assumption that all liabilities mature in one year is clearly violated in practice. Hillegeist et al. (2004) find, however, that this specification is better suited to measure the probability of default. As is reported later in the paper, the same finding was made for these samples of bankrupt firms.

## Appendix A.2 Additional Tables

**Table A.1: Descriptive statistics for Fraction of bank debt**

The table reports the median, mean, and standard deviation for Fraction of Bank Debt for the whole German sample and for two subsamples of 2002 and 2002 with the companies being traded on Neuer Markt.

| | Fraction of bank debt of GER sample | | | |
|---|---|---|---|---|
| Sample | N | Median | Mean | Std. Dev. |
| 2002 and Neuer Markt | 23 | 0.4012 | 0.3779 | 0.2539 |
| 2002 only | 45 | 0.4012 | 0.3961 | 0.2773 |
| Whole | 104 | 0.3801 | 0.3862 | 0.2845 |

**Table A.2, Panel A, Regression results for the USA, use of market model and not Scholes and Williams (1997)**

The table reports regression results, explaining the BHAR's for the event windows [-250;10], [-10;10], and [-3;3] using the market model. The dependent variable is the buy and hold abnormal return [*BHAR*] for the respective time frame. *TD/TA* denotes total debt to total assets, E/TL is common equity to total liabilities, *d_EBITDA* is the scaled change of EBITDA to total assets [*EBITDA/TA*]. Size is the natural log of total assets, *d_TA* is the scaled change of total assets, *MTB* is the market to book ratio, *BSM_Prob* is the default probability determined by the Black and Scholes Merton model is the default probability determined by the Black and Scholes Merton model 250 days before the announcement, *y_2001* and *y_2002* are dummies for 2001 and 2002 respectively, *penny_stock* is a dummy variable that is unity if the price of the company was lower than one 250 days before the bankruptcy announcement, *Chapter 7* is a dummy taking the value of one, if the company has filed under Chapter 7, *OTC* and *NASDAQ* are also dummies if the firms was traded OTC or on NASDAQ respectively, *SIC1*, *SIC3*, and *SIC7* are dummies denoting the sector the company was operating in. ***,** and * indicates coefficients significant at 1%, 5% and 10% levels, respectively. Models 2-4 are variation of Model 1. They isolate Hypotheses 1 and 2, 1 and 4, and 1 respectively.

| Panel A: USA | Model 1 | | | Model 2 | | | Model 3 | | | Model 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 |
| TD/TA | 0.0021 | 0.0099 *** | 0.0096 *** | 0.0046 *** | 0.0101 *** | 0.0101 *** | | | | | | |
| E/TL | -0.0002 *** | 0.0000 | -0.0002 *** | -0.0001 ** | 0.0001 | -0.0002 *** | | | | | | |
| EBITDA/TA | 0.0032 | 0.0122 *** | 0.0156 *** | 0.0061 ** | 0.0115 *** | 0.0154 *** | | | | | | |
| d_EBITDA | 0.0022 *** | 0.0024 | 0.0025 | 0.0022 *** | 0.0025 | 0.0026 | | | | | | |
| d_TA | -0.1073 *** | -0.0108 | 0.0948 | -0.1011 *** | -0.0086 | 0.0935 | | | | | | |
| Size | 0.0144 *** | -0.0020 | -0.0080 | 0.0191 *** | 0.0113 * | 0.0017 | | | | | | |
| MTB | 0.0001 *** | 0.0001 *** | 0.0001 ** | 0.0001 *** | 0.0000 ** | 0.0000 | | | | | | |
| BSM_Prob | -0.2083 *** | -0.2172 *** | -0.1070 * | -0.1800 *** | -0.2794 *** | -0.1550 *** | -0.1883 *** | -0.1950 *** | -0.1342 ** | -0.1875 *** | -0.2725 *** | -0.1722 *** |
| y_2001 | -0.0663 *** | 0.0705 * | 0.0655 * | | | | -0.0708 *** | 0.0755 ** | 0.0571 * | | | |
| y_2002 | -0.1107 *** | 0.0101 | -0.0029 | | | | -0.0939 *** | 0.0109 | -0.0087 | | | |
| penny_stock | 0.0613 ** | -0.0036 | 0.0089 | | | | 0.0376 | -0.0031 | 0.0229 | | | |
| Chapter 7 | -0.0738 ** | -0.1494 ** | -0.0489 | | | | -0.0994 *** | -0.1689 *** | -0.0372 | | | |
| OTC | -0.2695 *** | -0.2497 *** | -0.2192 *** | | | | -0.2783 *** | -0.2415 *** | -0.1893 *** | | | |
| NASDAQ | -0.1133 | -0.0806 | -0.0783 | | | | -0.0992 | -0.0614 | -0.0472 | | | |
| SIC1 | 0.0889 * | 0.2454 *** | 0.1269 * | | | | 0.0813 * | 0.2677 *** | 0.1459 ** | | | |
| SIC3 | -0.0044 | -0.0727 ** | -0.0959 *** | | | | -0.0050 | -0.0659 ** | -0.0812 ** | | | |
| SIC7 | -0.0528 *** | -0.0227 | -0.0367 | | | | -0.0632 *** | -0.0220 | -0.0409 | | | |
| Const. | -0.6986 *** | -0.1199 | 0.0365 | -1.0338 *** | -0.4912 *** | -0.2754 *** | -0.5113 *** | -0.1561 *** | -0.0832 | -0.8014 *** | -0.3580 *** | -0.2510 *** |
| *N* | 678 | 714 | 714 | 678 | 714 | 714 | 706 | 743 | 743 | 710 | 749 | 749 |
| $R^2$ | 0.2600 | 0.1130 | 0.0741 | 0.1329 | 0.0567 | 0.0479 | 0.0337 | 0.1018 | 0.0504 | 0.0409 | 0.0371 | 0.0151 |
| *F* | 14.69 *** | 9.35 *** | 10.11 *** | 21.03 *** | 8.03 ** | 15.95 *** | 7.64 ** | 11.61 *** | 4.79 *** | 68.81 *** | 25.18 *** | 12.34 *** |
| *mean VIF* | 1.33 | 1.29 | 1.29 | 1.26 | 1.20 | 1.20 | 1.24 | 1.23 | 1.23 | 1.00 | 1.00 | 1.00 |

**Table A.2, Panel B, regression results for Germany, use of market model, and not Scholes and William (1977)**

The table shows the regression results, explaining the BHAR's for the event windows [-250;10], [-10;10], and [-3;3] using the market model. The dependent variable is the buy and hold abnormal return [*BHAR*] for the respective time frame. *Long/Total Debt* is the fraction of long to total debt, *Fraction Debt* is the fraction of total debt to total liabilities, *FD_02* is an interaction term of the same fraction and *y_2002*, *TD/TA* denotes total debt to total assets, *E/TL* is common equity to total liabilities. *Size* is the natural log of total assets, *MTB* is the market to book ratio, *BSM_Prob* is the default probability determined by the Black and Scholes Merton model 250 days before the announcement and *BSM_Prob_10* is the default probability determined by the Black and Scholes Merton model 10 days before the announcement, *y_2002* is a dummy for 2002. "*Imminent*" is a dummy taking the value of one, if the company has filed under "imminent insolvency", and *Neuer Markt* is a dummy indicating if the company was traded on this market segment. ***,** and * indicates coefficients significant at 1%, 5% and 10% levels, respectively. Models 2-4 are variations of Model 1. Model 2 isolates Hypotheses 1 and 4, and Model 4 isolates Hypothesis 1.

| Panel B: GER | Model 1 | | | Model 2 | | | Model 3 | | | Model 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 | BHAR261 | BHAR21 | BHAR7 |
| Long/Total De | 0.0778 | -0.0617 | 0.0379 | | | | 0.0785 | | | | | |
| Fraction Debt | -0.2706 ** | 0.0297 | -0.0097 | | | | -0.2747 ** | | | | | |
| FD_02 | 0.2392 | -0.3561 | -0.1783 | | | | 0.2524 * | | | | | |
| TD/TA | 0.1308 *** | 0.0418 | 0.0319 | | | | 0.1389 *** | | | | | |
| E/TL | -0.0040 | 0.0054 | 0.0102 | | | | | | | | | |
| Size | -0.0093 | -0.0474 ** | -0.0374 ** | | | | | -0.0522 *** | -0.0459 *** | | | |
| MTB | -0.0003 | 0.0017 | 0.0008 | | | | | | | | | |
| BSM_Prob | 0.4159 ** | -0.7981 ** | -0.4832 ** | 0.3821 ** | -0.8253 *** | -0.4616 ** | 0.4286 ** | -0.8445 *** | -0.4784 ** | 0.5180 ** | -0.4317 * | -0.1611 |
| BSM_Prob_10 | | 0.4521 ** | 0.3429 *** | | 0.3661 ** | 0.1935 | | 0.4392 ** | 0.2577 ** | | 0.2748 | 0.1593 |
| y_2002 | -0.1486 ** | -0.0157 | -0.0692 | -0.0702 ** | -0.2106 *** | -0.1210 ** | -0.1589 ** | -0.1933 *** | -0.1058 * | | | |
| Imminent | 0.0439 | -0.0178 | 0.0149 | 0.0378 | -0.0253 | -0.0236 | 0.0496 | -0.0424 | -0.0386 | | | |
| Neuer Markt | -0.1153 *** | -0.0794 | -0.1693 *** | -0.1105 *** | -0.0726 | -0.1390 *** | -0.1189 *** | -0.0886 | -0.1531 *** | | | |
| Const | -0.6026 *** | 0.1080 | 0.0436 | -0.7364 *** | -0.3535 *** | -0.2999 *** | -0.7148 *** | 0.2098 | 0.1949 | -0.8176 *** | -0.4888 *** | -0.4365 *** |
| *N* | 80 | 92 | 92 | 90 | 102 | 102 | 80 | 102 | 102 | 90 | 102 | 102 |
| $R^2$ | 0.3755 | 0.2081 | 0.1592 | 0.2446 | 0.1430 | 0.1363 | 0.3687 | 0.1986 | 0.2070 | 0.1090 | 0.0439 | 0.0195 |
| *F* | 9.20 *** | 2.61 *** | 2.56 *** | 5.60 *** | 3.62 *** | 3.11 ** | 10.95 *** | 4.63 *** | 4.78 *** | 4.92 ** | 1.94 | 0.87 |
| *mean VIF* | 2.38 | 2.39 | 2.39 | 1.10 | 1.15 | 1.15 | 2.69 | 1.15 | 1.15 | 1.00 | 1.07 | 1.07 |

**Table A.3 a) P-values for the two sample t-tests for equal means**

The table reports the p-values for the 2-sample equal mean test with unequal variances. It presents the mentioned test statistics for different combinations of the full and matched US and German samples, and the firms in the S&P500 and CDAX indices.

**H0: equal mean (two sample t-test with unequal variances)**

| **TA** / **MTB** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.01** | **0.01** | | **0.00** | **0.00** |
| bankrupt_GER | 0.32 | | | 0.35 | **0.00** | **0.00** |
| **matched_US** | 0.38 | | | 0.93 | | |
| **matched_GER** | | 0.41 | 0.62 | | | |
| S&P 500 | 0.32 | 0.32 | | | | **0.00** |
| CDAX | 0.32 | 0.72 | | | 0.22 | |

| **S/TA** / **WC/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | 0.86 | 0.39 | | **0.00** | **0.09** |
| bankrupt_GER | **0.03** | | | 0.17 | **0.09** | 0.78 |
| **matched_US** | **0.08** | | | 0.93 | | |
| **matched_GER** | | **0.00** | 0.27 | | | |
| S&P 500 | **0.02** | 0.47 | | | | **0.00** |
| CDAX | **0.02** | **0.02** | | | **0.00** | |

| **CL/CA** / **EBITDA/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | **0.01** | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | 0.22 | 0.14 |
| **matched_US** | **0.00** | | | **0.04** | | |
| **matched_GER** | | 0.80 | 0.61 | | | |
| S&P 500 | **0.00** | **0.00** | | | | 0.35 |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **NI/TA** / **E/TL** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | **0.00** | | **0.00** | **0.00** |
| bankrupt_GER | 0.54 | | | 0.88 | **0.00** | **0.00** |
| **matched_US** | **0.08** | | | 0.26 | | |
| **matched_GER** | | **0.00** | **0.01** | | | |
| S&P 500 | 0.28 | **0.03** | | | | **0.00** |
| CDAX | 0.53 | 0.95 | | | **0.00** | |

| **BSM_250** / **BSM_10** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | **0.00** | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | **0.00** | **0.00** |
| **matched_US** | 0.79 | | | 0.92 | | |
| **matched_GER** | | **0.00** | **0.00** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **Fraction** / **Short/Total** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.27 | | **0.00** | **0.00** |
| bankrupt_GER | **0.04** | | | **0.00** | 0.89 | 0.12 |
| **matched_US** | 0.33 | | | **0.05** | | |
| **matched_GER** | | 0.84 | **0.03** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | 0.76 | **0.00** | | | **0.00** | |

| **TL/TA** / **TD/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.02** | **0.06** | | **0.01** | **0.01** |
| bankrupt_GER | **0.02** | | | **0.00** | 0.23 | 0.25 |
| **matched_US** | 0.13 | | | 0.24 | | |
| **matched_GER** | | **0.00** | 0.12 | | | |
| S&P 500 | **0.01** | 0.15 | | | | 0.72 |
| CDAX | **0.01** | **0.02** | | | **0.00** | |

**Table A.3 b) P-values for the two sample tests for equal medians**

The table reports the p-values for the 2-sample equal medians tests. It presents the mentioned test statistics for different combinations of the full and matched US and German samples, and the firms in the S&P500 and CDAX indices.

**H0: same median (Median test)**

| **TA** / **MTB** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.35 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.02** | **0.00** | **0.00** |
| **matched_US** | 0.22 | | | 0.85 | | |
| **matched_GER** | | **0.10** | 0.13 | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | 0.84 | | | **0.00** | |

| **S/TA** / **WC/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | 0.15 | **0.08** | | **0.00** | **0.01** |
| bankrupt_GER | **0.00** | | | 0.28 | 0.69 | **0.08** |
| **matched_US** | 1.00 | | | 0.19 | | |
| **matched_GER** | | **0.07** | 0.85 | | | |
| S&P 500 | **0.00** | 0.13 | | | | **0.00** |
| CDAX | **0.00** | **0.05** | | | **0.00** | |

| **CL/CA** / **EBITDA/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 1.00 | | **0.00** | **0.00** |
| bankrupt_GER | 0.12 | | | 0.11 | 0.28 | **0.02** |
| **matched_US** | 1.00 | | | 0.61 | | |
| **matched_GER** | | 1.00 | 0.85 | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **NI/TA** / **E/TL** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.68 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | 0.38 | **0.00** | **0.00** |
| **matched_US** | 0.89 | | | 0.14 | | |
| **matched_GER** | | **0.00** | 0.35 | | | |
| S&P 500 | **0.00** | 0.84 | | | | **0.00** |
| CDAX | **0.00** | 1.00 | | | **0.00** | |

| **BSM_250** / **BSM_10** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.50 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | **0.00** | **0.00** |
| **matched_US** | 0.68 | | | 0.85 | | |
| **matched_GER** | | **0.01** | **0.00** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **Fraction** / **Short/Total** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.34 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | 0.77 | **0.02** |
| **matched_US** | 0.58 | | | **0.10** | | |
| **matched_GER** | | 0.34 | **0.01** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | 0.36 | **0.01** | | | **0.00** | |

| **TL/TA** / **TD/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.14 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | 0.84 | 0.84 |
| **matched_US** | 0.89 | | | 0.85 | | |
| **matched_GER** | | **0.00** | **0.02** | | | |
| S&P 500 | **0.00** | 0.76 | | | | **0.01** |
| CDAX | **0.00** | **0.04** | | | **0.00** | |

**Table A.3 c) P-values for the two-sample Wilcoxon rank-sum (Mann-Whitney) tests**

The table reports the p-values two-sample Wilcoxon rank-sum (Mann-Whitney) tests. It presents the mentioned test statistics for different combinations of the full and matched US and German samples, and the firms in the S&P500 and CDAX indices.

**H0: same distribution (Two-sample Wilcoxon rank-sum (Mann-Whitney) test)**

| **TA** / **MTB** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.01** | 0.32 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.02** | **0.00** | **0.00** |
| **matched_US** | 0.41 | | | 0.95 | | |
| **matched_GER** | | **0.02** | **0.04** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | 0.26 | | | **0.00** | |

| **S/TA** / **WC/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | 0.41 | **0.07** | | **0.00** | **0.05** |
| bankrupt_GER | **0.00** | | | 0.44 | **0.09** | **0.10** |
| **matched_US** | 0.43 | | | 0.17 | | |
| **matched_GER** | | **0.00** | 0.21 | | | |
| S&P 500 | **0.00** | 0.82 | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **CL/CA** / **EBITDA/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.62 | | **0.00** | **0.00** |
| bankrupt_GER | **0.02** | | | **0.00** | 0.46 | **0.00** |
| **matched_US** | 0.54 | | | **0.10** | | |
| **matched_GER** | | 0.34 | 0.18 | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **NI/TA** / **E/TL** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.18 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | 0.99 | **0.00** | **0.00** |
| **matched_US** | 0.94 | | | 0.14 | | |
| **matched_GER** | | **0.00** | **0.01** | | | |
| S&P 500 | **0.00** | 0.44 | | | | **0.00** |
| CDAX | **0.00** | 0.60 | | | **0.06** | |

| **BSM_250** / **BSM_10** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.34 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | **0.00** | **0.00** |
| **matched_US** | 0.98 | | | 0.90 | | |
| **matched_GER** | | **0.00** | **0.00** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.00** | **0.00** | | | **0.00** | |

| **Fraction** / **Short/Total** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.24 | | **0.00** | **0.00** |
| bankrupt_GER | **0.01** | | | **0.00** | 0.65 | **0.01** |
| **matched_US** | 0.84 | | | **0.03** | | |
| **matched_GER** | | 0.85 | **0.03** | | | |
| S&P 500 | **0.00** | **0.00** | | | | **0.00** |
| CDAX | **0.03** | **0.00** | | | **0.00** | |

| **TL/TA** / **TD/TA** | bankrupt_ US | bankrupt_ GER | **matched_ US** | **matched_ GER** | S&P 500 | CDAX |
|---|---|---|---|---|---|---|
| bankrupt_US | | **0.00** | 0.11 | | **0.00** | **0.00** |
| bankrupt_GER | **0.00** | | | **0.00** | 0.37 | 0.33 |
| **matched_US** | 0.50 | | | 0.31 | | |
| **matched_GER** | | **0.00** | **0.08** | | | |
| S&P 500 | **0.00** | 0.91 | | | | 0.80 |
| CDAX | **0.00** | **0.01** | | | **0.00** | |