

# Systemic Risk: Is the Banking Sector Special?

Wolfgang Bühler and Marcel Prokopczuk\*

January 2007

## Abstract

In this paper we empirically investigate the degree of systemic risk in the banking sector versus other industry sectors of Germany and the United States. We characterize the systemic risk in each sector by the tail dependence of stock returns. Our study differs from the existing literature in three aspects. First, we compare the degree of systemic risk in the banking sector with other sectors in the economy. Second, we analyze how the systemic risk depends on the state of the economy and of the stock market. Third, we investigate the problem of systemic risk in an international context by comparing the German and the US banking system. Our study shows in seven out of eight cases considered that the systemic risk of the banking sector is significantly larger than in all other sectors. Moreover, the degree of systemic risk is higher under adverse market conditions. Finally we find that the banking sector in Germany shows a lower systemic risk than the US banking sector. Assuming that the interbank integration does not differ considerably between the German and the US banks in the sample, this finding implies that the regulation in Germany is more successful.

**JEL classification:** G21, G15, G28, G11

**Keywords:** Systemic Risk, Copulas, Systemic Crisis, Empirical Study, Germany vs. US

---

\*Prof. Dr. Dr. h.c. Wolfgang Bühler, Marcel Prokopczuk: Chair of Finance, University of Mannheim, D-68131 Mannheim, Germany. Contact e-Mail: prokopczuk@uni-mannheim.de.

# 1 Introduction

In this paper we empirically investigate the degree of systemic risk in the banking sector versus other industry sectors of Germany and the United States. To the best of our knowledge this is the first study that compares the specific systemic risk between different sectors in the economy and for different states of the stock market and the business cycle. In line with most of the literature we define systemic risk in the banking sector as the risk of the failure of the financial system caused by the default of one banking institution.<sup>1</sup> This definition is analogously used for any other sector of an economy.

It is well known that the systemic risk in the banking sector is of utmost importance for the entire economy and, therefore, subject to extensive regulation. In addition, systemic risk in the more general sense plays an important role in portfolio management, as an increase in dependence of asset returns during downside movements may spoil diversification effects when they are needed most.<sup>2</sup>

The empirical literature on systemic risk can be roughly grouped into two streams. The first analyzes the degree of systemic risk in an economy arising from possible contagion effects through the interbank market. These contagion effects depend on the netting system and the banking structure of the economy and are thus primarily conducted on a domestic level by central bank researchers of the examined economy, e.g. Switzerland (Sheldon and Maurer (1995)), Italy (Angelini et al. (1996)), Sweden (Blåvarg and Nimander (2002)), Denmark (Bech et al. (2002)), USA (Furfine (2003)), UK (Furfine (2003)), Germany (Upper and Worms (2004)), Belgium (Degryse and Nguyen (2004)), Austria (Elsinger et al. (2006)) and the

---

<sup>1</sup>De Bandt and Hartmann (2000) and Kaufman and Scott (2003) discuss various aspects of systemic risk.

<sup>2</sup>Das and Uppal (2004) and Kole et al. (2006) analyze this problem in a continuous-time framework.

Netherlands (van Lelyveld and Liedorp (2006)). The majority of these studies find that the risk of contagion within the interbank system is low.

The second stream of literature analyzes the systemic risk in the banking sector utilizing stock market data. Our paper belongs to this second stream. This literature can be further divided into two groups. The first group employs the event study methodology to examine how adverse events have contagious effects on banks' equity. Adverse events are either actual bank failures (e.g. Aharony and Swary (1983), Wall and Peterson (1990), Saunders and Wilson (1996)) or global financial crises<sup>3</sup> (e.g. Musumeci and Sinkey Jr. (1990), Kho et al. (2000), Bartram et al. (2005)). The evidence for contagion in the banking sector of these studies is ambiguous.

The second group makes use of time series information from stock markets to study the dependence structure between banking institutions. Our paper is closely related to this work. Using an option-theoretic approach Lehar (2005) finds that systemic risk increases in Japan and decreases in North America in the time period from 1988 to 2002. Other papers employ a correlation study of bank stock returns to analyze the degree of systemic risk. De Nicolo and Kwast (2001) find rising correlations of bank stock returns in the US between 1988 and 1999, indicating an increasing systemic risk. Schüler (2002) finds similar results for Europe using a sample from 1980 to 2001.

This approach based on the correlation of returns suffers from the fact that, as empirically shown, correlation differs for upside and downside movements (see e.g. Ang and Chen (2002)).

Therefore, other studies focus on the tail of the joint distribution, e.g. Gropp et al. (2006)

---

<sup>3</sup>Typical crises considered are the Mexican crisis 1982, the Asian crisis 1998, the Russian crisis 1998, the LTCM crisis 1998 or 09/11 2001.

who analyze the joint co-exceedance of bank returns and find increasing dependence since the introduction of the Euro. Hartmann et al. (2005) apply a tail measure of extreme downside dependence to analyze the banking system stability in Europe and the US. They find a higher degree of systemic risk in the US when compared with Europe and an increase in both regions since 1990.

Our paper differs from the existing literature, especially from Hartmann et al. (2005), in the following ways:

First, we do not only analyze the banking sector, but compare the degree of systemic risk in this sector with other sectors in the economy. This enables us to put the results into a perspective and allows an analysis whether the systemic risk in the banking sector is effectively larger than in other, non-regulated sectors of the economy.

Second, we analyze how the systemic risk depends on the state of the economy and the market. Important state variables are the growth rate of the economy (recessions vs. booms), the growth rate of the stock market (bear vs. bull market) and the volatility of stock market returns.

Third, we investigate the problem of systemic risk in an international context by comparing the German and the US banking system and relate the results to the degree of systemic risk in other sectors of these two economies. This approach allows us to study the consequences of different regulation systems on the degree of systemic risk.<sup>4</sup>

We consider the systemic risk for 10 different sectors in Germany and 12 different sectors in the US using stock market data from 1990 to 2006. The systemic risk of a sector is measured by the tail dependence of stock returns for firms operating in the same industry. Economically,

---

<sup>4</sup>Hartmann et al. (2005) compare the US and European banking systems as well.

the tail dependence of stock returns characterizes the probability that  $N$  companies of a sector default in the same period given that one company defaults. By definition the tail dependence depends on the copula underlying the joint stock returns of these firms.

We use a two-parametric Archimedean copula which combines analytical tractability with the flexibility of modelling different degrees of dependencies in the lower and the upper tail of the distribution. The tail dependence is estimated for up to five dimensions in the entire sample period and for selected subperiods. To detect changes in the dependence structure and the crisis probability we use three different definitions of adverse market conditions. First of all, we estimate the degree of systemic risk within one sector during bear and bull markets. Next, we analyze the changes between volatile and tranquil stock market conditions, and last, we estimate the joint default probability during recession and boom periods.

Our study yields the following main results. First, in seven out of eight cases considered, the systemic risk of the banking system is significantly larger than in all other sectors. This is true for Germany and the US. The degree of systemic risk differs most during adverse market conditions. This result shows that the banking sector is more vulnerable against shocks than the other sectors of the economy. However, it neither implies that the banking sector should be regulated more, nor does it imply the converse.

Second, under adverse market conditions the systemic risk in the banking sector is higher than under non-adverse conditions for Germany as well as for the US. This finding confirms that the financial regulator should be especially aware of possible contagion effects during these adverse market conditions.

Third, the banking sector in Germany shows a lower systemic risk than the US banking sector.

Assuming that the interbank integration do not differ considerably between the German and the US banks in the sample, this finding implies that the regulation in Germany is more successful.

The remainder of this paper is organized as follows. Section 2 introduces the tail dependence coefficient as measure of dependence and systemic risk and discusses its estimation. In section 3 we describe our dataset and give some summary statistics. The results of our study are discussed in section 4. Section 5 concludes.

## 2 Measuring and Estimation of Systemic Risk

### 2.1 Measuring systemic risk

We define the degree of systemic risk by the conditional probability of joint defaults of several companies given that one company defaults. If a company defaults its stock price is assumed to be zero and its log stock return relative to the last non-zero stock price is  $-\infty$ . The conditional probabilities of joint extreme downward movements of  $N$  stock returns is characterized by the dependence in the lower tail of the joint distribution. The traditional dependence measure of two random variables is Pearson's correlations coefficient. However, it is well known that the correlation coefficient has several shortcomings for measuring the dependence in the distributions' tails.<sup>5</sup> It is a dependence measure of the entire distribution, not only the part we are interested in. Moreover, it is not able to capture non-linear dependencies and is

---

<sup>5</sup>For a detailed critical discussion of the correlation coefficient as dependence measure see Embrechts et al. (2002). They show that the range of values the correlation coefficient can take on is depending on the margins. Gropp and Moerman (2004) find non-linear dependencies in bank stock returns and thus, reject the hypothesis of the multivariate Gaussian distribution.

not independent of the marginal distributions and thus, is not a function of the dependence structure only, which makes it impossible to disentangle effects in the marginal distributions and the dependence structure.

To overcome these shortcomings it is common to use a copula based measure of dependence. Copulas have become popular in the empirical literature to study complex dependence structures of financial markets. They have been used to characterize the dependence structure of currency exchange rates (e.g. Breymann et al. (2003) and Patton (2006)), of international equity markets (e.g. Longin and Solnik (2001), Fortin and Kuzmics (2002), Ané and Kharoubi (2003), Patton (2004), Rodriguez (2006) and Hu (2006)) and of individual stock return pairs (e.g. Junker and May (2005)). They unanimously find asymmetric degrees of dependencies in the lower and upper tails of asset returns.

A copula is a function  $C : [0, 1]^N \rightarrow [0, 1]$  which binds together the  $N$  univariate margins  $F_1, F_2, \dots, F_N$  to the joint distribution  $F$ , i.e.

$$F(x_1, x_2, \dots, x_N) = C(F_1(x_1), F_2(x_2), \dots, F_N(x_N)) \quad (1)$$

It can be considered as a multivariate distribution function with uniformly distributed margins. This function carries the same information about the dependence structure as the multivariate distribution  $F$ , however, it is completely independent of the marginal distributions. Based on the copula the dependence structure in the tails of the multivariate distribution can be characterized as a limit of conditional probabilities. E.g. the lower tail dependence coefficient of two random variables  $X_1$  and  $X_2$  with marginal distribution

functions  $F_1$  and  $F_2$  is defined as.<sup>6</sup>

$$\lambda_L = \lim_{u \downarrow 0} P[X_1 < F_1^{-1}(u) | X_2 < F_2^{-1}(u)] \quad (2)$$

This coefficient measures the probability that one random variable has a value in the lower tail of its distribution, given that the other variable exhibits an analogous behavior.  $\lambda_L$  is restricted to values between 0 and 1. In case the  $X_i$  represent stock returns,  $\lambda_L$  can be interpreted as the probability that one company defaults, given that another company defaults.

If  $C$  is the copula of  $X_1$  and  $X_2$  we can compute  $\lambda_L$  as

$$\lambda_L = \lim_{u \downarrow 0} \frac{C(u, u)}{u} \quad (3)$$

Equation (3) shows that  $\lambda_L$  does only depend on the copula and not on the marginal distributions. If  $\lambda_L > 0$ ,  $X_1$  and  $X_2$  are defined as asymptotically dependent, in case of  $\lambda_L = 0$ ,  $X_1$  and  $X_2$  are asymptotically independent. The best known example for a copula with asymptotic independence is the Gauss copula, which represents the dependence structure of the multivariate Gaussian distribution.<sup>7</sup> Since we are interested in the multivariate case, we generalize (2) to  $N$  random variables  $X_1, \dots, X_N$

$$\lambda_L^N = \lim_{u \downarrow 0} P[X_1 < F_1^{-1}(u) \wedge \dots \wedge X_{N-1} < F_{N-1}^{-1}(u) | X_N < F_N^{-1}(u)] \quad (4)$$

---

<sup>6</sup>The upper tail dependence coefficient can be defined analogously.

<sup>7</sup>Tail independence (for  $\rho < 1$ ) of the Gaussian copula has been shown by Sibuya (1960). A common example for a copula with tail dependence is the Student-t copula. An overview of various copulas and their tail dependence coefficients can be found in Heffernan (2000).

Analogous to the bivariate case, it is possible to show that (4) can be represented by means of the underlying copula:

$$\lambda_L^N = \lim_{u \downarrow 0} \frac{C(u, u, \dots, u)}{u} \quad (5)$$

If  $X_1, \dots, X_N$  denote stock market returns,  $\lambda_L^N$  is the probability that  $N$  companies default, given that one defaults.

## 2.2 Estimation of the Tail Dependence Coefficient

Various ways to estimate the tail dependence coefficient have been proposed in the literature. Schmidt and Stadtmüller (2003) discuss nonparametric approaches. A semiparametric approach can be found in Genest et al. (1995). Frahm et al. (2005) compare various methods in a simulation study. As our empirical study will be based on relatively small samples we follow a parametric approach and use the two-parametric Archimedean copula BB7 (see Joe (1997). p.153).<sup>8</sup> This copula is given by

$$C_{BB7}(u_1, \dots, u_N) = 1 - \left[ ((1 - (1 - u_1)^\theta)^{-\delta} + \dots + (1 - (1 - u_N)^\theta)^{-\delta} - (N - 1))^{-1/\delta} \right]^{1/\theta} \quad (6)$$

where the generator function  $\varphi(x)$  is defined as  $\varphi(x) = (1 - (1 - x)^\theta)^{-\delta} - 1$ , ( $\theta \geq 1, \delta > 0$ ). The BB7 copula has several desirable properties for our application. First of all, it is parsimoniously parameterized and analytically tractable. Second, it allows for different degrees of tail dependence in the lower and the upper tail. Moreover, the coefficient of lower (upper) tail dependence depends on  $\delta$  ( $\theta$ ) only, i.e. each parameter determines the

---

<sup>8</sup>The class of Archimedean copulas is characterized by the following representation:  $C(u_1, \dots, u_N) = \varphi^{-1}(\varphi(u_1) + \dots + \varphi(u_N))$ , with  $\varphi : [0, 1] \rightarrow [0, \infty]$ , strictly monotonic decreasing and  $\varphi(1) = 0$ .

dependence in one of the two tails. This is an important property as it allows us to identify the tail dependence in the lower tail independently from the upper tail. For  $\delta \rightarrow 0$  and  $\theta = 1$  the variables are asymptotically independent in the lower and upper tail, respectively. The last important advantage of the BB7 Copula, which is shared with all Archimedean copulas, is the straightforward extension to higher dimensions.

Using definition (5) we can directly compute the lower tail dependence coefficient of the BB7 copula for various dimensions. We get

$$\lambda_L^N = N^{-\frac{1}{\delta}} \quad (7)$$

The upper tail dependence coefficient has an analogous representation as a function of  $N$  and  $\theta$ . Since we only consider the lower tail dependence coefficient we drop the subscript  $L$  in the following to make notation simpler.

To estimate the copula parameters we utilize the semi-parametric Canonical Maximum Likelihood (CML) approach (see Joe and Xu (1996)). In the first step of the CML method we estimate for each firm  $i$ , ( $i = 1, \dots, N$ ) an empirical distribution function  $\hat{F}_i$  of stock returns.  $\hat{F}_i$  is estimated in a standard way on the basis of a time series of  $T$  observed consecutive stock returns  $(x_{i1}, \dots, x_{iT})$ . Next, the stock returns  $x_{it}$  are transformed into the interval  $[0, 1]$  by

$$(\hat{u}_{1t}, \dots, \hat{u}_{Nt}) = (\hat{F}_1(x_{1t}), \dots, \hat{F}_N(x_{Nt})). \quad t = 1, \dots, T \quad (8)$$

In the second step we estimate the copula parameters by maximizing the likelihood function

$$L(\delta, \theta) = \sum_{t=1}^T \log c(\hat{F}_1(x_{1t}), \dots, \hat{F}_N(x_{Nt}); \delta, \theta) \quad (9)$$

with respect to the two tail parameters. Here  $c(\cdot)$  denotes the density of the copula function. The CML approach has two advantages. It is computationally faster than a one step estimation approach and we do not have to make parametric assumptions about the marginal distributions, thereby reducing the likelihood of misspecifications, which would bias our estimation of the dependence structure.

To compute standard errors we apply a block-bootstrap approach as our data show significant intertemporal dependencies. Based on  $T$  observations we use a moving-block-bootstrap with a blocklength  $l = T^{1/3}$  and  $T - l + 1$  overlapping blocks.<sup>9</sup>

In summary, our estimation consists of the following steps:

1. Determine  $\hat{F}_i$  nonparametrically as the empirical distribution functions.
2. Transform the observations  $x_{it}$  with  $\hat{F}_i$  into pseudo observations  $\hat{u}_{it} := \hat{F}_i(x_{it})$ .
3. Estimate the copula parameters  $(\delta, \theta)$  with maximum likelihood.
4. Compute  $\hat{\lambda}^N$  with Equation (7).
5. Calculate  $\hat{\sigma}(\hat{\lambda}^N)$  with the block-bootstrap as described above.

---

<sup>9</sup>See Hall et al. (1995) on the choice of the blocklength in a block-bootstrap.

## 3 Data and Sample Periods

### 3.1 Data

We use stock market returns from Germany and the United States. All returns are calculated on a total return basis. Our sample spans the period from the 01-Jan-1990 to 31-Dec-2006. This length was chosen as a trade-off between the need of a period long enough to include different economic conditions and data availability. To analyze the systemic risk on a sectoral level we make use of the Industrial Classification Benchmark (ICB)<sup>10</sup> which classifies all companies into one of the 10 industries: oil & gas, basic materials, industrials, consumer goods, health care, consumer services, telecommunications, utilities, financials and technology. If one company operates in more than one industry it is assigned to the sector in which it generates the highest revenues. All data is obtained from Thomson Financial Datastream.

As we are especially interested in the banking sector we analyze the financial sector on a more detailed level and split it into banks and insurance companies. The consumer goods industry consists of the sectors automobiles & parts, food & beverage and personal & household goods. Due to the importance of the automotive industry especially in Germany we also subdivide the consumer industry into these three sectors. In total we consider 13 sectors.

We select five companies from each sector. Our first criterion is the market value of the company, as an indicator for the importance of a company in its sector. We exclude all companies with a free float below 25% of stocks because of potential illiquidity problems.<sup>11</sup>

---

<sup>10</sup>See [www.icbenchmark.com](http://www.icbenchmark.com).

<sup>11</sup>We make one exception from this rule for the German banking companies and include the Hypovereinsbank in our sample. The Hypovereinsbank was acquired by the Italian Unicredit in November 2005 which owns today more than 90%. However, as we do not want to lose the second largest Bank of Germany from our sample we include the stock in our analysis.

The second criterion is availability of data. We favour companies where we have stock price information for the entire sample period.

For the oil & gas sector we are not able to find enough companies in both markets, Germany and the US. For the telecommunication and the utilities sector there is sufficient data for the US market only. This leaves us with 12 sectors in the US and 10 sectors in Germany.

Table 17 and 18 in the appendix report the selected companies of Germany and the United States, respectively. For each company we give a brief description of their main activities.

The homogeneity of the business lines in most of the different sectors can be regarded as well balanced. By the nature of the sector, we have rather inhomogeneous business activities in the consumer services sector. This is true for Germany as well as for the US. Among others, we have picked an airline carrier and a publisher in Germany. In the US we selected a DIY store company and a fastfood restaurant chain. This heterogeneity could only be resolved by splitting up the sector, as we have done for the financial and the consumer industries.

However, this would lead us into data availability problems as we require five companies from each sector with long enough time series information. For most of the sectors we believe the degree of homogeneity of the lines of business to be sufficient and comparable among sectors.

Before beginning our study of systemic risk, we analyze the time series data on a univariate level. The results are reported in Table 19 and 20, respectively. In these tables we also report the ISIN numbers of the stocks to make each uniquely identifiable. The start and end date of each time series is given in the following columns. In the US the entire sample period is available for each company. In Germany we have in some sectors only shorter periods available. In the banking sector we only miss the first 14 months of Depfa Bank, in the

automobile, basic materials, consumer services, food & beverage and industrials sectors the data sets are complete. In the next two columns we report the annualized daily mean returns and the annualized return volatilities. Except for GEA (formerly known as Metallgesellschaft), Nuernberger and Infineon the average return is positive, the annualized standard deviation is for most companies between 20% and 40%. The skewness is neglectable for the greater part of the sample, however, the excess kurtosis is clearly above zero for all return series. Consequently, the Jarque-Bera test of normality reported in the last column is rejected for every company at the 1% level. We perform for all series the Augmented-Dickey-Fuller test of stationarity, and are able to reject the null of non-stationarity in every case at the 1% level. The Q-Statistic of Ljung and Box tests the null hypothesis of independence and must be rejected at the 1% level in 29 out of 50 cases for the German data and in 39 out of 60 cases for the US data. Due to this evidence of autocorrelation we will use the block-bootstrap procedure to estimate standard errors of our estimates as described in the previous section.

## **3.2 Sample Periods**

We aim to estimate the systemic crisis probability during different economic conditions. To do so we select subperiods out of the whole sample period. First, we compare the risk during bearish and bullish markets in each sector. To identify these periods we calculate for each sector the six months index returns using a rolling window over the entire sample period. We single out the period with the lowest return as bear market period. As bull market period we use the subsample which has the the highest index return. In the similar way we select periods of high and low volatility. The growth rate of the GDP serves as the third indicator

of adverse conditions, i.e. we subsample recession and boom periods. In Germany we identify four recession periods, indicated by at least two consecutive quarters of significant negative growth. In the US, we identify two recession periods.<sup>12</sup>

## 4 Results

### 4.1 Entire Sample Period

Applying the technique described in the previous sections to the sampled stock price returns we estimate the crisis probability for two to five companies (i.e.  $N = 2, \dots, 5$  in Equation (7)) belonging to the same industry sector. The higher  $N$ , the more companies are involved and the more one can speak of systemic risk.

Table 1 reports the systemic crisis probabilities in Germany estimated over the entire sample period from 1990 to 2006. Theoretically the crisis probability should decrease with an increasing number of firms involved. This holds for all industries considered.

In the German banking sector the crisis probability is 44.40% in the bivariate case, falling to 1.32% when dealing with five banks. The crisis coefficient  $\lambda^N$  is significantly different from zero in all cases.

In the other sectors, we can make out two different main groups. First, the automotive, the basic material and the industrials sectors show significant degrees of systemic risk also.

Compared to the banking sector higher default probabilities in the bivariate case for the

---

<sup>12</sup>The identification of recession periods in the US is delicate as we hardly observe negative GDP growth rates during the observation period. We identify two short recessions 09/1990–03/1991 and 01/2001–09/2001. The second one does not completely fulfil our criterion of two consecutive quarters with negative GDP growth, as we have a positive growth rate in the second quarter of 2001.

Table 1: **Germany: Systemic Risk in the entire Period**

*This table reports the estimation results of the crisis coefficient for the entire sample period and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\hat{\lambda}^2$	$\hat{\lambda}^3$	$\hat{\lambda}^4$	$\hat{\lambda}^5$
Automobiles & Parts	0.4683***	0.1664***	0.0199**	0.0010*
Banks	0.4440***	0.2868***	0.0624***	0.0132**
Basic Material	0.5509***	0.2023***	0.0143***	0.0028**
Consumer Services	0.0166	0.0042	0.0000	0.0001
Food & Beverage	0.0000	0.0000	0.0000	0.0000
Healthcare	0.0762**	0.0020	0.0003	0.0000
Industrials	0.3284***	0.1064***	0.0251**	0.0019*
Insurance	0.5156***	0.1655***	0.0020*	0.0000
Pers. & Household	0.0434***	0.0070**	0.0011	0.0000
Technology	0.3502**	0.0819	0.0266*	0.0123*

automotive and basic material sectors are observed. However, the degree falls to values 5–10 times smaller than in the banking sector for the five companies case. Second, the sectors consumer services, food & beverage, healthcare and personal & household goods show only weak or no signs of systemic risk. For the insurance and the technology sectors the results are inconclusive. The insurance sector shows a high crisis probability for low dimensions but it is falling to zero when increasing the number of companies involved. This indicates a high dependence between the big players of the industry but weak connections to smaller companies. The technology sector exhibits the contrary case. For two companies the crisis probability is 35.02%, in the five firms case the second highest value in the sample of 1.23% is observed, indicating a constant degree of dependence among many firms of the sector.

To see whether the finding of a higher systemic risk in the banking sector is also statistically significant we perform a cross-sectional test with each other sector. The null hypothesis is a smaller crisis coefficient in the banking industry. Table 2 reports the differences of the default probabilities in the banking and the other sectors and whether they are significantly

Table 2: **Germany: Cross Sectional Differences**

*This table reports the cross sectional differences between the banking sector and the other sectors for the entire sample period and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	-0.0243	0.1203***	0.0425**	0.0122
Basic Material	-0.1069	0.0845***	0.0481	0.0104
Consumer Services	0.4275***	0.2825***	0.0623***	0.0131
Food & Beverage	0.4440***	0.2868***	0.0624***	0.0132
Healthcare	0.3678***	0.2847***	0.0620***	0.0132
Industrials	0.1156***	0.1804***	0.0372*	0.0113
Insurance	-0.0715	0.1213***	0.0604***	0.0132
Pers. & Household	0.4006***	0.2797***	0.0612***	0.0132
Technology	0.0938***	0.2048***	0.0358*	0.0009

different from zero. A negative value means that the risk is lower in the banking sector. This is only the case for three sectors when considering two companies. One sees that up to four companies most of the differences are significantly different from zero. In the five companies case the null hypothesis cannot be rejected, although we have remarkably higher results.

Table 3 reports the results for the US. We find again a high degree of systemic risk in the banking sector. Starting from 36.63% for the two companies case, which is a little smaller than in Germany, the crisis probability stays significantly above zero with a remaining value of 5.52% for five banks, noticeably higher than for the other sectors. This value is more than four percentage points higher than in Germany.

In the other US industry sectors the systemic risk is significantly different from zero in all cases. Sectors with relative high systemic risk (at the five companies level) include healthcare, technology and the utilities sector. For the two companies case, the insurance sector shows a surprisingly low value of 1.85%, indicating almost no dependence in this sector.

Table 3: **USA: Systemic Risk in the entire Period**

*This table reports the estimation results of the crisis coefficient for the entire sample period and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\hat{\lambda}^2$	$\hat{\lambda}^3$	$\hat{\lambda}^4$	$\hat{\lambda}^5$
Automobiles & Parts	0.0794***	0.0209**	0.0146***	0.0042**
Banks	0.3663***	0.1969***	0.0922***	0.0552***
Basic Materials	0.3016***	0.0815***	0.0280***	0.0042**
Consumer Services	0.3007***	0.0542***	0.0111**	0.0027**
Food & Beverage	0.2708***	0.0407**	0.0048**	0.0018*
Healthcare	0.2968***	0.1363***	0.0355***	0.0176***
Industrials	0.1789***	0.0855***	0.0273***	0.0092**
Insurance	0.0185*	0.0184*	0.0060**	0.0029**
Pers. & Household	0.0697*	0.0303**	0.0099**	0.0013*
Technology	0.2197***	0.1044***	0.0451***	0.0183***
Telecommunications	0.4133***	0.0911***	0.0233***	0.0029**
Utilities	0.3064***	0.1391***	0.0614***	0.0347***

Comparing the US industry sectors with their German counterparts we observe for many sectors smaller crisis probabilities for two companies but higher ones for four or five companies. This finding indicates higher dependencies between the market leaders in Germany but a higher degree of overall dependence in the US.

Performing the test of cross-sectional differences for the US yields conclusive evidence for higher systemic risk in the banking sector. As displayed in Table 4 for two companies 10 out of 11 sectors show significantly lower probabilities. At the five firms level, we find significantly different values for all but the technology and the utilities sector.

## 4.2 Bull vs. Bear Markets

We analyze the systemic risk during bear and bull markets of the respective sectors. Table 5 displays the results for Germany. It reports the systemic risk in each sector for two to five companies. For each case the third column gives the difference of the two values and whether

Table 4: **USA: Cross Sectional Differences**

*This table reports the cross sectional differences between the banking sector and the other sectors for the entire sample period and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.2868***	0.1760***	0.0776***	0.0510*
Basic Materials	0.0646***	0.1154***	0.0642**	0.0510**
Consumer Services	0.0656***	0.1427***	0.0811***	0.0525**
Food & Beverage	0.0955***	0.1562***	0.0875***	0.0533**
Healthcare	0.0695***	0.0606**	0.0567*	0.0375*
Industrials	0.1874***	0.1114***	0.0649**	0.0460*
Insurance	0.3483***	0.1785***	0.0862***	0.0522**
Pers. & Household	0.2966***	0.1666***	0.0823***	0.0539*
Technology	0.1466***	0.0925***	0.0472*	0.0368
Telecommunications	-0.0470	0.1058***	0.0689**	0.0523**
Utilities	0.0599***	0.0578**	0.0308	0.0204

it is significantly different from zero.

Analyzing the banking sector first, we find a high conditional default probability of 72.92% for two banks during bear markets, but it is not significantly higher than in the bull market, where it stays at 65.18%. Three banks exhibit slightly higher values for the bull market. However, increasing the number of banks involved we find evidence of a higher systemic risk during bear markets, which is 11.74% for five banks compared to 1.07% in bull markets.

In the other sectors the results are less conclusive. Except for the basic material sector there is no evidence supporting a higher degree of systemic risk during bear markets. In many instances one observes higher crisis probabilities in bull markets compared with the overall results of the previous section. This may indicate that periods of fast rising stock prices are also vulnerable for shocks (burst of a bubble), although the evidence is not conclusive.

In Table 6 the cross-sectional differences with the banking industry and the degree of significance are reported. All values are significant at the 1% level, yielding clear evidence of

Table 5: **Germany: Systemic Risk in bear and bull markets**

*This table reports the estimated crisis coefficients for the different sectors during bearish and bullish market conditions and whether it is significantly different from zero. The column  $\Delta$  gives the difference and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	N = 2			N = 3		
	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$
Automobiles & Parts	0.4454***	0.5084***	-0.0630	0.1818***	0.1613***	0.0205
Banks	0.7292***	0.6518***	0.0774	0.5234***	0.5243***	-0.0009
Basic Material	0.5185***	0.4700***	0.0484	0.1897**	0.1490*	0.0408
Consumer Services	0.1430	0.0754	0.0676***	0.0531	0.0013	0.0518**
Food & Beverage	0.0000	0.1973*	-0.1972	0.0000	0.0000	0.0000
Healthcare	0.3329***	0.0480	0.2849***	0.0187	0.0000	0.0187
Industrials	0.2840**	0.6390***	-0.3551	0.2549***	0.2501***	0.0048
Insurance	0.5558***	0.5604***	-0.0046	0.2712***	0.1681**	0.1031*
Pers. & Household	0.0855	0.0000	0.0855**	0.0343	0.0091	0.0251
Technology	0.0558	0.3707***	-0.3149	0.0376	0.1128***	-0.0752

  

	N = 4			N = 5		
	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$
Automobiles & Parts	0.0492*	0.0179*	0.0312*	0.0048	0.0001	0.0047
Banks	0.2018***	0.0603***	0.1414***	0.1174***	0.0107**	0.1067***
Basic Material	0.0854*	0.0225	0.0628*	0.0383*	0.0017	0.0366*
Consumer Services	0.0037	0.0000	0.0037	0.0040	0.0008	0.0032
Food & Beverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Industrials	0.0865**	0.0438*	0.0427	0.0126*	0.0009	0.0117
Healthcare	0.0117	0.0000	0.0117	0.0041*	0.0000	0.0041
Insurance	0.0199	0.0117	0.0082	0.0001	0.0003	-0.0002
Pers. & Household	0.0067	0.0000	0.0067	0.0005	0.0000	0.0005
Technology	0.0058	0.0116	-0.0058	0.0014	0.0014	-0.0001

higher systemic risk in the banking sector compared with other sectors given the respective sector is in a bearish condition.

Table 7 presents the estimation results during bear and bull markets for the US. For two banks we find a systemic crisis probability of 67.01% in bear markets which is almost 100% higher than in the entire sample period. For the bull market, the probability is less than half compared to the entire period and less than a fourth of the bear market value. This pattern sustains while increasing the number of banks considered. For five banks a crisis probability

Table 6: **Germany: Cross Sectional Differences in bearish markets**

*This table reports the cross sectional differences between the banking sector and the other sectors during bearish market conditions and whether it is significantly different from zero. The column  $\Delta$  gives the difference and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.2259***	0.3981***	0.1525***	0.0978***
Basic Material	0.1726***	0.3403***	0.0488***	0.0747***
Consumer Services	0.7339***	0.5799***	0.1852***	0.1003***
Food & Beverage	0.7416***	0.5942***	0.1894***	0.1013***
Industrials	0.3000***	0.3141***	0.1092***	0.0978***
Healthcare	0.4408***	0.5887***	0.1861***	0.0996***
Insurance	0.2160***	0.3959***	0.1792***	0.1013***
Personal & Household Goods	0.6504***	0.5483***	0.1846***	0.1012***
Technology	0.2649***	0.5014***	0.1210***	0.0767***

of 22.30% is estimated in bear markets (four times higher than in the entire sample), whereas the probability for the bull market is only 0.74% (seven times lower than in the entire sample).

All differences are significantly different from zero.

The automobile and industrials sectors show similar patterns, although on a lower level. For the other sectors we observe rising crisis probabilities during bear markets compared to the entire sample period. For about 50% of the cases we find higher crisis probabilities in bull markets, which is, as in Germany, indication for a high downside dependence during periods of rising prices.

Testing whether the differences between the banking sector and the other industries are significant gives again conclusive evidence. Table 8 reports the results. For 7 out of 11 cases the difference is significant at the 1% level, for the other four cases at the 5% or 10% level.

Table 7: **USA: Systemic Risk in bear and bull markets**

*This table reports the estimated crisis coefficients for the different sectors during bearish and bullish market conditions and whether it is significantly different from zero. The column  $\Delta$  gives the difference and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$N = 2$			$N = 3$		
	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$
Automobiles & Parts	0.2598**	0.0762	0.1836***	0.1475*	0.0218	0.1258**
Banks	0.6701***	0.1565	0.5137***	0.4755***	0.0928*	0.3827***
Basic Materials	0.6008***	0.4189***	0.1819***	0.3078***	0.0902***	0.2176***
Consumer Services	0.3045**	0.5326***	-0.2280	0.0592	0.1024*	-0.0432
Food & Beverage	0.1255*	0.3474***	-0.2220	0.0512*	0.2150***	-0.1638
Healthcare	0.5330***	0.3284***	0.2046***	0.3044***	0.2688***	0.0356
Industrials	0.4465***	0.1428**	0.3037***	0.3898***	0.0904*	0.2994***
Insurance	0.0025	0.0000	0.0025	0.0012	0.0179	-0.0167
Pers. & Household	0.0000	0.1204	-0.1204	0.0055	0.1066*	-0.1011
Technology	0.2922*	0.4992***	-0.2070	0.1642**	0.3089***	-0.1447
Telecommunications	0.6757***	0.4933***	0.1825***	0.1818*	0.1307**	0.0511
Utilities	0.5182***	0.6375***	-0.1193	0.3213**	0.4621***	-0.1408
	$N = 4$			$N = 5$		
	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$	$\hat{\lambda}_{bear}$	$\hat{\lambda}_{bull}$	$\Delta$
Automobiles & Parts	0.1186**	0.0329	0.0857*	0.0885**	0.0025	0.0860*
Banks	0.2829***	0.0477***	0.2353***	0.2230***	0.0074	0.2156***
Basic Materials	0.2315***	0.0271*	0.2044***	0.0244**	0.0027	0.0217
Consumer Services	0.0340	0.0339**	0.0001	0.0089	0.0110	-0.0021
Food & Beverage	0.0135	0.0565**	-0.0430	0.0049	0.0301*	-0.0252
Healthcare	0.1998***	0.1006**	0.0992**	0.1090***	0.0536**	0.0553
Industrials	0.1880***	0.0219*	0.1661***	0.1243***	0.0048	0.1196**
Insurance	0.0027	0.0196	-0.0169	0.0013	0.0243*	-0.0230
Pers. & Household	0.0054	0.0312*	-0.0258	0.0006	0.0039	-0.0033
Technology	0.0824**	0.1600***	-0.0777	0.0257	0.0844***	-0.0587
Telecommunications	0.1281*	0.0863**	0.0418	0.0570*	0.0160	0.0410**
Utilities	0.2034**	0.3174***	-0.1140	0.1191 **	0.2212***	-0.1021

### 4.3 Volatile vs. Tranquil Markets

Table 9 displays the estimation results in volatile and tranquil stock market periods for Germany. In the banking sector the crisis probability is 74.16%, considering two banks in volatile times, compared to 42.19% in tranquil times, which is significantly lower. At the five companies level, a systemic risk probability of 10.12% is estimated during volatile conditions, 10 times higher than the result using the entire sample. In tranquil times it drops to 0.57%

Table 8: **USA: Cross Sectional Differences in bearish markets**

*This table reports the cross sectional differences between the banking sector and the other sectors during bearish market conditions and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.4103***	0.3279***	0.1644**	0.1345**
Basic Materials	0.0693**	0.1676***	0.0514	0.1986***
Consumer Services	0.3656***	0.4163***	0.2489***	0.2142***
Food & Beverage	0.5446***	0.4243***	0.2695***	0.2182***
Healthcare	0.1371***	0.1710***	0.0831	0.1141**
Industrials	0.2236***	0.0857	0.0949	0.0987*
Insurance	0.6676***	0.4743***	0.2802***	0.2218***
Pers. & Household	0.6701***	0.4699***	0.2775***	0.2224***
Technology	0.3779***	0.3113***	0.2006***	0.1973***
Telecommunications	-0.0056	0.2937***	0.1548**	0.1660***
Utilities	0.1519***	0.1542***	0.0795	0.1040*

which is 50% lower than in the whole sample period and not significant anymore. Thus, the systemic risk of the banking sector is truly increased during volatile times.

In the other sectors there is no evidence for this conclusion. Although the estimated values are by the majority higher for the volatile periods and smaller for the tranquil periods than the probabilities estimated using the entire sample they are not significantly different, except for the basic material sector.

In Table 10 the cross-sectional differences and their significance are presented. As for the first case considered, there is clear evidence of higher probabilities of joint conditional defaults in the banking sector during volatile times. For the five companies case eight out of nine sectors show significance at the 1% level, one at the 5% level.

Table 11 reports the estimation results for the US during volatile and tranquil times. Similar to the findings in Germany an increased systemic crises probability of the banking sector

Table 9: **Germany: Systemic Risk in volatile and tranquil markets**

*This table reports the estimated crisis coefficients for the different sectors during volatile and tranquil market conditions and whether it is significantly different from zero. The column  $\Delta$  gives the difference and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	N = 2			N = 3		
	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$
Automobiles & Parts	0.5157***	0.3949***	0.1208	0.1961***	0.1290***	0.0671**
Banks	0.7416***	0.4219***	0.3197***	0.5942***	0.2609***	0.3333***
Basic Material	0.5689***	0.5916***	-0.0227	0.2539***	0.1958***	0.0581
Consumer Services	0.0076	0.0382	-0.0306	0.0143	0.0000	0.0143*
Food & Beverage	0.0000	0.1101**	-0.1101	0.0000	0.0013	-0.0013
Healthcare	0.3008***	0.0859	0.2149***	0.0055	0.0004	0.0051
Industrials	0.4416***	0.4643***	-0.0227	0.2800***	0.1660**	0.1140***
Insurance	0.5256***	0.1278	0.3978***	0.1983**	0.0156	0.1827
Pers. & Household	0.0912	0.0232	0.0680	0.0459**	0.0057	0.0401**
Technology	0.4766***	0.5579***	-0.0812	0.0928*	0.0917***	0.0011
	N = 4			N = 5		
	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$
Automobiles & Parts	0.0369**	0.0045	0.0323**	0.0036	0.0000	0.0036
Banks	0.1894***	0.0738**	0.1156***	0.1013***	0.0057	0.0957***
Basic Material	0.1406***	0.0707	0.0698***	0.0266**	0.0008	0.0259**
Consumer Services	0.0041	0.0000	0.0041	0.0011	0.0000	0.0011
Food & Beverage	0.0000	0.0002	-0.0002	0.0000	0.0000	0.0000
Healthcare	0.0033	0.0000	0.0033	0.0018*	0.0000	0.0018
Industrials	0.0802	0.0422**	0.0380	0.0036	0.0043	-0.0007
Insurance	0.0102	0.0001	0.0101	0.0000	0.0000	0.0000
Pers. & Household	0.0047	0.0054	-0.0007	0.0002	0.0000	0.0002
Technology	0.0684**	0.0414*	0.0270	0.0246	0.0094	0.0152

during volatile market conditions is observed. For the two companies case the probability is 59.52%, compared to 41.47% in tranquil times. For five companies it stays at a high level of 19.76% which is four times higher than for the whole period. In the tranquil market it lies at 3.95%. All differences in the banking sector are significant. Similar to the results of the entire sample period the risk in the US banking sector is lower when compared with the German one for the two companies case and distinctively higher when considering five banks.

The results for the other industries show increasing crisis probabilities during volatile times

Table 10: **Germany: Cross Sectional Differences in volatile markets**

*This table reports the cross sectional differences between the banking sector and the other sectors during volatile market conditions and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.2838**	0.3417***	0.1526***	0.1125***
Basic Material	0.2107***	0.3337***	0.1164***	0.0791**
Consumer Services	0.5862***	0.4703***	0.1981***	0.1134***
Food & Beverage	0.7292***	0.5234***	0.2018***	0.1174***
Industrials	0.4452***	0.2686***	0.1152*	0.1047***
Insurance	0.1734***	0.2522***	0.1819***	0.1173***
Healthcare	0.3963***	0.5047***	0.1900***	0.1133***
Personal & Household Goods	0.6436***	0.4892***	0.1951***	0.1169***
Technology	0.6734***	0.4858***	0.1959**	0.1160***

compared to the overall results in Table 3. In tranquil periods they are lower than observed for the entire period but at the five companies level they are significant higher during volatile times in three cases only.

The cross-sectional comparison during volatile market conditions is reported in Table 12. Except for the industrials sector all differences are significant (at the five firms level). In six cases this is true at the 1% level, supporting the hypothesis of higher systemic risk in the banking sector in volatile times.

#### 4.4 Recession vs. Boom Periods

The third adverse economic environment analyzed are recession periods. Table 13 displays the crisis probabilities for these periods in Germany. The banking sector shows increased systemic risk during recessions. For the two banks case the probability of a joint default given that one defaults is with 63.17% almost twice as big as in periods of strongly growing GDP. Considering

Table 11: **USA: Crisis Probability in volatile and tranquil markets**

*This table reports the estimated crisis coefficients for the different sectors during volatile and tranquil market conditions and whether it is significantly different from zero. The column  $\Delta$  gives the difference and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$N = 2$			$N = 3$		
	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$
Automobiles & Parts	0.1959	0.0000	0.1959***	0.1459**	0.0000	0.1459***
Banks	0.5952***	0.4147***	0.1805***	0.4113***	0.1570**	0.2543***
Basic Materials	0.5528***	0.1959***	0.3570***	0.2898***	0.0141	0.2757***
Consumer Services	0.2827	0.0173	0.2654***	0.0294	0.0001	0.0293
Food & Beverage	0.1133	0.3753***	-0.2620	0.0018	0.1357***	-0.1339
Healthcare	0.1159	0.4585***	-0.3426	0.0816	0.1681**	-0.0865
Industrials	0.5041***	0.0000	0.5041***	0.4349***	0.0017	0.4332***
Insurance	0.0044	0.0000	0.0044	0.0047	0.0000	0.0047
Pers. & Household	0.0224	0.0025	0.0198	0.0223	0.0004	0.0220
Technology	0.3701***	0.4984***	-0.1283**	0.2188***	0.0363	0.1825***
Telecommunications	0.7132***	0.3185***	0.3947***	0.1362	0.0786***	0.0576
Utilities	0.5296***	0.0625	0.4671***	0.2778***	0.0192*	0.2585***
	$N = 4$			$N = 5$		
	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$	$\hat{\lambda}_{vol}$	$\hat{\lambda}_{tra}$	$\Delta$
Automobiles & Parts	0.1119***	0.0000	0.1119***	0.0865***	0.0000	0.0865**
Banks	0.2514***	0.0594**	0.1921***	0.1976***	0.0395**	0.1581**
Basic Materials	0.1551**	0.0037	0.1514***	0.0198**	0.0003	0.0196
Consumer Services	0.0308	0.0000	0.0308	0.0063	0.0000	0.0063
Food & Beverage	0.0070	0.0421**	-0.0351	0.0044	0.0229**	-0.0186
Healthcare	0.0124	0.0045	0.0079	0.0092	0.0061	0.0031
Industrials	0.2420***	0.0000	0.2420***	0.1750***	0.0000	0.1750***
Insurance	0.0097	0.0000	0.0097	0.0051	0.0000	0.0051
Pers. & Household	0.0257	0.0000	0.0257	0.0058	0.0000	0.0058
Technology	0.1149***	0.0101	0.1047***	0.0413*	0.0009	0.0404
Telecommunications	0.1037	0.0210	0.0827*	0.0397	0.0016	0.0381
Utilities	0.1596*	0.0004	0.1592*	0.0712*	0.0004	0.0708*

five banks the crisis probability is 2.89%, more than 100% higher than estimated during the entire period and almost 200% higher than in booming times. Up to four banks the differences between recession and boom periods are significant. This significance is lost for the five banks case.

In the other industries in seven cases increasing probabilities for two companies during recession periods are observed. For the consumer services and food & beverage sector the

**Table 12: USA: Cross Sectional Differences in volatile markets**

*This table reports the cross sectional differences between the banking sector and the other sectors during volatile market conditions and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.3993***	0.2654***	0.1396**	0.1111*
Basic Materials	0.0424	0.1215*	0.0963*	0.1778***
Consumer Services	0.3125***	0.3819***	0.2206***	0.1913***
Food & Beverage	0.4819***	0.4095***	0.2445***	0.1932***
Healthcare	0.4793***	0.3296***	0.2390***	0.1884***
Industrials	0.0911*	-0.0236	0.0094	0.0226
Insurance	0.5908***	0.4065***	0.2417***	0.1925***
Pers. & Household	0.5728***	0.3890***	0.2257***	0.1918***
Technology	0.2251***	0.1925***	0.1366**	0.1563**
Telecommunications	-0.1180	0.2751***	0.1478*	0.1579**
Utilities	0.0656	0.1335**	0.0918	0.1264*

values are close to zero as in the other cases considered. For five companies the crisis probabilities are increasing in six cases, however, in none of the non-banking sectors the systemic crisis probability stays significantly above zero.

The cross-sectional inspection is reported in Table 14. It shows a higher systemic risk of the banking sector in all cases and between all sectors considered. For up to four companies these differences are significant except for the industrials sector. For five firms the crisis probability is almost three percentage points higher for the banking sector compared with the others, however, the significance of this difference vanishes. Thus, there is evidence for a higher systemic risk in the banking industry, although it is weaker than for the other two considered adverse periods. This may be due to the fact that we selected the first two adverse time periods based on a sector specific indicator (the sector stock index), regarding the recession identification the growth rate of the GDP was used. Since different sectors may react with different time lags to recession periods the estimation might be biased by this effect.

Table 13: **Germany: Crisis Probability during recessions and boom periods**

*This table reports the estimated crisis coefficients for the different sectors during recessions and boom periods and whether it is significantly different from zero. The column  $\Delta$  gives the differences and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	N = 2			N = 3		
	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$
Automobiles & Parts	0.6035***	0.3791***	0.2244***	0.2602***	0.1241***	0.1361***
Banks	0.6317***	0.3555***	0.2762***	0.4966***	0.1725***	0.3241***
Basic Material	0.5820***	0.5169***	0.0651*	0.2465**	0.1950***	0.0515
Consumer Services	0.0063	0.0054	0.0009	0.0054	0.0025	0.0030
Food & Beverage	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001
Healthcare	0.2534***	0.0415*	0.2119***	0.0318*	0.0005	0.0313**
Industrials	0.4568***	0.2430*	0.2138***	0.2471***	0.0560	0.1911***
Insurance	0.5772***	0.5523***	0.0249	0.1947***	0.1926***	0.0021
Pers. & Household	0.0775**	0.0759	0.0016	0.0209	0.0013	0.0196
Technology	0.3625***	0.4615**	-0.0990	0.0853**	0.2147	-0.1294

  

	N = 4			N = 5		
	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$
Automobiles & Parts	0.0226*	0.0229**	-0.0003	0.0005	0.0005	0.0000
Banks	0.1292***	0.0376*	0.0916**	0.0289***	0.0103	0.0186
Basic Material	0.0257*	0.0368**	-0.0112	0.0036	0.0034	0.0002
Consumer Services	0.0000	0.0000	0.0000	0.0002	0.0001	0.0001
Food & Beverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Healthcare	0.0043	0.0001	0.0042	0.0020	0.0000	0.0020
Industrials	0.0937***	0.0140	0.0797	0.0099	0.0015	0.0084
Insurance	0.0077***	0.0034***	0.0043	0.0001	0.0001	0.0000
Pers. & Household	0.0048	0.0001	0.0047	0.0002	0.0000	0.0002
Technology	0.0073**	0.1001	-0.0928	0.0010	0.0799**	-0.0789

Table 15 reports the results for the US. Surprisingly the crisis probability of the banking sector in booming periods is higher when compared with recession periods. In the other sectors this effect is not observable. Mostly increased probabilities during recessions and decreased ones during boom periods are reported. For up to four companies this differences are also significant for seven sectors.

To discover the reason for the unexpected finding in the banking sector during recessions, this case is examined more closely. The sample is split into the recession of 1990/1991 and

Table 14: **Germany: Cross Sectional Differences in recessions**

*This table reports the cross sectional differences between the banking sector and the other sectors during recessions and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.0282	0.2364***	0.1067**	0.0284
Basic Material	0.0497	0.2502***	0.1036*	0.0254
Consumer Services	0.6254***	0.4912***	0.1292***	0.0287
Food & Beverage	0.6317***	0.4966***	0.1292***	0.0289
Healthcare	0.3782***	0.4649***	0.1249***	0.0270
Industrials	0.1749***	0.2495***	0.0355	0.0190
Insurance	0.0545	0.3019***	0.1216*	0.0289
Pers. & Household	0.5542***	0.4757***	0.1244**	0.0288
Technology	0.2692***	0.4114***	0.1219**	0.0280

the recession of 2001. For these two periods the systemic crises probabilities are estimated separately. We find that for the first period the systemic risk in the banking was extremely low with 10.91% for two banks, 6.58% for three banks, 4.06% and 1.02% for four and five banks. In the recession 2001 the results are completely different, namely 53.50%, 36.50%, 20.81% and 16.13%, indicating that the first recession period did not increase the systemic banking risk, whereas the second one did.<sup>13</sup> This finding is also in line with Hartmann et al. (2005) who discover increasing systemic risk in the US banking sector during the 1990s.

To analyze the cross sectional differences between the banking sector and the other sectors we rely on the second recession only since we are mainly interested in the systemic risk prevailing under the actual regulation. Table 16 reports the cross-sectional differences during the recession of 2001. The crises probabilities are significantly higher in all sectors except for the utilities sector.

<sup>13</sup>This may be due to the fact that until 1999 the Glass-Steagall Act was in force which separated investment and commercial banking activities.

Table 15: **USA: Systemic Risk in recessions and boom periods**

*This table reports the estimated crisis coefficients for the different sectors during recessions and boom periods and whether it is significantly different from zero. The column  $\Delta$  gives the differences and its significance. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$N = 2$			$N = 3$		
	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$
Automobiles & Parts	0.2348***	0.1154**	0.1193***	0.0968***	0.0358**	0.0611***
Banks	0.2690***	0.4926***	-0.2237	0.1387**	0.2811***	-0.1424
Basic Materials	0.3697***	0.2753***	0.0944***	0.1277***	0.0550**	0.0727***
Consumer Services	0.4046***	0.3554***	0.0492**	0.1119**	0.0881***	0.0239
Food & Beverage	0.4080***	0.2229***	0.1851***	0.1433**	0.0129	0.1303***
Healthcare	0.3979***	0.2071***	0.1908***	0.2352***	0.0764***	0.1588***
Industrials	0.3622***	0.1252***	0.2370***	0.1921***	0.0776***	0.1145***
Insurance	0.0918**	0.0713	0.0205	0.0487**	0.0340*	0.0147
Pers. & Household	0.2563**	0.0576	0.1987***	0.1226*	0.0247	0.0979***
Technology	0.3179***	0.2456***	0.0723**	0.1824***	0.0943***	0.0882***
Telecommunications	0.4795***	0.3465***	0.1330***	0.1258***	0.0845**	0.0413*
Utilities	0.3954***	0.3913***	0.0041	0.1996***	0.2028***	-0.0031

  

	$N = 4$			$N = 5$		
	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$	$\hat{\lambda}_{rec}$	$\hat{\lambda}_{boom}$	$\Delta$
Automobiles & Parts	0.0493***	0.0229**	0.0264*	0.0170**	0.0062*	0.0108
Banks	0.0594**	0.1413***	-0.0819	0.0289*	0.0920***	-0.0631
Basic Materials	0.0662***	0.0218*	0.0444***	0.0077**	0.0021	0.0056
Consumer Services	0.0232**	0.0238***	-0.0007	0.0094*	0.0052*	0.0042
Food & Beverage	0.0347	0.0011	0.0336*	0.0141	0.0005	0.0135
Healthcare	0.0845***	0.0240**	0.0604**	0.0476***	0.0137**	0.0339
Industrials	0.0878***	0.0294**	0.0585**	0.0273**	0.0115**	0.0159
Insurance	0.0168*	0.0072*	0.0095	0.0067	0.0014*	0.0053
Pers. & Household	0.0645**	0.0110*	0.0535**	0.0084	0.0017	0.0067
Technology	0.0767***	0.0407***	0.0360*	0.0285***	0.0173**	0.0112
Telecommunications	0.0417***	0.0177**	0.0239	0.0071**	0.0025*	0.0046
Utilities	0.1001***	0.1073***	-0.0072	0.0633***	0.0752***	-0.0118

## 5 Summary and Conclusion

In this paper we address three problems concerning the systemic risk of the banking sector.

We find significantly higher systemic risk in the banking sectors of Germany and the US compared with the other sectors of the respective economies. Due to the importance of the banking sector this clearly justifies the need of a supervising authority whose task is to prevent a systemic crisis affecting the entire economy. Presumed that banking regulation is lowering

Table 16: **USA: Cross Sectional Differences during recessions**

*This table reports the cross sectional differences between the banking sector and the other sectors during recessions and whether it is significantly different from zero. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.*

	$\Delta(\hat{\lambda}_{cross}^2)$	$\Delta(\hat{\lambda}_{cross}^3)$	$\Delta(\hat{\lambda}_{cross}^4)$	$\Delta(\hat{\lambda}_{cross}^5)$
Automobiles & Parts	0.0913***	0.1402***	0.0880***	0.1043***
Basic Materials	0.1404***	0.1781***	0.0939***	0.1407***
Consumer Services	0.0711**	0.2569***	0.1826***	0.1495***
Food & Beverage	0.1811***	0.3009***	0.1939***	0.1546***
Healthcare	0.1152***	0.1341***	0.1289***	0.1112***
Industrials	0.2132***	0.1496***	0.0957***	0.0936***
Insurance	0.4396***	0.2829***	0.1598***	0.1413***
Pers. & Household	0.4522***	0.3205***	0.1680***	0.1602***
Technology	0.1741***	0.1408***	0.1101**	0.0971**
Telecommunications	0.0263	0.1685***	0.1000***	0.1381***
Utilities	0.0437**	0.0225	-0.0533	-0.0406

systemic risk the need of a stricter regulation is supported. However, theoretical studies as Eichberger and Summer (2005) show that systemic risk might increase as a consequence of extensive regulation. Thus, it is difficult to draw unambiguous policy implication.

Second, the degree of systemic risk in a sector depends strongly on the state of the economy, characterized by the sectors stock index or the business cycle. In adverse states the systemic risk is considerably higher than in positive environments. This finding indicates a high sensitivity of the banking sector towards the economic conditions demanding the best attention of the regulator during adverse periods of time.

Third, our cross border comparison of the banking sectors between Germany and the United States confirms the results of Hartmann et al. (2005) who find higher extreme dependencies in the US banking system, when compared with the European one. If one assumes a similar integration in both banking systems this result implies a more successful banking regulation in Germany than in the US.

## References

- J. Aharony and I. Swary. Contagion effects of bank failures: Evidence from capital markets. *Journal of Business*, 56(3):305–322, 1983.
- T. Ané and C. Kharoubi. Dependence Structure and Risk Measure. *Journal of Business*, 76(3):411–438, 2003.
- A. Ang and J. Chen. Asymmetric correlations of equity portfolios. *Journal of Financial Economics*, 63:443–494, 2002.
- P. Angelini, G. Maresca, and D. Russo. Systemic risk in the netting system. *Journal of Banking and Finance*, 20:853–868, 1996.
- S. M. Bartram, G. W. Brown, and J. Hund. Estimating systemic risk in the international financial system. Working Paper, 2005.
- M.L. Bech, B. Madsen, and L. Natorp. Systemic risk in the danish interbank netting system. Danmarks Nationalbank Working Paper 2002-8, 2002.
- Blåvarg and P. Nimander. Interbank exposures and systemic risk. *Sveriges Riksbank's Economic Review*, (2):19–45, 2002.
- W. Breymann, A. Dias, and P. Embrechts. Dependence structures for multivariate high-frequency data in finance. *Quantitative Finance*, 3(1):145–167, 2003.
- S.R. Das and R. Uppal. Systemic risk and international portfolio choice. *Journal of Finance*, (6), 2004.
- O. De Bandt and P. Hartmann. Systemic Risk: A Survey. CEPR Discussion Paper Series No. 2634, 2000.
- G. De Nicolo and M.L. Kwast. Systemic risk and financial consolidation: Are they related? *Journal of Banking and Finance*, 26:861–880, 2001.
- H.A. Degryse and G. Nguyen. Interbank exposures: An empirical examination of systemic risk in the belgian banking system. CentER Discussion Paper No. 2004-04, 2004.
- J. Eichberger and M. Summer. Bank capital, liquidity, and systemic risk. *Journal of the European Economic Association*, 3(2), 2005.
- H. Elsinger, A. Lehar, and M. Summer. Risk assessment for banking systems. *Management Science*, 52(9):1301–1314, 2006.

- P. Embrechts, A. McNeil, and D. Straumann. Correlation and dependence in risk management: Properties and pitfalls. In M.A.H. Dempster, editor, *Risk Management: Value at Risk and Beyond*, pages 176–223. Cambridge University Press, 2002.
- I. Fortin and C. Kuzmics. Modelling asymmetric exchange rate dependence. *International Journal of Intelligent Systems in Accounting, Finance & Management*, 11(2):89–107, 2002.
- G. Frahm, M. Junker, and R. Schmidt. Estimating the tail-dependence coefficient: Properties and pitfalls. *Insurance: Mathematics and Economics*, 37:80–100, 2005.
- C.H. Furfine. Interbank exposures: Quantifying the risk of contagion. *Journal of Money, Credit and Banking*, 35(1):111–128, 2003.
- C. Genest, K. Ghoudi, and L.-P. Rivest. A semiparametric estimation procedure of dependence parameters in multivariate families of distributions. *Biometrika*, 82(3):543–552, 1995.
- R. Gropp, M. Lo Duca, and J. Vesala. Cross-border bank contagion in europe. ECB Working Paper Series No. 662, 2006.
- R. Gropp and G. Moerman. Measurement of contagion in banks’ equity prices. *Journal of International Money and Finance*, 23:405–459, 2004.
- P. Hall, J.L. Horowitz, and B.-Y. Jing. On blocking rules for the bootstrap with dependent data. *Biometrika*, 82(3):561–574, 1995.
- P. Hartmann, S. Straetmans, and C. de Vries. Banking system stability: A cross-atlantic perspective. NBER Working Paper Series, 2005.
- J.E. Heffernan. A directory of coefficients of tail dependence. *Extremes*, 3(3):279–290, 2000.
- L. Hu. Dependence Patterns across Financial Markets: a Mixed Copula Approach. *Applied Financial Economics*, 16:717–729, 2006.
- H. Joe. *Multivariate Models and Dependence Concepts*. Chapman & Hall/CRC, 1997.
- H. Joe and J.J. Xu. The estimation method of inference functions for margins for multivariate models. Technical Report no. 166, Department of Statistics, University of British Columbia, 1996.
- M. Junker and A. May. Measurement of aggregate risk with copulas. *Econometrics Journal*, 8:428–454, 2005.
- G.G. Kaufman and K.E. Scott. What is systemic risk, and do bank regulators retard or contribute it? *The Independent Review*, (3), 2003.

- B.-C. Kho, D. Lee, and R.M. Stulz. U.s. banks, crises, and bailouts: From mexico to ltc. *The American Economic Review*, 90(2):28–31, 2000.
- E. Kole, K. Koedijk, and M. Verbeek. Portfolio implications of systemic crises. *Journal of Banking and Finance*, 30(8):2347–2369, 2006.
- A. Lehar. Measuring systemic risk: A risk management approach. *Journal of Banking and Finance*, 29:2577–2603, 2005.
- F. Longin and B. Solnik. Extreme Correlation of International Equity Markets. *Journal of Finance*, (2):649–676, 2001.
- J.J. Musumeci and J.F. Sinkey Jr. The international debt crisis, investor contagion, and bank security returns in 1987: The brazilian experience. *Journal of Money, Credit, and Banking*, 22(2), 1990.
- A.J. Patton. On the out-of-sample importance of skewness and asymmetric dependence for asset allocation. *Journal of Financial Econometrics*, 2(1):130–168, 2004.
- A.J. Patton. Modelling asymmetric exchange rate dependence. *International Economic Review*, 47(2):527–556, 2006.
- J.C. Rodriguez. Measuring Financial Contagion: A Copula Approach. *Journal of Empirical Finance*, 2006.
- A. Saunders and B. Wilson. Contagious bank runs: Evidence from the 1929-1933 period. *Journal of Financial Intermediation*, 5:409–423, 1996.
- M. Schüler. The threat of systemic risk in banking – evidence from europe. *Quarterly Journal of Business and Economics*, 41, 2002.
- R. Schmidt and U. Stadtmüller. Nonparametric estimation of tail dependence. Working Paper, 2003.
- G. Sheldon and M. Maurer. Interbank lending and systemic risk. *Swiss Journal of Economics and Statistics*, 134:685–704, 1995.
- M. Sibuya. Bivariate extreme statistics. *Ann. Inst. Statist. Math.*, 11:195–210, 1960.
- R.S. Tsay. *Analysis of Financial Time Series*. Wiley, 2005.
- C. Upper and A. Worms. Estimating bilateral exposures in the german market: Is there a danger of contagion. *European Economic Review*, 48(4):827–849, 2004.

I. van Lelyveld and F. Liedorp. Interbank contagion in the dutch banking sector: A sensitivity analysis. *International Journal of Central Banking*, 2(4):99–133, 2006.

L.D. Wall and D.R. Peterson. The effect of continental illinois' failure on the financial performance of other banks. *Journal of Monetary Economics*, 26:77–99, 1990.

Table 17: **Germany: Company Description**

<b>Company</b>	<b>Principal Activities</b>
BMW VW Continental Rheinmetall Elringklinger	Development, Manufacturing and selling of a range of cars and motorcycles Design, manufacturing and distribution of cars and other vehicles worldwide Manufacturing tires, plastic products and other industrial rubber products Supply of automotive components and defence equipments Manufacturing of cylinder-head gaskets and other sealing and plastic components mainly for the automotive industry
Deutsche Bank HVB Commerzbank Depfa Bank IKB	Provision of a range of banking and financial services Provision of universal banking and financial services Provision of banking services Provision of a range of banking, financial and related services to public sector clients worldwide Provision of banking services, predominantly by granting medium and long term loans to small and medium sized companies
BASF Bayer Linde K+S Fuchs Petrolub	Chemicals, Plastics, Performance Products, Agricultural Products & Nutrition and Oil & Gas Health care, nutrition and high-tech materials sectors Industrial gas, Engineering and Material handling Supply of agricultural and industrial products and related services Manufacturing and marketing of lubricants, speciality chemicals, oil products, polishing products, base oil, heating oil and fuel
Deutsche Lufthansa Celesio Karstadt Quelle Axel Springer TUI	Provision of passenger and freight airline services and related businesses, both domestically and internationally Pharmaceutical wholesale, Pharmacies and Solutions Management of department stores, mail order services, information and finance services and real estate services Printing, publishing and sale of newspapers, magazines, books and periodicals Tourism, Shipping and other operating units
Suedzucker Gabriel Sedlmayr Baywa KWS Saat Stuttg. Hofbraeu	Production of sugar Brewing and distribution of beer and other beverages Sale of agricultural and horticultural products Cultivation of a variety of crops and other food produce including sugar beet, maize, seeds, grain and cereals Brewing of beer and sale of soft drinks and other non-alcoholic beverages
Siemens Thyssen Krupp MAN GEA Group Pfleiderer	Information and Communications, Automation and Control, Power, Transportation, Medical, Lighting Steel, Services, Automotive, Technology, Elevators, Engineering Supply of capital goods and systems in the fields of commercial vehicle construction, mechanical and plant engineering Customized Systems, Process Equipment, Process Engineering and Plant Engineering Marketing of engineered wood, surface-finished panels and rail sleeper technology, provision of infrastructure for the energy and communication sectors
Allianz Muenchener Rueck	Life/Health, Property/Casualty, Banking, Asset Management Provision of insurance and reinsurance services

Continued on next page

**Table 17 – continued from previous page**

<b>Company</b>	<b>Principal Activities</b>
Hannover Rueck Gerling	Provision of all major types of reinsurance services
Nuernberger	Provision of a comprehensive range of general insurance business, including accident, liability, motor and property insurance
	Provision of a wide range of insurance policies, including life, accident, disability, health, automobile, general liability and other insurance services
Bayer Pharma Altana	Development and manufacturing of pharmaceuticals and diagnostic substances
Schering	Research, manufacturing and marketing of innovative prescription drugs and chemical products
Schwarz Pharma	Research, development, manufacturing and marketing of pharmaceuticals
Merck	Development, manufacturing and distribution of pharmaceuticals and chemicals
Stada Arzneimittel	Manufacturing of generic drugs
Beiersdorf Henkel Adidas Puma Bijou Brigitte	Develop, produce and market cosmetics, health care products and adhesives.
	Cosmetics/toiletries, Detergents/household cleaners, Adhesives
	Production and marketing of sports goods
	Design, manufacturing and marketing of sporting goods
	Manufacturing, importation and retailing of costume jewellery, gold and silver jewellery, precious stones and fashion accessories
SAP	Development, marketing, and selling of a variety of software solutions for organizations including corporations, government agencies, and educational institutions
Infineon Technologies	Design, research, development, manufacture and marketing of semiconductors and complete systems solutions used in a variety of micro electrical applications
United Internet	Marketing, sales and other services in the fields of telecommunications, information technology, data processing and related areas
Software AG	Development and license of enterprise system software products, enterprise application integration and electronic business
freenet.de	Provision of internet connectivity services

Table 18: USA: Company Description

Company	Principal Activities
Harley-Davidson General Motors Johnson Controls Ford Motor Co. Genuine Parts Co.	Motorcycles and Related Products Automotive and Other Operations and Financing and Insurance Operations Automotive systems and building controls Production and selling of cars and trucks. Distribution of automotive replacement parts, industrial replacement parts, office products and electrical and electronic materials
Citigroup Bank of America JPMorgan Chase & Co. Wells Fargo & Co. Wachovia	Provision of financial services Provision of banking and certain non-banking financial services Provision of global financial services Provision of banking, insurance, investment, mortgage banking and consumer financing services Provision of commercial and retail banking and trust services
Du Pont De Nemours & Co Dow Chemical  Alcoa Phelps Dodge Newmont Mining	Manufacturing and selling of materials, synthetic fibers, agriculture and biotechnology products. Manufacturing and selling of chemicals, plastic materials, agricultural and other specialized products and services. Production of aluminum products Production of copper, carbon black, magnet wire and continuous-cast copper rod Acquisition, development, exploration and production of gold properties worldwide
Wal-Marts Stores Home Depot  Disney (Walt) Company Comcast McDonald's	Operation of retail stores in various formats Selling of assortment of building materials, home improvement and lawn and garden products Provision of entertainment and information Development, management and operation of broadband communications network Operation and franchise restaurant businesses under the McDonald's brand.
Coca-Cola  Pepsico  Anheuser-Busch Archer-Daniels-Midland Kellogg	Manufacturing, distribution and marketing of nonalcoholic beverage concentrates and syrups Manufacturing, marketing and selling of salty, sweet and grain-based snacks, carbonated and non-carbonated beverages and foods Beer manufacturing and wholesale Production, transportation, storage, processing and merchandising of agricultural commodities and products Manufacturing and marketing of ready-to-eat cereal and convenience food products
Johnson & Johnson Pfizer  Merck & Co.  Amgen  Abbott Laboratories	Manufacturing and marketing of a range of products in the health care field Discovering, development, manufacturing and selling of prescription medicines for humans and animals and also healthcare products Development, manufacturing and marketing of a broad range of innovative products to improve human and animal health Discovering, development, manufacturing and marketing of human therapeutics based on advances in cellular and molecular biology Discovering, development, manufacturing and selling of a broad and diversified line of health care products.

Continued on next page

**Table 18 – continued from previous page**

Company	Principal Activities
General Electric	Development, manufacturing and marketing of a wide variety of products for the generation, transmission, distribution, control and utilization of electricity
Boeing	Offering of products and services in aerospace industry
United Technologies	Provision of high technology products and services to the building systems and aerospace industries worldwide
3M	Research, manufacturing and marketing of various products
Caterpillar	Design, manufacturing and marketing of construction machinery and engines.
American International	Provision of general and life insurance operations, financial services, retirement savings and asset management
Berkshire Hathaway	Provision of insurance and reinsurance of property also casualty risks and reinsure life, accident and health risks world-wide
St. Pauls Travellers	Provision of commercial property-liability and non life reinsurance products and services worldwide
AFLAC	Provision of supplemental health and life insurance services
Loews	Provision of property and casualty insurance, production and selling of cigarettes and operate offshore oil and gas drilling rigs and natural gas pipeline systems
Procter & Gamble	Manufacturing and marketing consumer products
Altria Group	Manufacturing and marketing various consumer products, including cigarettes, grocery products, snacks, beverages, cheese and convenient meals
Colgate-Palmolive	Manufacturing and marketing a wide variety of consumer products
Kimberly-Clark	Manufacturing and marketing of various health and hygiene products
Nike	Design, production, development and market ing of high quality sports and fitness footwear, apparel, equipment and accessory products
Microsoft	Development, manufacturing, licensing and supporting a wide range of software products for a multitude of computing devices
IBM	Provision of business and information technology services
Intel	Design, development, manufacturing and marketing computers, networking and communication products
Hewlett-Packard	Provision of products, technologies, solutions and services to individual consumers and businesses.
Oracle	Development, manufacturing, marketing and distribution of computer software.
AT&T	Provision of communication services and products
Verizon	Provision of wireline and wireless communication services
Sprint Nextel	Provision of communication products and solutions
ALLTEL	Provision of wireline and wireless communication
Leucadia	Telecommunication, healthcare services, banking and lending, manufacturing, winery operations, real estate activities and development of copper mine
Exelon	Energy generation and delivery
Dominion Resources	Generation, transmission, distribution and selling of gas and electric energy
Southern Company	Acquisition, development, building, operation of power production and delivery facilities
TXU	Generation of electricity, wholesale energy trading, retail energy marketing, energy delivery, and other energy-related services
Duke Energy	Provision integrated energy services, offer physical delivery and manage electricity and natural gas

Table 19: Germany: Summary Statistics

This table reports descriptive statistics of the data. The second and third column give the start and end date of the time series. The mean and the standard deviation are reported annualized. The next two columns give the skewness and the excess kurtosis. The Min and Max columns report the smallest and highest return observed in the sample period. The column ADF reports the Augmented-Dickey-Fuller Test of a unit root. The next column reports the value of the Q-Statistic with  $m$  lags. We follow Tsay (2005) and use  $m = \log(T)$ . The last column gives the Jarque-Bera-Test of Normality. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.

Sector	Name	ISIN	Start Date	End Date	$\mu$	$\sigma$	$S$	$K$	Min	Max	ADF	Q(m)	JB
Automobiles & Parts	BMW	DE0005190003	01-Jan-90	29-Dec-06	0.1136	0.3021	-0.0555	5.27	-0.1599	0.1133	-17.53***	27.42***	5155.0***
	VW	DE0007664005	01-Jan-90	29-Dec-06	0.0839	0.3079	-0.2001	3.71	-0.1466	0.1250	-15.14***	42.27***	2580.4***
	Continental	DE0005439004	01-Jan-90	29-Dec-06	0.1097	0.2984	0.0272	3.48	-0.1168	0.1282	-17.04***	12.84	2247.6***
	Rheinmetall	DE0007030009	01-Jan-90	29-Dec-06	0.0905	0.3484	0.0927	6.58	-0.1478	0.2102	-16.01***	19.18**	8022.1***
	Erlingklinger	DE0007856023	01-Jan-90	29-Dec-06	0.1907	0.3441	-0.1110	33.81	-0.3555	0.3295	-17.80***	44.77***	211489.9***
Banks	Deutsche Bank	DE0005140008	01-Jan-90	29-Dec-06	0.0708	0.2832	-0.1360	4.78	-0.1235	0.1277	-16.50***	30.53***	4253.4***
	HVB	DE0008022005	01-Jan-90	29-Dec-06	0.0639	0.3411	0.0647	7.02	-0.1730	0.1848	-16.21***	29.57***	9130.3***
	Commerzbank	DE0008032004	01-Jan-90	29-Dec-06	0.0635	0.3008	0.0554	7.24	-0.1349	0.1803	-16.20***	15.81**	9708.6***
	Depfa Bank	IE0072559994	13-Mar-91	29-Dec-06	0.1462	0.2947	0.0897	6.21	-0.1645	0.1435	-14.81***	17.93**	6651.2***
	IKB	DE0008063306	01-Jan-90	29-Dec-06	0.0918	0.1871	0.1096	5.53	-0.0901	0.0795	-16.27***	39.89***	5670.3***
Basic Materials	BASF	DE0005151005	01-Jan-90	29-Dec-06	0.1219	0.2510	0.0501	3.24	-0.0872	0.1074	-17.59***	16.28**	1952.7***
	Bayer	DE0005752000	01-Jan-90	29-Dec-06	0.0872	0.2895	0.8381	27.28	-0.1843	0.3230	-16.96***	13.37*	138164.7***
	Linde	DE0006483001	01-Jan-90	29-Dec-06	0.0618	0.2540	-0.0265	4.16	-0.1132	0.1048	-16.81***	8.95	3217.2***
	K + S	DE0007162000	01-Jan-90	29-Dec-06	0.1281	0.3026	-0.0568	6.19	-0.1835	0.1547	-16.21***	14.03*	7107.9***
	Fuchs Petrolub	DE0005790406	01-Jan-90	29-Dec-06	0.1121	0.2707	0.2594	5.76	-0.1267	0.1278	-16.96***	24.20***	6194.8***
Consumer Services	Deutsche Lufthansa	DE0008232125	01-Jan-90	29-Dec-06	0.0610	0.3448	-0.0688	4.22	-0.1521	0.1640	-16.20***	11.20	3309.6***
	Celesio	DE000CLS1001	01-Jan-90	29-Dec-06	0.1298	0.2780	0.0451	2.53	-0.1192	0.0944	-17.74***	24.96***	1187.8***
	Karstadt Quelle	DE0006275001	01-Jan-90	29-Dec-06	0.0093	0.3333	0.0781	5.02	-0.1772	0.1483	-16.47***	8.62	4668.5***
	Springer	DE0005501357	01-Jan-90	29-Dec-06	0.0962	0.2697	0.6612	10.30	-0.1147	0.1709	-16.36***	9.07	19958.2***
	TUI	DE000TUAG000	01-Jan-90	29-Dec-06	0.0300	0.3072	-0.0117	5.73	-0.1734	0.1254	-16.10***	25.93***	6083.5***
Food & Beverage	Suedzucker	DE0007297004	01-Jan-90	29-Dec-06	0.0569	0.2307	0.3054	7.15	-0.0919	0.1335	-15.93***	33.70***	9532.1***
	Gabriel Sedl.	DE0007224008	01-Jan-90	29-Dec-06	0.0541	0.2231	-0.0905	19.67	-0.1671	0.1256	-18.24***	72.75***	71633.0***
	Baywa	DE0005194062	01-Jan-90	29-Dec-06	0.0944	0.2698	0.8125	7.96	-0.1224	0.1466	-16.67***	28.17***	12229.6***
	KWS Saat	DE0007074007	01-Jan-90	29-Dec-06	0.0830	0.2532	-0.1681	7.91	-0.1445	0.1147	-15.49***	75.04***	11597.6***
	SHB Stuttgart	DE0007318008	01-Jan-90	29-Dec-06	0.0766	0.2531	2.9084	155.45	-0.2766	0.4257	-18.12***	21.07***	447484.0***
Healthcare	Bayer Schering Pharma	DE0007172009	01-Jan-90	29-Dec-06	0.1288	0.2603	0.3705	12.98	-0.1545	0.2258	-16.38***	16.41**	31304.4***
	Altana	DE0007600801	01-Jan-90	29-Dec-06	0.1361	0.3073	-0.5131	14.68	-0.2648	0.1431	-16.74***	26.99***	40052.9***
	Schwarz Pharma	DE0007221905	19-Jun-95	29-Dec-06	0.1734	0.4240	3.7203	88.25	-0.2471	0.5867	-13.32***	13.13	984832.0***
	Merck	DE0006599905	20-Oct-95	29-Dec-06	0.1057	0.3379	-0.1333	4.49	-0.1530	0.1245	-14.44***	31.11***	2474.7***
	Stada	DE0007251803	16-Feb-98	29-Dec-06	0.2201	0.3098	0.6720	11.75	-0.1308	0.2280	-13.15***	18.61**	13518.4***
Industrials	Siemens	DE0007236101	01-Jan-90	29-Dec-06	0.0795	0.2977	0.0936	4.45	-0.1067	0.1565	-15.27***	35.75***	3685.4***
	ThyssenKrupp	DE0007500001	01-Jan-90	29-Dec-06	0.0843	0.3016	-0.0249	4.14	-0.1659	0.1136	-16.35***	20.67***	3178.7***
	MAN	DE0005937007	01-Jan-90	29-Dec-06	0.1091	0.3149	-0.0799	3.45	-0.1468	0.0983	-16.71***	4.37	2211.7***
	GEA Group	DE0006602006	01-Jan-90	29-Dec-06	-0.0525	0.3797	-0.5844	12.14	-0.2669	0.1595	-16.63***	27.27***	27518.1***
	Pfeiderer	DE0006764749	01-Jan-90	29-Dec-06	0.0982	0.3979	3.7998	87.49	-0.2154	0.6078	-15.84***	13.77*	1426450.0***
Insurance	Allianz	DE0008404005	01-Jan-90	29-Dec-06	0.0436	0.3098	-0.0306	6.12	-0.1568	0.1380	-15.36***	34.90***	6952.2***
	Muenchner Rueck	DE0008430026	01-Jan-90	29-Dec-06	0.0620	0.3212	-0.1317	7.36	-0.1719	0.1653	-16.52***	65.27***	10060.3***
	Hannover Rueck	DE0008402215	30-Nov-94	29-Dec-06	0.1020	0.3309	-0.5396	11.13	-0.1989	0.1538	-14.49***	32.84***	16449.8***
	Gerling	DE0008418922	01-Jan-90	29-Dec-06	0.0065	0.3701	0.9697	79.79	-0.4234	0.4795	-15.69***	57.59***	117737.4***
	Nuernberger	DE0008435967	01-Jan-90	29-Dec-06	-0.0062	0.2370	-0.5875	21.09	-0.2289	0.1361	-16.92***	23.30***	82553.0***
Pers. & Household	Beiersdorf	DE0005200000	01-Jan-90	29-Dec-06	0.1392	0.3020	0.0302	6.17	-0.1342	0.1610	-17.15***	69.40***	7045.2***
	Henkel	DE0006048408	01-Jan-90	29-Dec-06	0.0917	0.2537	-0.0353	5.59	-0.1423	0.1081	-19.02***	7.08	5790.2***
	Adidas	DE0005003404	17-Nov-95	29-Dec-06	0.1260	0.3236	-0.0012	3.14	-0.1126	0.1024	-14.14***	30.70***	1197.7***
	Puma	DE0006969603	01-Jan-90	29-Dec-06	0.1577	0.3917	0.4442	5.79	-0.1526	0.1653	-16.58***	15.96**	6353.2***
	Bijou Brigitte	DE0005229504	01-Jan-90	29-Dec-06	0.2211	0.3171	0.4127	19.49	-0.2331	0.2831	-16.07***	12.66	70445.6***
Technology	SAP	DE0007164600	01-Jan-90	29-Dec-06	0.2111	0.4210	0.1297	9.39	-0.2554	0.2355	-15.97***	27.60***	16321.9***
	Infineon	DE0006231004	10-Mar-00	29-Dec-06	-0.1652	0.5861	3.7095	68.60	-0.1654	0.6903	-12.47***	29.02***	353024.2***
	United Internet	DE0005089031	20-Mar-98	29-Dec-06	0.2829	0.7356	5.8707	134.87	-0.2643	1.0944	-11.49***	14.17*	1751980.9***
	Software AG	DE0003304002	23-Apr-99	29-Dec-06	0.0957	0.5859	-1.0304	19.31	-0.4367	0.2271	-12.62***	25.41***	31605.8***
	Freenet	DE0005792006	02-Dec-99	29-Dec-06	0.1274	0.8693	6.4651	136.51	-0.2424	1.2278	-11.00***	5.34	1449475.4***

Table 20: USA: Summary Statistics

This table reports descriptive statistics of the data. The second and third column give the start and end date of the time series. The mean and the standard deviation are reported annualized. The next two columns give the skewness and the excess kurtosis. The Min and Max columns report the smallest and highest return observed in the sample period. The column ADF reports the Augmented-Dickey-Fuller Test of a unit root. The next column reports the value of the Q-Statistic with  $m$  lags. We follow Tsay (2005) and use  $m = \log(T)$ . The last column gives the Jarque-Bera-Test of Normality. \*\*\* shows significance at the 1% level, \*\* at the 5% level and \* at the 10% level.

Sector	Name	ISIN	Start Date	End Date	$\mu$	$\sigma$	$S$	$K$	Min	Max	ADF	Q(m)	JB
Automobiles & Parts	Harley-Davidson	US4128221086	01-Jan-90	29-Dec-06	0.2329	0.3439	-0.2892	8.76	-0.2486	0.1300	-16.09***	13.32***	14240.6***
	General Motors	US3704421052	01-Jan-90	29-Dec-06	0.0318	0.3251	0.0761	3.80	-0.1504	0.1665	-14.95***	6.59	2676.8***
	Johnson Controls	US4783661071	01-Jan-90	29-Dec-06	0.1560	0.2627	0.1236	4.17	-0.1309	0.1097	-16.81***	18.61**	3227.9***
	Ford Motor Company	US3453708600	01-Jan-90	29-Dec-06	0.0359	0.3343	0.1390	3.97	-0.1589	0.1451	-15.96***	27.14***	2932.5***
Banks	Genuine Parts	US3724601055	01-Jan-90	29-Dec-06	0.0847	0.2006	0.2520	3.45	-0.0951	0.0808	-16.33***	38.33***	2247.9***
	Citigroup	US1729671016	01-Jan-90	29-Dec-06	0.1997	0.3271	0.0309	4.92	-0.1711	0.1684	-16.49***	22.33***	4485.7***
	Bank of America	US0605051046	01-Jan-90	29-Dec-06	0.1204	0.2929	-0.1422	3.89	-0.1443	0.0988	-16.60***	47.81***	2813.8***
	JPMorgan Chase & Co.	US46625H1005	01-Jan-90	29-Dec-06	0.1217	0.3454	0.1585	5.45	-0.1998	0.1487	-15.54***	10.81	5505.0***
Basic Materials	Wells Fargo	US9497461015	01-Jan-90	29-Dec-06	0.1699	0.2631	0.1152	2.67	-0.0919	0.0953	-17.69***	24.16***	1324.7***
	Wachovia	US9299031024	01-Jan-90	29-Dec-06	0.1333	0.2764	0.0497	3.62	-0.1171	0.1075	-17.11***	18.41**	2424.4***
	Du Pont De Nemours & Co	US2635341090	01-Jan-90	29-Dec-06	0.0789	0.2670	0.0539	3.25	-0.1170	0.0941	-17.13***	21.47***	1955.5***
	Dow Chemical Company	US2605431038	01-Jan-90	29-Dec-06	0.0671	0.2791	0.0125	4.31	-0.1118	0.1079	-17.73***	14.88*	3432.9***
Consumer Services	Alcoa	US0138171014	01-Jan-90	29-Dec-06	0.0865	0.3138	0.2073	3.19	-0.1166	0.1315	-17.21***	17.54**	1909.7***
	Phelps Dodge	US7172651025	01-Jan-90	29-Dec-06	0.1476	0.3323	0.4218	5.59	-0.1278	0.2373	-16.55***	15.83**	5921.2***
	Newmont Mining	US6516391066	01-Jan-90	29-Dec-06	0.0185	0.4003	0.4150	4.47	-0.1826	0.1927	-16.72***	32.94***	3827.6***
	Wal-Mart Stores	US9311421039	01-Jan-90	29-Dec-06	0.1254	0.2928	0.0376	3.54	-0.1560	0.0902	-16.97***	40.56***	2325.7***
Food & Beverage	Home Depot	US4370761029	01-Jan-90	29-Dec-06	0.1799	0.3360	-0.9693	17.51	-0.3388	0.1213	-17.19***	31.48***	57396.3***
	Disney (Walt) Company	US2546871060	01-Jan-90	29-Dec-06	0.0807	0.3045	-0.1165	8.02	-0.2029	0.1420	-16.25***	11.09	11916.3***
	Comcast	US20030N1019	01-Jan-90	29-Dec-06	0.1206	0.3984	0.2849	3.73	-0.1622	0.1754	-16.74***	26.55***	2634.1***
	McDonald's	US5801351017	01-Jan-90	29-Dec-06	0.1026	0.2649	-0.0423	4.26	-0.1372	0.1031	-16.18***	10.85	3360.2***
Healthcare	Coca-Cola	US1912161007	01-Jan-90	29-Dec-06	0.1062	0.2417	-0.0492	4.15	-0.1107	0.0922	-17.14***	16.56**	3191.0***
	Pepsico	US7134481081	01-Jan-90	29-Dec-06	0.1192	0.2606	0.3688	6.45	-0.1183	0.1497	-16.55***	42.37***	7802.0***
	Anheuser-Busch	US0352291035	01-Jan-90	29-Dec-06	0.1138	0.2221	-0.1694	3.24	-0.0861	0.0745	-16.57***	62.77***	1962.2***
	Archer-Daniels-Midland	US0394831020	01-Jan-90	29-Dec-06	0.0845	0.2886	-0.1104	5.71	-0.1843	0.1319	-15.71***	39.12***	6043.2***
Industrials	Kellogg	US4878361082	01-Jan-90	29-Dec-06	0.0863	0.2435	0.3037	4.40	-0.0995	0.1030	-16.73***	39.22***	3655.0***
	Johnson & Johnson	US4781601046	01-Jan-90	29-Dec-06	0.1400	0.2366	-0.2824	6.26	-0.1725	0.0789	-16.86***	57.89***	7297.4***
	Pfizer	US7170811035	01-Jan-90	29-Dec-06	0.1427	0.2886	-0.1971	2.92	-0.1182	0.0927	-17.32***	42.18***	1604.9***
	Merck & Co.	US5893311077	01-Jan-90	29-Dec-06	0.0967	0.2770	-1.3578	25.54	-0.3117	0.1225	-16.25***	29.56***	122006.1***
Insurance	Amgen	US0311621009	01-Jan-90	29-Dec-06	0.2370	0.3905	-0.0045	4.43	-0.2231	0.1406	-15.79***	50.52***	3623.3***
	Abbott Laboratories	US0028241000	01-Jan-90	29-Dec-06	0.1223	0.2715	-0.3094	5.83	-0.1760	0.1175	-18.16***	45.33***	6356.1***
	General Electric	US3696041033	01-Jan-90	29-Dec-06	0.1316	0.2512	0.0441	4.48	-0.1129	0.1174	-16.96***	20.73***	3723.2***
	Boeing	US0970231058	01-Jan-90	29-Dec-06	0.1012	0.3004	-0.5278	8.05	-0.1939	0.1100	-16.36***	17.30**	12202.9***
Pers. & Household	United Technologies	US9130171096	01-Jan-90	29-Dec-06	0.1461	0.2735	-1.6024	33.04	-0.3320	0.0938	-17.04***	41.47***	203793.6***
	3M Company	US88579Y1010	01-Jan-90	29-Dec-06	0.1045	0.2267	0.0208	4.44	-0.1008	0.1050	-16.33***	22.06***	3655.5***
	Caterpillar	US1491231015	01-Jan-90	29-Dec-06	0.1407	0.3064	-0.1535	4.00	-0.1569	0.1030	-16.62***	7.11	2975.8***
	American International	US0268741073	01-Jan-90	29-Dec-06	0.1229	0.2607	0.1070	3.71	-0.1102	0.1046	-16.52***	39.38***	2557.0***
Technology	Berkshire Hathaway	US0846701086	01-Jan-90	29-Dec-06	0.1432	0.2296	0.4446	6.03	-0.0977	0.0974	-16.75***	41.68***	6871.3***
	St. Pauls Travellers	US7928601084	01-Jan-90	29-Dec-06	0.1022	0.2590	0.2975	5.70	-0.1232	0.1299	-16.42***	24.97***	6076.6***
	AFLAC	US0010551028	01-Jan-90	29-Dec-06	0.1770	0.3011	0.3640	5.40	-0.1413	0.1491	-17.63***	21.14***	5483.2***
	Loews	US5404241086	01-Jan-90	29-Dec-06	0.0884	0.2258	-0.2395	7.17	-0.1606	0.0852	-16.10***	20.13***	9542.4***
Telecommunications	Procter & Gamble	US7427181091	01-Jan-90	29-Dec-06	0.1315	0.2497	-3.2106	76.19	-0.3766	0.0910	-16.78***	29.45***	1081169.9***
	Altria Group	US02209S1033	01-Jan-90	29-Dec-06	0.1472	0.2943	-0.8415	16.00	-0.2614	0.1507	-15.15***	12.51	47871.1***
	Colgate-Palmolive	US1941621039	01-Jan-90	29-Dec-06	0.1376	0.2518	-0.0811	10.67	-0.1732	0.1850	-17.05***	41.75***	21057.2***
	Kimberly-Clark	US4943681035	01-Jan-90	29-Dec-06	0.1013	0.2426	-0.1859	6.06	-0.1196	0.1007	-16.23***	35.05***	6818.5***
Utilities	Nike	US6541061031	01-Jan-90	29-Dec-06	0.1630	0.3450	-0.2589	7.38	-0.2165	0.1335	-15.54***	13.61*	10116.0***
	Microsoft	US5949181045	01-Jan-90	29-Dec-06	0.2281	0.3397	-0.0460	4.70	-0.1696	0.1787	-15.71***	12.41	4093.5***
	IBM	US4592001014	01-Jan-90	29-Dec-06	0.0966	0.3009	0.0269	7.56	-0.1689	0.1237	-14.99***	11.12	10566.6***
	Intel	US4581401001	01-Jan-90	29-Dec-06	0.1693	0.4215	-0.4220	5.84	-0.2489	0.1833	-14.52***	26.43***	6435.2***
Other	Hewlett-Packard	US4282361033	01-Jan-90	29-Dec-06	0.1345	0.4011	-0.0798	6.30	-0.2070	0.1899	-16.01***	13.19	7346.3***
	Oracle	US68389X1054	01-Jan-90	29-Dec-06	0.1912	0.5541	-0.1569	11.57	-0.3716	0.3637	-15.34***	23.31***	24786.0***
	AT&T	US00206R1023	01-Jan-90	29-Dec-06	0.0820	0.2717	-0.0754	3.70	-0.1354	0.0883	-17.81***	20.02***	2540.1***
	Verizon	US92343V1044	01-Jan-90	29-Dec-06	0.0592	0.2621	0.1261	4.60	-0.1261	0.1157	-17.31***	28.89***	3930.8***
Utilities	Sprint Nextel	US8520611000	01-Jan-90	29-Dec-06	0.0467	0.3588	-0.7597	12.43	-0.2598	0.1882	-16.95***	6.38	28988.2***
	ALLTEL	US0200391037	01-Jan-90	29-Dec-06	0.1036	0.2449	-0.0410	4.36	-0.1254	0.1178	-16.60***	18.08**	3517.1***
	Leucadia National	US5272881047	01-Jan-90	29-Dec-06	0.1908	0.2400	1.0724	11.79	-0.0681	0.2076	-15.88***	7.01	26549.9***
	Exelon	US30161N1019	01-Jan-90	29-Dec-06	0.1387	0.2289	-0.3294	6.38	-0.1255	0.1054	-16.15***	11.87	7608.4***
Utilities	Dominion Resources	US25746U1097	01-Jan-90	29-Dec-06	0.1083	0.1850	-1.0008	13.76	-0.1368	0.0838	-16.60***	26.36***	35750.7***
	Southern Company	US8425871071	01-Jan-90	29-Dec-06	0.1339	0.1945	0.0690	3.76	-0.0885	0.0878	-17.89***	21.15***	2626.6***
	TXU	US8731681081	01-Jan-90	29-Dec-06	0.1180	0.2775	-3.1942	76.52	-0.3709	0.1806	-15.82***	154.90***	1090332.0***
	Duke Energy	US26441C1053	01-Jan-90	29-Dec-06	0.0925	0.2339	-0.2969	12.06	-0.1614	0.1498	-16.31***	11.78***	26976.3***