The German Equity Market:
Risk, Return, and Liquidity

Hermann Göppl Torsten Lüdecke
Christian Schlag Heinrich Schütz[1]

Diskussionspapier Nr. 183

Address of the authors:

Institut für Entscheidungstheorie
und Unternehmensforschung
Universität Karlsruhe
D-76128 Karlsruhe
GERMANY
Phone +49-721-608-3427 FAX: +49-721-359200

---

[1] We are indebted to the *Deutsche Börse AG*, in particular to the *Deutsche Wertpapierdatenzentrale (DWZ)* and to *Wertpapier-Mitteilungen (WM)* for providing us with the data. Hermann Göppl and Torsten Lüdecke would like to thank the *Deutsche Forschungsgemeinschaft (DFG)* for financial support.

1 Introduction

Within the international research community knowledge about German capital markets is not widespread. This may be due to the facts that no central data base did exist and that empirical results in German journals could not be acknowledged by the English speaking majority. Meanwhile, data bases open to researchers on stocks, bonds, warrants and all derivative products of the German options and futures exchange exist.

In this article we will give some more general characteristics of the German stock market. After a description of the stock data base and market organization we focus on the liquidity of the German stock market, the risk-return relationship and the pricing anomalies.

2 The German stock market

There are eight stock exchanges in Germany with the Frankfurt Stock Exchange (FSE) as the largest, representing approximately 75 percent of the total trading volume. Second largest is Düsseldorf with a share of 10 percent, thus leaving only a small percentage to the other stock markets (ordered by volume: Munich, Hamburg, Stuttgart, Berlin, Hanover and Bremen). The 37 most liquid stocks are also traded on the Integriertes Börsenhandels- und Informationssystem (IBIS), finally introduced in April 1991. IBIS is part of the FSE and accounts for about 30 percent of the total trading volume in these stocks.

The market capitalization of domestic companies in Germany was DM 728,74 billions at the end of 1994 (cf. Deutsche Börse AG (1994)). At the same time 417 domestic and 344 foreign companies were listed in Frankfurt. Despite the number of foreign listings, the volume of trading accounts for only 2 percent of total volume.

Stock option trading is concentrated at an electronic exchange, the Deutsche Terminbörse (DTB) in Frankfurt. DTB offers 20 stock options, and options, futures and futures options on the Deutscher Aktienindex (DAX), a performance index of 30 stocks. Besides the DTB there also exists a dying options segment at the FSE.

The FSE has 238 member firms: 68 domestic and 69 foreign banks, 41 Kursmakler and 60 Freimakler. Participation in IBIS is either possible exclusively or in connection with membership in one of the floor exchanges. Currently 12 Freimakler are exclusively admitted for trading on IBIS. Trading hours on the floor-based exchanges are from 10:30 to 13:30. Trading hours on IBIS are from 8:00 to 17:00, which matches the trading hours at the DTB. Off-exchange trading among banks and institutional investors is possible at any time between 8:00 and 17:00. Direct trades and exchange trades are immediately entered into the host of the Deutsche Wertpapier-Datenzentrale (DWZ) for order processing purposes.

There are three market segments, the Amtlicher Handel, Geregelter Markt and Freiverkehr. The first segment is further divided in the continuous market and the periodic market. The determination of prices is based on auction principles. The segments differ in terms of listing requirements and legal oversight. The major stocks are listed in the Amtlicher Markt and trade continuously.

3 Data

The data for empirical research come from the Deutsche Finanzdatenbank (DFDB). The DFDB contains daily data for all German stocks, warrants and options traded at the Frankfurt Stock Exchange (FSE). Price and volume data for stocks and warrants are available since 1974. Daily stock prices are also at hand for the period from 1960 to 1973 for a sample of 100 stocks. Prices for the remaining stocks exist on an end-of-month basis. In addition to the price data, the DFDB contains the data necessary to adjust prices for dividends, capital alterations and stock splits. Daily prices from the floor-based options market at the FSE exists since April 1983. Furthermore, several indexes for the German stock market are available, among them is the Deutsche Aktien-Forschungsindex (DAFOX), which was constructed especially for research needs (cf. Göppl and Schütz (1993)). A detailed description of the DFDB is given in Bühler et al. (1993).

Beyond the DFDB data the University of Karlsruhe has several other datasets available. These cover daily prices and volume for all stocks and warrants traded at one of the seven regional exchanges, daily bid prices of investment funds, and daily price and volume data for a sample of bonds issued by the Bund, Bahn, Post or Treuhand.[2] All data exists since 1974, except for the volume data of the regional exchanges, which start in April 1990. Transaction data comprising time-stamped prices and volume from IBIS and DTB add recently to the database. Data from the DTB exists for all derivative products since trading started.

All data come from official data sources of the German capital market. Price and volume data are delivered by the Deutsche Wertpapier-Datenzentrale (DWZ) and the Deutsche Terminbörse (DTB). Both the DWZ and DTB are under the roof of the Deutsche Börse AG since January 1990. Information necessary for price adjustments are delivered by Wertpapier-Mitteilungen (WM).

4 Stock market liquidity

To investigate the liquidity of the German stock market we use a sample of 508 common and preferred stocks traded at the FSE in the period from January, 2, 1987 to December 30, 1994. To be included for the analysis by year a stock must be traded for at least 220 days a year.

Liquidity is an elusive concept, thus a lot of measures can be found in the literature (cf. Bernstein (1987)). For our purposes we use the daily number of shares traded as a proxy for liquidity. The analysis is done by year and by market segment. Furthermore, we examine the tendency of trading to concentrate on certain stocks. This is done by using three samples of stocks, called the DTB, DAX and DAX100 sample. The DTB sample contains 15 stocks (16 stocks in 1994) admitted for options trading at the DTB, the DAX sample contains 30 and the DAX100 sample covers 100 stocks. All stocks in the samples trade in the first segment, the Amtlicher Markt.

---

[2] These are bonds with maturity from 5 to 30 years guaranteed by the federal government.

First, we compute the total number of shares traded per year in the sampling period. To show how total trading volume is distributed across market segments and samples, we express their corresponding volume as a percentage of total volume in a particular year. Second, liquidity in each year is analysed on a daily level.

Descriptive statistics for liquidity on a yearly basis are shown in Table 1. From 1987 to 1994, the number of shares traded has grown by more than 400 percent, while the number of stocks increased by 25 percent. With the exeception of 1991, there was a strong growth of stock trading in every year. The largest jump is about 56 percent in 1989, which was partly driven by the German reunification (cf. Griswold (1995)).

Liquidity of the stock market is heavily concentrated in the first segment (Amtlicher Markt) and within this segment in the continuous market, while the periodic market only captures a very low percentage of the total trading volume. Continuous trading in the first segment is about 97 percent of overall trading, leaving only a small percentage to the periodic markets in the first to third segment.

Periodic trading is in general losing grounds to the continuous market since 1990. Within the periodic markets the second tier is gaining back some attraction in recent years. Especially in 1994, its share outgrew the periodic market in the first segment. A look at the market share of the three samples in Table 1 gives some insight into these developments. As to see, trading is heavily concentrated in the upper 16 (DTB-sample) and 30 (DAX-sample) stocks. The stocks not included in the DAX100 sample account on average for less than 10 percent of the total trading volume. The numbers are, however, not stable over time. During the hausse period from 1988 to 1990 there is a tendency towards increasing volume for smaller stocks as indicated by the ΔDAX100 and residual market shares. In later years this movement is reversed and especially the residual market share decreases substantially.

Table 1

Number of shares traded by year and market segment

	1987	1988	1989	1990	1991	1992	1993	1994
Total[a]	810.48	991.81	1546.34	1983.45	1858.97	2055.86	2761.92	2662.41
	(344)	(360)	(372)	(401)	(428)	(445)	(451)	(465)
Percentage of yearly volume by market segment[b]								
1.1	96.97	96.97	95.39	98.07	98.77	98.79	98.80	98.10
	(129)	(138)	(144)	(153)	(160)	(165)	(168)	(174)
1.2	2.56	2.25	3.85	1.22	0.71	0.70	0.64	0.61
	(121)	(125)	(126)	(138)	(146)	(145)	(145)	(146)
2	0.33	0.37	0.46	0.39	0.35	0.39	0.47	1.15
	(27)	(33)	(40)	(44)	(55)	(68)	(73)	(78)
3	0.21	0.36	0.30	0.33	0.17	0.13	0.10	0.14
	(67)	(64)	(62)	(66)	(67)	(67)	(65)	(67)
Percentage of yearly volume by index samples[c]								
DTB	62.92	60.72	55.16	65.60	68.12	71.74	67.91	65.13
ΔDAX	15.85	14.19	15.73	14.05	15.13	14.25	15.37	15.75
ΔDAX100	14.00	14.27	16.19	12.74	11.51	9.06	10.32	11.21
Residual	7.23	10.82	12.92	7.61	5.24	5.05	6.40	7.91

[a]Number of shares × 1.000.000.

[b]The number of stocks qualifying for the sample in the respective year is given in parentheses. The numbers on the left refer to the market segments: 1.1 denotes the Amtlicher Markt/continuous trading, 1.2 denotes the Amtlicher Markt/periodic trading, 2 denotes the Geregelter Markt, and 3 denotes the Freiverkehr.

[c]ΔDAX is the share of the DAX sample minus the percentage of the DTB sample. ΔDAX100 is the share of the DAX100 sample minus the percentage of the DAX sample. The residual share is 100-DTB-ΔDAX-ΔDAX100.

This may be due to the opening of DTB in spring of 1990, showing up in the growing market share of the DTB- and DAX-samples. In the last two years there is a slight recovery of stocks outside the DAX-sample.

In Table 2, trading volume is ordered by daily number of shares traded in every year of the sampling period. The numbers confirm strong concentration of trades (i.e. liquidity) in the last decile. Over time liquidity nearly tripled in this group of stocks. The relative improvement in other quantiles is remarkable, too, but low in absolute terms.

Table 2:
Daily average number of shares traded by decile and year

Decile	1987	1988	1989	1990	1991	1992	1993	1994
1	2	2	12	4	3	2	3	2
2	10	9	48	24	14	16	18	19
3	24	28	113	66	49	54	72	69
4	71	96	263	180	152	138	244	236
5	209	277	620	468	338	302	491	457
6	555	713	1331	1082	650	619	938	805
7	1366	1374	2847	2092	1465	1422	1970	1854
8	3627	3389	5874	4403	3092	3356	5103	4508
9	10272	10325	16936	14075	9316	8116	13392	13404
10	78850	94014	139374	173585	159403	168352	221322	207932

5 The relationship between risk and return

Next we analyze the risk and return behaviour of German stocks using the Deutsche Aktien-Forschungsindex DAFOX (German Stock Price Research Index). The DAFOX is a capital-weighted performance index including all German stocks which are traded in the Amtlicher Markt on the FSE. It is important to mention that in contrast to many common indices the DAFOX is a total return index, including dividends and proceeds from sale of rights. To German investors dividends come with a 30 percent (before 1994: 36 percent) tax credit, which is deductible from personal income tax. This tax credit is (as with the DAX) not included in the calculation, thus assuming implicitly a 30 percent personal tax rate.

5.1 Risk, return

The overall risk-return relation in the German market is described by the DAFOX and further analyzed by two subindices, the DAFOX-BC and the DAFOX-SC[3]. Descriptive statistics are given in Table 3. Annual returns are computed from continuously compounded monthly returns and expressed in percent. The sampling period (1/1974 - 12/1994) is divided into three subperiods (1974 - 1980, 1981 - 1987, 1988 - 1994). Table 3 shows that blue chips earned the highest return over the whole period, whereas small caps earned 0.83 percent less. This is true for the second and the third subperiod, too. Only in the years 1974 to 1980 small caps slightly outperformed the whole market.

Mean returns are lower in the first and higher in the second and third subperiod than on average. The same results can be found for the volatilities: They are above average in subperiods two and three and lower in subperiod one. Overall, mean returns show in the same direction as volatilities. A closer look at the numbers reveals that this return-volatility-relationship does not hold in subperiod one. The mean return of the small-cap-index is slightly greater and its volatility smaller than their counterparts.

Over the whole period, the distributions of the three index returns are not symmetric but skewed to the left. From the kurtosis one can infer fat-tailed return distributions. These statistics differ from (sub-) period to period indicating instable distributions over time.

[3] The DAFOX-BC (*Blue Chips*) and the DAFOX-SC (*Small Caps*) are subsamples of the DAFOX. The DAFOX-BC consists of all German stocks trading in the *continuous* market of the Amtlicher Markt at the FSE and the DAFOX-SC includes only stocks trading in the *periodic* market of the first segment. Both subsamples are treated as separate indices. The DAFOX is no linear combination of the subindices, since variations in and between the subsamples occur even within one year.

Table 3:

Statistics of DAFOX-indices for the whole sample period and three subperiods

Index	Mean	Volatility[4]	Skewness	Kurtosis
January 1974 to December 1994				
DAFOX	9.65	16.49	-0.91	4.20
DAFOX-BC	9.81	17.15	-0.84	3.74
DAFOX-SC	8.98	15.36	-0.77	4.67
January 1974 to December 1980				
DAFOX	6.72	11.73	0.06	0.63
DAFOX-BC	6.85	12.48	0.07	0.58
DAFOX-SC	6.83	11.10	0.38	0.97
January 1981 to December 1987				
DAFOX	11.85	19.55	-1.16	4.54
DAFOX-BC	12.06	20.02	-1.07	4.01
DAFOX-SC	10.91	19.30	-1.20	4.86
January 1988 to December 1994				
DAFOX	10.31	17.35	-0.88	2.79
DAFOX-BC	10.53	18.23	-0.87	2.83
DAFOX-SC	9.19	14.74	-0.28	1.44

[4] Volatility is calculated by multiplying the standard deviation of monthly returns by square root of 12.

5.2 Risk premia

Risk premia are calculated as excess return of the stock market, i.e. as the mean difference between market returns and the riskless rate. The DAFOX-returns serve as different proxies for the market returns and Frankfurt interbank rates are identified as riskless rates. The annualized risk premia are then calculated from the monthly differences as mentioned before. Table 4 exhibits their means and standard deviations (in parentheses) for the different periods.

Table 4:
Risk premia of the DAFOX-indices for the whole sample period and three subperiods

Index	1/74 - 12/94	1/74-12/80	1/81-12/87	1/88-12/94
DAFOX	3.33 (16.52)	1.06 (11.78)	5.58 (19.54)	3.36 (17.42)
DAFOX-BC	3.52 (17.18)	1.19 (12.53)	5.79 (20.01)	3.58 (18.30)
DAFOX-SC	2.68 (15.39)	1.17 (11.15)	4.64 (19.30)	2.24 (14.81)

Over the whole period risk premia are positive for the DAFOX and both subindices. Blue chips earned a risk premium which was 0.19 percent higher than the DAFOX and 0.84 percent higher than small cap-premium. Small caps had a premium 0.65 percent below the DAFOX. As seen from Table 3, too, higher volatilities (as risk proxies) earn higher risk premia, again with the exception of the DAFOX-SC in period one.

A look at Figure 1 reveals high variations of the risk premia over time. Ten out of twenty-one years exhibit negative premia. So, the positive risk premia in all subperiods are partially due to the choice of the sampling subperiods. One could also find subperiods with negative risk reward by a different subdivision of the sampling period.

As seen before, investors in German equities always receive (on average) a premium for risk. Attempts to explain this risk premium by the CAPM or the APT proved at best mixed results. Whereas Winkelmann (1984) in an early study rejects the validity of the CAPM, Frantzmann (1989) finds a significant positive relation between mean returns and market (beta) risk. But as in Müller (1992), this result holds only in bull markets. Idiosyncratic risk has a premium, too, but does not, if added, improve the cross-sectional regression.

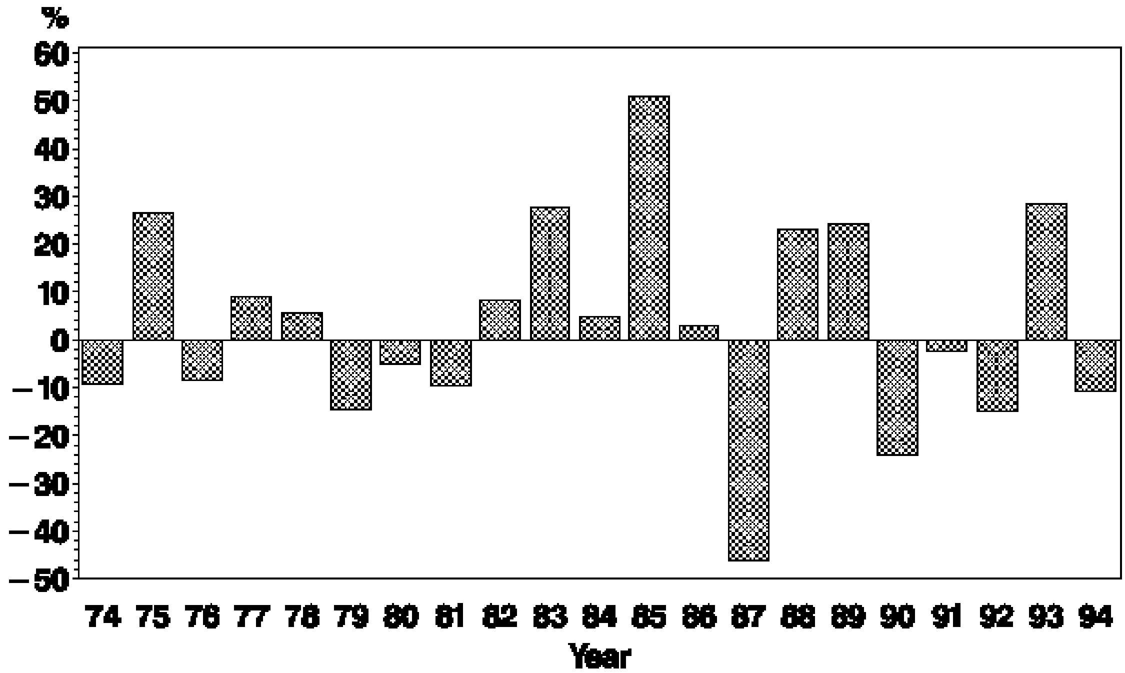

Figure 1: Risk premia of the DAFOX

Table 5 represents mean annual returns and betas of 12 industry groups for the period 1974 to 1994. The industry groups correspond to the classification of the Statistische Bundesamt and the DAFOX is used as a market index. The cross-sectional regression yields γ_0 = 4.63 percent and γ_1 = 4.48 percent with R^2 = 0.16.

Tests of the APT by Frantzmann and Müller show results similar to the CAPM tests. The existence of significant risk premia on the factors cannot be denied in general. But for a bear market, the null hypothesis of zero risk premia is not rejected. Sauer (1994) does not find significant premia for systematic risk, so that no exact factor valuation model exists

Table 5:

Mean annnual returns and betas of industry groups

Industry	Mean return (percentage p.a.)	beta
Chemicals/Pharmaceutical	9.97	0.89
Electrical	8.08	1.10
Utilities/Energy/Coal	10.14	0.63
Banking/Insurance	10.60	1.13
Vehicles/Machinery	9.81	1.18
Steel/Metals	8.81	1.03
Construction/Building/Material	9.89	0.86
Retail	5.67	0.87
Consumer Goods/Leisure	6.60	0.71
Transportation	7.59	0.87
Holdings	11.89	1.08
Others	6.32	0.80

.

6 The intervalling effect and other anomalies in the German stock market

6.1 Anomalies revisited

Empirical studies have detected a number of anomalies in stock returns, i.e. systematic patterns in returns with respect to calendar time or certain firm characteristics. The most prominent of these regularities are the turn-of-the-week (or Monday) effect, the turn-of-the-year (or January) effect and the size (or small firm) effect.[5]

The turn-of-the-week effect has first been discovered by French (1980) and by Gibbons and Hess (1981) who find that Monday returns are systematically lower than returns on any

[5] Other anomalies are, for example, the dividend-yield effect and the price-earnings effect.

other day of the week. Banz (1981) analyzes the relationship between the market value of the equity of a firm and the average return of its stocks. He shows that the stocks of firms with a smaller market value of equity have significantly higher average returns than stocks of larger firms. The January anomaly was first detected by Keim (1983). He investigates the behaviour of the size anomaly across the different months of the year and finds that the return differences are signifiantly larger in January than in any of the other eleven months.

Frantzmann (1989) provides a detailed study of seasonalities for the German stock market. He finds that in the period 1970 to 1980 Friday returns are significantly positive and the highest of all days of the week, in contrast to Monday and/or Tuesday returns, which are not significantly different from zero. These results further hold for all months. Chang et al. (1993) show, that the Monday effect is observable on the German market, it disappears, however, when the test statistics are adjusted for potential heteroskedasticity. Frantzmann also shows that the turn-of-the-year-effect exists over the whole sample period. Whereas January shows the highest returns, May exhibits significantly negative returns. In addition, a turn-of-the-month-effect can be found.

Studies on a size effect in Germany were conducted by Stehle (1992) and by Schlag and Wohlschieß (1992). Whereas Stehle finds some evidence of a size effect in Germany, especially in January, Schlag and Wohschieß obtain very low *t*-statistics for size as an explanatory variable for mean returns. Sauer (1994), too, does not detect a size related anomaly for stock returns in Germany.

6.2 Overreaction

The overreaction hypothesis stipulates, that extreme stock price movements in one direction are followed by subsequent movements in the opposite direction. The reaction will be the greater, the more extreme the initial price movement is. Empirical results mainly reported by DeBondt and Thaler (1985, 1987) for the U.S. have been criticized in the literature for several reasons. The main arguments are that overreaction is due to size or to changing risk over time.

In his broad investigation Meyer (1994) takes into account most of the critics of previous studies. For the period 1961 to 1990 he generally finds an overreaction effect for the German stock market. The results are strong and more significant for longer formation and test periods. The effect holds for market and for risk adjusted returns. It can neither be explained by size nor by a risk change in the investigation period. It is nevertheless not clear if a contrarian investment strategy including transaction and information costs would prove profitable.

6.3 The intervalling effect

The intervalling-effect bias in the estimated coefficient for the systematic risk of a stock has first been analyzed and empirically documented by Cohen, Hawawini, Maier, Schwartz and Whitcomb (CHMSW) (1983a, 1983b) for the U.S. market. Frantzmann (1990) shows first results on this issue for the German market. He finds that the (equally weighted) average β coefficient for the stocks in his sample almost monotonically increases with the length of the return interval. Schlag (1994) groups the stocks in his sample with respect to their market capitalization and their trading volume. He detects that the direction of the monotonic relationship between the estimate for β and the length of the return interval is exactly opposite for small and large stocks, and this result also holds for the liquidity classification. Consistent with the results for the U.S. market it can be observed that the estimated β decreases with the return interval for large stocks, and that it increases for small stocks. There is one important difference, however. Whereas in the U.S. smaller stocks tend to have a higher β just the opposite is true for Germany. As a consequence of this fact the difference in estimated systematic risk between highly capitalized stocks and small firms tends to increase with increasing return intervals in the U.S., but the gap narrows in Germany.

This is again confirmed by the results of the following study. The sample consisted of all the stocks traded on the Frankfurt Stock Exchange which had no more than two missing daily return observations during the period from January 1987 to December 1993. These stocks were then grouped into ten size deciles according to their market value of equity on December 31, 1986. The β coefficients were then estimated using a technique suggested by

Corhay (1992) for intervals of 1, 5, 10, 20, 30, 60 and 120 trading days. The DAFOX was used as the market index, and the regressions were performed using OLS.

Table 6 shows some descriptive statistics for the market value of equity in the ten groups. It is interesting to note that the increase in mean market value is rather slow from deciles 1 to 9. In decile 10, however, the mean market value is about six times as large as in decile 9. Furthermore, the average firm in decile 10 has a market capitalization that is about three

Table 6

Market value of equity for size deciles[a]

Decile	Mean	Minimum	Maximum
1	12,988	3,225	23,895
2	40,978	24,000	58,740
3	75,532	58,800	95,000
4	132,651	96,000	184,000
5	249,968	191,400	343,000
6	485,515	377,513	624,800
7	885,243	689,005	1,090,000
8	1,343,623	1,092,000	1,648,800
9	2,610,362	1,739,500	3,881,200
10	15,188,526	3,882,760	52,172,102

[a]Measured in thousands of DEM on Dec. 31, 1986.

times as large as the market value of the representative firms of all the other nine groups together. It becomes obvious from these statistics that market capitalization is heavily concentrated in a few very large stocks on the German market. Sauer (1994) provides further data on this issue.

Table 7 shows the results for the estimation of systematic risk coefficients. The entries represent the average β for the respective size decile for the given return interval. First note that decile 10 has the largest coefficients for any return interval. Furthermore, it is the only decile with β oefficients larger than one. Decile 6, however, is somewhat different from the other groups in that it always violates the monotonicity of β with respect to size for a given return interval.

Concerning the main point of interest, the monotonic reationship between systematic risk and β this study confirms the results of Schlag (1994). For small stocks we observe a

Table 7

Mean β for size deciles for various return intervals[a]

	Return Interval (Trading Days)						
Decile	1	5	10	20	30	60	120
1	0.1625	0.2502	0.3133	0.4092	0.4848	0.5958	0.6239
2	0.2244	0.3086	0.3560	0.4304	0.4786	0.5411	0.6047
3	0.2529	0.3868	0.4358	0.4838	0.5013	0.5627	0.6162
4	0.3695	0.4760	0.5397	0.5931	0.6214	0.6711	0.6987
5	0.5132	0.5911	0.6171	0.6774	0.6970	0.7263	0.7688
6	0.7342	0.7533	0.7824	0.8323	0.8542	0.8869	0.9699
7	0.6103	0.6905	0.7292	0.8007	0.8331	0.8645	0.9088
8	0.7000	0.7050	0.7308	0.7680	0.7929	0.8258	0.8631
9	0.9221	0.9416	0.9568	0.9645	0.9663	0.9786	0.9760
10	1.1631	1.1328	1.1161	1.0986	1.0980	1.1017	1.0768

[a] β computed as in Corhay (1992).
Values in the table are mean values for the respective size decile.
Regression method: OLS.

steady increase in β with increasing return intervals. In deciles 1 to 9 there is only one violation of this monotonicity in group 9, where the average β is slightly lower for an interval of 120 days than it is for 60 days. In decile 10 there is not such a strict pattern of monotonicity, although the tendency for β to decrease with the length of the return interval is clearly noticeable, especially in the range from one to 30 days. In addition, the β for 120 days has the lowest estimate across all intervals in this class.

It is further interesting to note that, as described above, the distance between the estimated β coefficients for small and large stocks decreases with increasing return periods. For daily returns this difference between the extreme deciles is more than 1.0 with a value of 0.1625 for the smallest and 1.1631 for the largest stocks. For an interval of 120 days the distance is just 0.4529, i.e. less than half of what is observed for daily returns.

7 Summary

We have shown that the German stock market as a part of the international equity market exhibits most of the results and problems known from the literature. The valuation process is not yet clear and research is ongoing. We did not mention empirical results related to accounting information. An excellent overview on this area of research can be found in Müller (1992).

References

Banz, R.W. (1981): The Relationship Between Return and Market Value of Common Stocks Journal of Financial Economics 9, pp. 3-18

Bernstein, P.L. (1987): Liquidity, Stock Markets, and Market Maker, Financial Management, Summer, pp. 54-62.

Bühler, W., H. Göppl, H.-P. Möller und Mitarbeiter (1993): Die Deutsche Finanzdatenbank (DFDB), Zeitschrift für betriebswirtschaftliche Forschung, Sonderheft 31, pp. 287-331.

Chang, E.C., M.J. Pinegar, R. Ravichandran (1993): International Evidence on the Robustness of the Day-of-the-Week Effect, Journal of Financial and Quantitative Analysis 28, pp. 497-513.

Cohen, K.J., G.A. Hawawini, S.F. Maier, R.A. Schwartz, D.K. Whitcomb (1983a): Friction in the Trading Process and the Estimation of Systematic Risk, Journal of Financial Economics 12, pp. 263-287.

Cohen, K.J., G.A. Hawawini, S.F. Maier, R.A. Schwartz, D.K. Whitcomb (1983b): Estimating and Adjusting for the Intervalling-Effect Bias in Beta, Management Science 29, pp. 135-148.

Corhay, A. (1993): The Intervalling Effect Bias in Beta: A Note, Journal of Banking and Finance 16, pp. 61-73.

DeBondt, W.F.M., R.H Thaler (1985): Does the Stock Market Overreact ?, Journal of Finance 40, pp. 793-805.

DeBondt, W.F.M., R.H Thaler (1987): Further Evidence on Investor Overrreaction and Stock Market Seasonality, Journal of Finance 42, pp. 557-581.

Deutsche Börse AG (1994): Frankfurter Monatsstatistik für Dezember 1994, Frankfurt.

Frantzmann, H.-J. (1989): Saisonalitäten und Bewertung am deutschen Aktien- und Rentenmarkt, Fritz Knapp Verlag, Frankfurt.
Frantzmann, H.-J. (1990): Zur Messung des Aktienrisikos deutscher Aktien, Zeitschrift für betriebswirtschaftliche Forschung 42, pp. 67-83.
French, K.F. (1980): Stock Returns and the Weekend Effect, Journal of Financial Economics 8, pp. 55-69.
Gibbons, M., P. Hess (1981): Day of the Week Effects and Asset Returns, Journal of Business 54, pp. 579-96.
Göppl, H., H. Schütz (1993): The Design and Implementation of a German Stock Price Research Index (Deutscher Aktien-Forschungsindex DAFOX), in: Diewert, D.E.; K. Spremann, F. Stehling (eds.): Mathematical Modelling in Economics - Essays in Honor of Wolfgang Eichhorn, Springer-Verlag, Berlin, pp. 506-519.
Griswold, D.R. (1995): German Reunification: Analysis of its Impact on German Equities, Dissertation, Chicago, Graduate School of Management.
Keim, D. (1983): Size-Related Anomalies and Stock Return Seasonality - Further Empirical Evidence, Journal of Financial Economics 12, pp. 13-32.
Meyer, B. (1994): Der Overreaction-Effekt am deutschen Aktienmarkt, Fritz Knapp Verlag, Frankfurt.
Müller, W. (1992): Bilanzinformation und Aktienbewertung, Fritz Knapp Verlag, Frankfurt.
Sauer, A. (1994): Faktormodelle und Bewertung am deutschen Aktienmarkt, Fritz Knapp Verlag, Frankfurt.
Schlag, C., V. Wohlschieß (1992): Is β dead ? - Results for the German Stock Market, Discussionpaper Nr. 178, Institut für Entscheidungstheorie und Unternehmensforschung, Universität Karlsruhe (TH).
Schlag, C. (1994): Neues zum Intervalling-Effekt am deutschen Aktienmarkt, Kredit und Kapital 27, pp. 437-460.
Stehle, R. (1992): The Size Effect in the German Stock Market, Working Paper, Universität Augsburg.
Winkelmann, M. (1984): Aktienbewertung in Deutschland, Verlag Anton Hain, Königstein.