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Performance and Market Share: Evidence from the German Mutual Fund Industry

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Abstract

The performance of a sample of German open-end mutual funds is analyzed, using monthly observations which cover the period 1987-1993. We show that the risk-adjusted performance of these funds varies significantly in cross-section. We provide evidence that these performance differences translate into changes in market shares, allowing better funds to grow faster than poor performers. A specification test supports the hypothesis that households base their investment decisions on risk-adjusted returns rather than on raw returns.

Keywords: Mutual fund performance, risk and return, household behavior

JEL-classification: G23

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1 Introduction

Starting with SHARPE (1966) and JENSEN (1968), the analysis of mutual fund performance has attracted considerable attention. Two lines of research can be identified. The classical one concentrates on the question of whether mutual funds outperform or underperform the market. Substantial progress has been made in improving the econometric methodology but a conclusive answer is yet to be found. (See GRINBLATT / TITMAN, 1995, for a survey.) Another (and younger) branch of literature accepts the existence of performance differences among mutual funds and between mutual funds and the market, looking into their causes and consequences.

DROMS / WALKER (1996) view differences in fund size as a reason for cross-sectional performance variation. The authors refer to "conventional wisdom in the investment industry" according to which "investment performance is negatively related to asset size" (p. 348). Their results, however, do not support this view. WARTHER (1995) looks into the impact of fund performance on cash flows into and out of mutual funds on an aggregate level. He documents a positive influence which may be caused either by price pressure or by informational effects. ZHENG (1996), extending an approach of GRUBER (1996), analyzes the relationship between cash flows and subsequent fund performance. He can show that newly invested money earns higher than average returns. This finding indicates that investors have either fund selection or timing ability. Also, it is consistent with investors rationally responding to cross-sectional variation in performance. A study which directly addresses the consequences of performance differences, is CAPON / FITSIMONS / PRINCE (1996). Based on a survey conducted among investors, they conclude that past performance is the most important (but not the sole) information source and mutual fund selection criterion. Also IPPOLITO (1992), PATEL / ZECKHAUSER / HENDRICKS (1994) and SIRRI / TUFFANO (1992) find that fund growth is related to past performance. LAKONISHOK / SHLEIFER / VISHNY (1992) report similar results for pension funds.

In this study we address the issue of whether there is cross-sectional variation in the performance of mutual funds in Germany. Also, we investigate into how such a variation, if it exists, is reflected in the housholds' investment decisions. More specifically, we analyze how performance differences translate into changes in market shares. We test nonnested models of investment behavior against each other, trying to gain insights into how households evaluate risk. Our empirical results indicate that cross-sectional variation in mutual fund performance indeed exists. We can show that these performance differences translate into changes in market shares, allowing better funds to grow faster than poor performers. A specification test supports the hypothesis that households base their investment decisions on risk-ajdusted returns rather than on raw returns.

As measured by U.S. standards, the German mutual fund industry is fairly small. At the end of the year 1995, there were 322 public funds investing in (domestic or international) stocks with DM 54.1 billion of assets under management. At that time, many of these funds were very young. This is illustrated by the fact that at the end of the year 1985, the number of funds did not exceed 82. By the end of the year 1995, the capital invested in mutual funds in the U.S. amounted to $ 10,933 per capita while the corresponding figure for Germany was not higher than $ 2,143. The little importance of mutual funds in Germany is a side-effect of its bank-based financial system, characterized by a small stock market (ALLEN / GALE 1995). A main reason for Germany's small stock market capitalization is its state-run pension system. While in the U.S. pension payments are based on past capital accumulation of the individual pensioner, there is no accumulated capital in the German system (EDWARDS / FISCHER 1994). Instead, individual claims are filed against the younger generation, i.e., pensions are paid out of contributions of the current workforce. Since the workforce holds the majority of votes in the country's political system, the pensioners' claims are subject to approval. As the German population has aged over the past decades, this approval has become increasingly costly. The retirement age has been increased and pension contributions have been cut down. As a consequence, people have started to build up private capital claims, insuring themselves against expropriation by the (future) working majority. A great deal of these private pension contributions have flown into mutual funds. This caused the capital invested in mutual funds per capita to increase from DM 963 at the end of 1985 to a 1995 year-end value of DM 3,073.

One of the salient features of the German bank-based financial system is that capital markets are dominated by big universal banks. This also holds for the mutual fund industry.

The largest investment trusts are bank subsidiaries and most of the retail business is done over the bank-counter. Banks promote their own funds and consult their customers accordingly. Thus, the mutual fund industry is characterized by a rather restrictive distribution network. This may limit the extent to which performance differences translate into changes in market shares.

In the following section we present our hypotheses. In Section 3 the performance of a sample of mutual funds is analyzed in cross-section. Section 4 deals with the impact of cross-sectional performance differences on market shares. In Section 5, we analyze the investors' behavior, trying to show that households indeed control for risk differences when making their investment decisions. Section 6 concludes.

2 The Hypotheses

The motivation of this paper emerges from the observation that the market shares of long-existing mutual funds in Germany have changed substantially in time. Table 1 presents a sample of funds and their relative market shares, i.e., their fractions in the domain spanned by the sample funds themselves. The figures show how these shares changed over a seven-year period ranging from December 1986 to December 1993. The share of the largest fund at the beginning of this period has declined from 28.82 percent to 16.08 percent seven years later. The fourth largest fund in December 1986 has increased its share from 13.51 percent to 20.36, becoming the largest fund at the end of the period under consideration. All funds with market shares of less than 3 percent could improve. As we shall see in the next section, the CAPM betas of these funds are very similar to each other and close to one. Thus, diversification is not a likely reason why investors chose to invest in new funds as opposed to increasing their investments in existing ones. We suspect that these changes in market shares are caused by cross-sectional variation in risk-adjusted returns. This leads us to the following hypothesis:

Hypothesis 1: There is cross-sectional variation in performance among mutual funds.

Insert Table 1 here

Given that there are performance differences, we hypothesize that investors are able to identify them. Instead of just looking at raw returns, households adjust returns for differences in risk. They exploit cross-sectional variation in performance when making new investments, i.e., they shop for the best fund:

Hypothesis 2: Households control for risk differences when comparing the performance of mutual funds.

It is this behavior of households that allows good performers to grow at the expense of bad performers. The consequence is changes in market shares:

Hypothesis 3: Cross-sectional performance differences among mutual funds translate into changes in market shares.

Both Hypotheses 1 and 2 have to hold if the chain of our arguments shall meet the empirical test. Without existing performance differences and without rational household behavior, we would not expect to find a link between the capital market performance and the retail performance of mutual funds. In the next section we try to uncover cross-sectional performance differences among funds. Also, we describe our dataset.

3 Fund Performance in Cross-Section

The dataset we used was provided by *Bundesverband Deutscher Investmentgesellschaften (BVI),* Frankfurt a.M. It consists of fifteen open-end mutual funds with monthly observations covering the period 1987-1993. Three of these funds held more than one percent of their assets in foreign stock for at least one month. We dropped them to avoid problems due to benchmark inadequacy. After eliminating another fund because of incomplete data, we were left with a sample of eleven funds as displayed in Table 1. For each of them we obtained monthly observations on certificate value, total assets under management, the fraction of assets invested in stocks, and net cash flow into or out of the fund.

Although the number of funds is fairly small, it should be noted that by December 1993, the end of the sample period, these funds accounted for 61.2 percent of the German market for domestic stock funds.

We calculated monthly returns, assuming that the funds' dividend payments were fully reinvested into the funds in question. Returns are net of management fees and bank custody fees.[1] As a benchmark for performance measurement, we used *Deutscher Aktienindex für Forschungszwecke (DAFOX)*.[2] This is a value-weighted index comprising all stocks traded in the premier market segment *(Amtlicher Handel)*[3] of the Frankfurt Stock Exchange. We used the three-month *Frankfurt Inter-Bank-Offered Rate (FIBOR)* as published by Deutsche Bundesbank as a risk-free rate of return.

We use three measures of fund performance. The first is the excess return measure developed by Jensen (1968), Jensen's alpha. The second measure is a modification of Jensen's alpha. It controls for changes in systematic risk due to cash flows into and out of the fund. We will call this measure the modified Jensen-alpha. As a third measure, we use raw returns.

The analysis of the relation between performance and changes in market share requires a time series of performance measures for each fund. We therefore use a rolling window estimation approach. The number of periods over which the performance of a mutual fund is to be measured, i.e., the choice of the window size, deserves attention. The smaller the window, the higher the number of performance observations. Also, the parameters in Jensen's model may not be stationary. Both arguments are in favor of small windows. If, however, the parameters are stationary, the statistical efficiency declines with the window size.

We chose window sizes of 18 and 24 months. We applied rolling windows, moving in steps of one month. The use of rolling windows implies an inconsistency with respect to the assumption of stationary parameters: while we assume the parameters to be stationary within each window, we allow them to vary across overlapping windows.[4] This generates an error-in-variables problem in the subsequent market shares regression which we will control for using an instrumental variables (IV)-approach.

The choice of our performance measures is motivated by related empirical work and limited by data availability. Our first measure, Jensen's alpha, is obtained as the intercept when regressing the fund's risk premium on the market risk premium. The second measure we apply is a modification of Jensen's alpha. FERSON / WARTHER (1996) show that cash flows into mutual funds are positively correlated with expected returns on the stock market. To the extent that these inflows are not immediately invested in stock, the funds' betas vary negatively with expected stock market returns.[5] In order to not let this bias the performance measure, we looked for a way to eliminate this effect. FERSON / WARTHER (1996) show that this can be achieved with the conditional performance evaluation approach developed by FERSON / SCHADT (1996). The approach we use is different, however. We control for the fraction of the fund's assets invested in stocks directly in the regression equation. Our econometric model reads:

$$(r_{i,t} - r_{f,t}) \;=\; a_i + b_i \, k_{i,t} \, (r_{m,t} - r_{f,t}) \;+\; e_t \qquad (1)$$

with e_t as the month t error term and $r_{i,t}$, $r_{f,t}$ and $r_{m,t}$ representing the respective month t returns of fund i, the riskless investment, and the market index. The fraction of assets invested in stocks by fund i at the end of month t is denoted by $k_{i,t}$. The intercept of this regression represents the modified Jensen-alpha whereas b_i estimates the CAPM beta of the (potentially time-varying) portion of the fund's assets invested in the stock market. The (unmodified) Jensen-alpha is obtained when restricting $k_{i,t}$ to being equal to one. In this case b_i estimates the CAPM beta of the fund's total assets with respect to the market index.

Our third performance measure is raw returns. According to empiricial results presented by SIRRI / TUFFANO (1992), investors react to raw returns rather than to risk-adjusted returns.

When measuring performance by raw returns, no regression is needed. We simply take the return within the amount of time spanned by the window. Jensen's alpha and its modification, however, were estimated within a pooled time series-cross section framework. Each fund forming one equation, we used Seemingly Unrelated Regression (SUR). This allowed us to control for contemporaneous correlation across the risk premiums of the funds. We obtained Maximum Likelihood (ML) estimators by iterated Generalized Least Squares (GLS) estimation. Standard errors were calculated using the WHITE (1980) correction for heteroskedasticity whenever the White-test indicated the presence of heteroskedasticity at the 10 percent significance level. Also, we tested for serial correlation using the LJUNG-BOX (1979) test statistic with a lag length of 12 months. Serial correlation, however, was never significant at the 10 percent level. This is to be expected in efficient capital markets.[6] We calculated a Wald-statistic under the hypothesis that the Jensen-alphas (or the modified Jensen-alphas) do not differ in cross-section. This test statistic was based on the corrected standard errors whenever heteroskedasticity turned out significant.[7]

The presented estimation procedure was applied to all windows, generating a time series of 67 and 61 performance observations, depending on which window size (18 or 24 months) was chosen.

Although the calculation of raw returns does not require an econometric model, a test on cross-sectional variation in performance does. For reasons of consistency with the Jensen-alpha approaches, we used a Wald-test within a SUR-framework, each fund forming one equation when regressing the raw returns on a constant and on fund-specific dummy variables. The same tests on serial correlation and heteroskedasticity and the same correction procedures for the standard errors were applied. As with the other two performance measures, serial correlation was never significant.

Table 2 offers descriptive statistics of the funds' CAPM betas as obtained for the modified Jensen-alpha approach and a window size of 24 months. These betas are fairly close to one, suggesting that investors may view the funds as close substitutes in terms of their risk-return characteristics. The results of the Wald-tests on the significance of cross-sectional performance variation are displayed in Table 3. For both the traditional and the modified Jensen-alpha approach, we find significant performance variation in cross-section for most of the periods analyzed. When using 18-month windows, 85 percent of the windows exhibit significant performance differences. With a window of 24 months, it is 72 percent. Our findings for the raw returns are quite different. For most of the periods the funds' returns do not differ significantly among each other.

Insert Tables 2 & 3 here

The findings support Hypothesis 1 which states that there is cross-sectional variation in mutual fund performance. This result is a prerequisite for our subsequent analysis of how a variation of performance among mutual funds translates into changes in market shares.

4 Performance and Market Shares

In this section, we try to empirically establish a relationship between the funds' investment performance and their retail performance. We apply all three concepts of mutual fund performance introduced in the preceding section. Also, we use two alternative measures of market share. The first one is based on assets under management. The amount of assets under management changes as capital flows into or out of the fund as a result of the households' acquisitions and sales of fund certificates. By this means it mirrors the sales performance of the fund. However, the amount of assets under management is also influenced by fund performance itself because performance affects the certificate value. This is why we use a second measure of market share, based on the number of certificates outstanding. This approach has the advantage of being solely determined by the fund's sales performance.

As a dependent variable, we use log changes in market shares. There are two types of regressors. The first one is the difference between the fund's performance and the sample mean, lagged by one period. By demeaning this variable, we try to eliminate the impact of time-specific common shocks. The second type of regressors is a fund-specific dummy variable. By using these fund-specific intercepts, we try to account for cross-sectional differences in growth opportunities and marketing efforts. The model reads:

$$\ln\left(MS_{i,t} / MS_{i,t-1} \right) = \gamma \left(perf_{i,t-1} - \overline{perf_{i,t-1}} \right) + \sum_i \eta_i I_I + \varepsilon_{i,t} \qquad (2)$$

with ε_t as the month t error term. $MS_{i,t}$ represents the market share of fund i in month t. The performance of fund i in month t is given by $perf_{i,t}$, $\overline{perf_t}$ is the mean performance of the sample funds in period t. The set of variables I_i denotes the fund-specific intercepts.

When using Jensen's alpha or its modification as a performance measure, we have to account for an error-in-variables problem which is not present with the raw returns. There are two reasons for the existence of that problem. Firstly, the alphas were generated in a regression, i.e., they are measured with error. Secondly, we deliberately allow for possible nonstationarities in the parameters of the Jensen model across windows while at the same time, we assume that these parameters are time-invariant within each window. Since these windows overlap, there is an inconsistency in our methodology. We control for this this error-in-variables problem with an IV-approach. As an instrument for $\left(perf_{i,t-1} - \overline{perf}_{t-1}\right)$, we used its lagged value. [8]

We estimated the market share model within a pooled time series-cross section framework. Again, each fund formed one equation. We controlled for contemporaneous correlation across funds using SUR. We calculated ML estimators by iterated GLS estimation. We corrected standard errors for heteroskedasticity whenever the White-statistic turned out significant. We also tested for serial correlation using the LJUNG-BOX (1979) test statistic with a lag of 12 months.[9]

We imposed a cross-equation constraint which demands that the parameter γ be equal for all funds. Since the changes in market shares of the funds add to zero, the variance-covariance matrix of the error terms is singular. We thus eliminated one equation (i.e. one fund) from the model. We use a result from BARTEN (1969) which states that ML estimators are invariant as to which equation is dropped.

The regression results are shown in Table 4. It turns out that the cross-sectional variation in fund performance is indeed a determinant of changes in market share. For the modified Jensen-alpha, the coefficient in question is significant irrespective of the window size or the measure of market share chosen. When using the traditional Jensen-alpha as a performance measure, statistical significance is limited to the 18-month windows. For the raw returns, the regression coefficient in question is significant only when using the number of certificates as the market share measure.

Insert Table 4 here

The results support Hypothesis 3, stating that differences in cross-sectional performance translate into changes in market shares. This holds despite a restrictive distribution network which chains the fund's retail business to the bank counter. With respect to the raw returns, the findings are puzzling. Not only did we find only very little support for the hypothesis that these returns vary in cross-section, they also do not fit into the picture of households reacting to past performance when making their investment decisions. We will investigate into this in the following section.

5 Investor Behavior

We have argued above that the CAPM betas of the analyzed funds are close to each other (see Table 2). As can be seen from Equation 1, raw returns and Jensen-alphas are perfectly correlated across funds if they all have the same beta. The more similar the betas are, the higher this correlation is, *ceteris paribus*. Thus, the significance of the raw returns in the market share equation may be spurious, generated by a correlation between raw returns and Jensen-alphas (or modified Jensen-alphas). We thus tested two nonnested share equation models against each other, one being based on raw returns, the other one building on the Jensen-alpha or its modification. We use the *J*-test statistic developed by DAVIDSON / MCKINNON (1981). This test procedure can easily be adjusted to a SUR-framework with heteroscedastic error terms and one of the two models using instrumental variables.[10]

A *J*-test consists of a pair of unidirectional specification tests which represent opposing null hypotheses. In the order we followed, the H_0 of the first test states that the Jensen-alpha (or its modification) is the correct performance measure. The H_0 of the second test says that the raw returns do better in explaining the changes in market shares. Given that households behave rationally, we would expect to obtain a significant statistic only in the second test. In small samples, however, it can happen that the *J*-test results are inconclusive, either rejecting both null hypotheses or neither one.[11]

The *J*-test results are presented in Table 5. Irrespective of the window size and the market concept chosen, the raw returns are rejected in favor of the modified Jensen-alphas. For the traditional Jensen-alphas, this holds only for the 18-month windows. When using 24-month windows, the *J*-test is inconclusive, rejecting neither model. We view these results as supporting Hypothesis 2 which claims that households behave rationally when making their investment decisions. This is what translates the investment performance of mutual funds into retail performance at the bank counter.

Insert Table 5 here

6 Conclusion

We analyzed the performance of 11 German mutual funds. The sample period covers the years 1987-1993. At the end of this period, these funds accounted for 61.2 percent of the German market for domestic stock funds. We could show that there are cross-sectional variations in fund performance and that these variations translate into changes in market shares. Good performers gain at the expense of bad performers. This result holds despite a restrictive retail network which is dominated by universal banks, promoting the funds of their own trust subsidiaries.

We found support for the hypothesis that households adjust the returns of mutual funds for risk differences when making their investment decisions.

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Table 1: Fund Market Shares

The market share of sample fund i is defined as the fraction of assets under management of fund i in the assets under management of all sample funds.

		Assets under Management (Million DM)		Market Share (percent)	
Fund No.	Fund Name	January 1987	December 1993	January 1987	December 1993
1	*MK Alfakapital*	79.5	378.4	1.20	2.53
2	*Concentra*	1,024.6	1,916.0	15.49	12.82
3	*Dekafonds*	893.7	3,042.1	13.51	20.36
4	*FT-Frankfurt-Effekten-Fonds*	43.3	1,188.3	0.65	7.95
5	*Fondak*	791.6	939.6	11.97	6.29
6	*SMH Special*	75.6	371.6	1.14	2.49
7	*Thesaurus*	153.4	741.4	2.32	4.96
8	*DIT Fonds für Vermögensbildung*	97.3	1,344.6	1.47	9.00
9	*DIT Wachstumsfonds*	107.8	290.4	1.63	1.94
10	*Investa*	1,441.3	2,325.1	21.79	15.56
11	*Unifonds*	1,905.9	2,402.9	28.82	16.08
	Total	6,614.0	14,940.4	100.00	100.00

Source: Bundesverband Deutscher Investmentgesellschaften, Frankfurt a.M., Germany.

Table 2: Descriptive Statistics of Estimated CAPM Betas

These descriptive statistics refer to the modified alpha approach using a 24-month window; it is based on 61 observations (windows).

Fund No.	CAPM betas				
	Mean	Median	Minimum	Maximum	Standard deviation
1	0.993	0.968	0.891	1.074	0.051
2	1.063	1.080	0.936	1.144	0.055
3	1.083	1.084	0.993	1.176	0.035
4	0.969	0.987	0.875	1.029	0.047
5	1.026	1.036	0.948	1.062	0.031
6	0.816	0.832	0.692	0.921	0.075
7	1.053	1.076	0.921	1.151	0.063
8	0.838	0.819	0.634	1.031	0.075
9	1.071	1.089	0.948	1.254	0.086
10	1.040	1.063	0.930	1.101	0.054
11	1.013	1.053	0.880	1.075	0.061

Table 3: Cross-Sectional Performance Differences

Statistical significance of cross-sectional performance differences among the sample funds are based on Wald-Tests, applying a 10 percent significance level.

Performance measure	Window size (in terms of months covered)	Number of windows	Period covered by first window	Windows with no significant cross-sectional performance difference [a)]	Number of windows with no significant cross-sectional performance difference
Jensen's alpha	18	67	1/1987- 6/1988	6/1988- 3/1989	10 out of 67
Jensen's alpha	24	61	1/1987-12/1988	12/1988-10/1989; 12/1989; 2/1991- 6/1991	17 out of 61
Modified alpha	18	67	1/1987- 6/1988	6/1988- 3/1989	10 out of 67
Modified alpha	24	61	1/1987-12/1988	12/1988-10/1989; 12/1989; 2/1991- 6/1991	17 out of 61
(Raw) Return	18	67	1/1987- 6/1988	6/1988- 4/1989; 9/1990-12/1993	51 out of 67
(Raw) Return	24	61	1/1987-12/1988	12/1988- 9/1989; 9/1990-11/1993	49 out of 61

[a)] Windows are labeled with the last month covered, e.g., the 6/1988 18-month window spans the period 1/1987-6/1988.

Table 4: Fund Performance and Market Share

Performance measure	Window size (in terms of months covered)	Number of observations (windows)	Market share based on	γ (*t*-value) [a)]
Jensen's alpha	18	67	number of certificates outstanding	1.188** (2.183)
Jensen's alpha	18	67	assets under management	1.044* (1.747)
Jensen's alpha	24	61	number of certificates outstanding	0.6581 (1.055)
Jensen's alpha	24	61	assets under management	0.8849 (1.218)
Modified alpha	18	67	number of certificates outstanding	1.348** (2.367)
Modified alpha	18	67	assets under management	1.261** (2.029)
Modified alpha	24	61	number of certificates outstanding	1.121* (1.786)
Modified alpha	24	61	assets under management	1.636** (2.273)
(Raw) Return	18	67	number of certificates outstanding	0.6325* (1.889)
(Raw) Return	18	67	assets under management	0.5577 (1.396)
(Raw) Return	24	61	number of certificates outstanding	0.7796* (1.849)
(Raw) Return	24	61	assets under management	0.40813 (0.824)

a) */**: signficant at the 10/5 percent level.

Table 5: *J*-Tests

Performance measure	Window size (in terms of months covered)	Number of observations (windows)	Market share based on	Significance level [a)] *;**;***: 10;5;1 percent
Jensen's alpha	18	67	number of certificates outstanding	-- / **
Jensen's alpha	18	67	assets under management	-- / *
Jensen's alpha	24	61	number of certificates outstanding	-- / --
Jensen's alpha	24	61	assets under management	-- / --
Modified alpha	18	67	number of certificates outstanding	-- / ***
Modified alpha	18	67	assets under management	-- / **
Modified alpha	24	61	number of certificates outstanding	-- / *
Modified alpha	24	61	assets under management	-- / **

a) Two significance levels are given. The first one refers to a *J*-test the H_0 of which states that the model with the risk-adjusted return (i.e. Jensen's alpha or its modification) is to be preferred over the one with the raw return. The second significance level represents a *J*-test with an H_0 that says that the raw returns are the correct specification.

[1] We calculated approximations for the total of management fees and bank custody fees from accounting statements. In the order the funds are presented in Table 1, these figures read (as a percentage of the market value of assets under management; averaged over the period 1989-1991): 1.225; 0.591; 0.552; 0.478; 0.525; 0.323; 0.697; 0.646; 0.620; 0.487; 0.572. Besides these costs, there exists a premium (load) that is charged at the time of issue. For some of the funds, this load is degressive. In the aforementioned order, the percentage loads for investments of amounts of less than DM 50,000 read: 7.53; 5.00; 5.26; 5.00; 5.00; 6.383; 5.00; 5.00; 5.00; 3.00; 5.00; 5.00. Source: Vademecum der Investmentfonds, ed. by Hoppenstedt Verlag, Darmstadt, Germany.

[2] The data was provided by *Deutsche Finanzdatenbank (DFDB)*, Karlsruhe, Germany.

[3] Besides the premier market segment there are three other segments. These are "Geregelter Markt", "Freiverkehr" (over-the-counter) and „Neuer Markt" (a market for small capitalization stocks set up in March 1997).

[4] This problem is also inherent in rolling-beta approaches used to test the CAPM (e.g. FAMA / MC BETH 1973).

[5] This partly explains the anomaly in the timing ability which several studies on mutual fund performance have discovered (see FERSON / SCHADT 1996).

[6] We used the LJUNG-BOX (1979) statistic since its direct counterpart is the NEWEY-WEST (1987) correction which will be relevant in either the sole presence of serial correlation or the presence of both serial correlation and heteroskedasticity.

[7] See GREENE (1997, p. 163).

[8] See GREENE (1997, p. 438-9).

[9] Serial correlation did not prove significant at the ten percent level for any market concept or performance measure used.

[10] As in the preceding regressions, we used the WHITE (1980)-correction for heteroskedasticity whenever the test-statistic turned out significant. Also, we checked on serial correlation using LJUNG-BOX (1979) with a lag of 12 months, never obtaining a significant test statistic.

[11] See GREENE (1997, p. 365-6).