No. 2006/06

Investment Performance and Market Share: A Study of the German Mutual Fund Industry

Jan Pieter Krahnen, Frank A. Schmid, and Erik Theissen

Center for Financial Studies
an der Universität Frankfurt ▪ Mertonstraße 17-21 ▪ D-60325 Frankfurt am Main
Telefon: +49 (0)69 798-30050
Fax: +49 (0)69 798-30077 ▪ http://www.ifk-cfs.de ▪ E-Mail: info@ifk-cfs.de

Center for Financial Studies

The *Center for Financial Studies* is a nonprofit research organization, supported by an association of more than 120 banks, insurance companies, industrial corporations and public institutions. Established in 1968 and closely affiliated with the University of Frankfurt, it provides a strong link between the financial community and academia.

The CFS Working Paper Series presents the result of scientific research on selected topics in the field of money, banking and finance. The authors were either participants in the Center´s Research Fellow Program or members of one of the Center´s Research Projects.

If you would like to know more about the *Center for Financial Studies*, please let us know of your interest.

Prof. Dr. Jan Pieter Krahnen

Prof. Volker Wieland, Ph.D.

Center for Financial Studies
an der Universität Frankfurt ▪ Mertonstraße 17-21 ▪ D-60325 Frankfurt am Main
Telefon: +49 (0)69 798-30050
Fax: +49 (0)69 798-30077 ▪ http://www.ifk-cfs.de ▪ E-Mail: info@ifk-cfs.de

CFS Working Paper No. 2006/06

Investment Performance and Market Share: A Study of the German Mutual Fund Industry*

Jan Pieter Krahnen[1], Frank A. Schmid[2], and Erik Theissen[3]

March 8, 2006

Abstract:
We study a set of German open-end mutual funds for a time period during which this industry emerged from its infancy. In those years, the distribution channel for mutual funds was dominated by the brick-and-mortar retail networks of the large universal banks. Using monthly observations from 12/1986 through 12/1998, we investigate if cross-sectional return differences across mutual funds affect their market shares. Although such a causal relation has been established in highly competitive markets, such as the United States, the rigid distribution system in place in Germany at the time may have caused retail performance and investment performance to uncouple. In fact, although we observe stark differences in investment performance across mutual funds (and over time), we find no evidence that cross-sectional performance differences affect the market shares of these funds.

JEL Classification: G23

Keywords: Mutual Funds, Abnormal Returns, Market Shares, Distribution Channel

* We thank Jonathan Evans and Peter Reichling for comments.

[1] University of Frankfurt, CFS, and CEPR; email: krahnen@finance.uni-frankfurt.de

[2] Center for Financial Studies (CFS); email: mail@frankschmid.com

[3] University of Bonn, CFR, and CFS; email: theissen@uni-bonn.de

1. Introduction

We study a set of German open-end mutual funds for a time period during which this industry emerged from its infancy. In those years, the distribution channel for mutual funds was dominated by the brick-and-mortar retail networks of the large universal banks. Using monthly observations from 12/1986 through 12/1998, we investigate if cross-sectional return differences across mutual funds affect their market shares. Although such a causal relation has been established in highly competitive markets, such as the United States, the rigid distribution system in place in Germany at the time may have caused retail performance and investment performance to uncouple.

Starting with Sharpe (1966) and Jensen (1968), there have been numerous academic studies dedicated to the analysis of the investment performance of mutual funds. Some of these studies focus on the question of how mutual funds perform relative to some return benchmark. Other studies take performance differences in mutual funds as given and go on to investigate their causes and consequences. This study falls into both categories as it both provides evidence for cross-sectional differences in investment performance and investigates the effects of such differences on the market shares of these funds.

In a cross-sectional study of the link between retail and investment performance of mutual funds, Droms and Walker (1996) relate investment performance to the amount of assets under management. They refer to "conventional wisdom in the investment industry," according to which "investment performance is negatively related to asset size" (p. 348). Although the findings of Droms and Walker do not substantiate this hypothesis, Chen et al. (2004) can show that investment performance indeed correlates negatively with the size of the fund.

Warther (1995) and Edelen and Warner (1999) study the impact of investment performance on the cash flow into and out of mutual funds at the aggregate level. These authors show that the cash flow into funds correlates positively with investment performance, a result that may be due to price pressure or informational effects. Reversing the direction of causality, Gruber (1996) and Zheng (1996) investigate how cash flow affects fund performance. These authors show that newly invested money garners higher-than-average returns. This finding indicates that investors have either fund-selection or timing ability. Further, the finding is consistent with the hypothesis that investors respond rationally to cross-sectional variation in mutual fund performance.

A study that addresses directly the consequences of investment performance differences is Capon, Fitsimons, and Prince (1996). Based on a survey conducted among investors, these authors conclude that past performance is the most important (but not sole) information source and criterion for mutual fund selection. Berk and Green (2004) provide a theoretical analysis of the relation between fund growth and investment performance. Several papers (e.g., Bergstresser and Poterba, 2002; Ippolito 1992; Patel, Zeckhauser, and Hendricks, 1994; and Sirri and Tuffano, 1998) analyze this relation empirically; overall, the empirical evidence supports the hypothesis that the growth of mutual funds correlates with their past investment performance; Lakonishok, Shleifer, and Vishny (1992) report similar results for pension funds.

Most relevant to the following analysis is the study by Ber, Kempf, and Ruenzi (2005). These authors analyze the retail performance of German mutual funds for the period 1990 through 2003. Ber, Kempf, and Ruenzi find that the (net) cash flow (as a percentage of assets under management) into funds relates positively (and in a convex way) to past investment performance. It bears to mention that these authors' empirical model lacks a steady-state equilibrium for the retail market. For instance, a fund that consistently offers the highest return would keep gaining market share in an unconstrained manner, thus approaching a market share of 100 percent. Further, it is doubtful that the investment performance of a fund (relative to its competitors) would have the same percentage effect on asset growth for small and large funds alike.

Another paper of import is Schmidt and Schleef (2001). Using data from 1997, these authors investigate if banks execute orders in good faith when operating as agents for their own line of funds. Schmidt and Schleef find no evidence that banks do not act in the best interest of the funds (and, hence, the private investors)—this holds in spite of the competitive restrictions arising from a retail network predominantly characterized by exclusive dealing, as discussed below.

In this study, we investigate for German open-end mutual funds possible cross-sectional variation in the investment performance and, if such variation is born out in the data, its influence on retail performance. More specifically, we examine how differences in investment records affect market shares. To this end, we employ three concepts of investment performance and two concepts of market shares.

The causal link between investment performance and (subsequent) retail performance is of particular interest for Germany during our period of observation. All the funds in our data set are operated and distributed by large, universal banks with extensive retail networks or large numbers of associated (savings or cooperative) banks. Most German households with brokerage accounts keep these accounts with their banks, and most households have only one major bank relationship. The mutual funds are typically sold on the shop floor of a brick-and-mortar bank branch. Further, online brokerages that offer the full menu of mutual funds were still in their infancy during our time of observation. Thus, there was little competition among funds that belonged to different retail (that is, banking) networks (see Ber, Kempf, and Ruenzi, 2005). Not surprisingly, although we discover stark performance differences in cross-section (and over time) in our set of mutual funds, we find no compelling evidence that such cross-sectional performance differences impact the market shares of these funds.

The paper is organized as follows. In section 2, we describe our data set and analyze the performance of a set of mutual funds in cross-section and over time. Section 3 studies the impact of possible cross-sectional performance differences on the market shares of these funds. Section 4 concludes.

2. Mutual Fund Performance in Cross Section

The German mutual fund industry is small, as measured by U.S. standards. At the end of 1998, there were 456 public funds investing in (domestic or international) stocks with 156.6 billion Deutschmarks of assets under management. Many of the mutual funds that existed at that point in time had just recently been set up, which is highlighted by the fact that at the end of 1986 (the beginning of our observation period), there had been only 86 such funds in Germany. In the United States, the capital held in mutual funds ran at $36,062 per capita at the end of 1998; by way of contrast, the corresponding figure for Germany amounted to only $4,900. In recent years, however, the mutual fund industry in Germany has grown considerably as households have been faced with the prospect of cut-backs in the state-run pension system. For instance, the per-capita investment in mutual funds amounted to 4,900 Deutschmarks by the end of 1998, up from 1,162 Deutschmarks as at the end of 1986.[1]

Our data set was provided by *Bundesverband Deutscher Investmentgesellschaften (BVI)*,[2] Frankfurt a.M. The observations, which are of the monthly frequency, start in December 1986. Although many of the funds in the data set had been in existence long before December 1986, we are constrained to this starting date as monthly data on assets under management are not available prior to that point in time. We include all mutual funds that were categorized as invested in domestic stocks by *BIV*, of which there were 13 at the beginning of our observation period. Although there had been 86 stock mutual funds at the time (as mentioned previously), most of these 86 funds either invested significant fractions of their assets in foreign stocks or in fixed income securities. Note that including funds with significant fixed-income or non-domestic stock holdings would cause benchmarking problems; this is because, for many of these funds, during the period in question, there are no complete records available on their asset allocation.

Of the funds that qualify for our sample, we discarded one fund (*DEVIF-Invest*) that went out of business in 1990. On the other hand, we added a fund (*DIT-Fonds für Vermögensbildung*), which, at the beginning of our observation period, had been categorized as invested in domestic stocks and bonds, but was re-categorized as a domestic stock fund in 1991. On average, this fund had more than 80 percent of its assets under management invested in domestic stocks prior to the reclassification, with a monthly low of 71.4 percent.

Table 1 displays the names of the analyzed funds, their sizes, and their market shares. For each of these funds, we collected monthly observations on certificate values, total assets under management, and the fractions of assets invested in stocks. Although the number of funds appears small, it bears to mention that, by December 1998 (the end of our sample period), these funds accounted for 61.2 percent of the German market of domestic-stock mutual funds.

We calculated monthly returns, assuming reinvestment of mutual fund dividends and capital gains. These returns are net of management and bank custody fees.[3] As a benchmark for performance measurement, we used *Deutscher Aktien-Forschungsindex (DAFOX)*, provided by the University of Karlsruhe. This index is value-weighted and comprises all stocks traded in the top tier *(Amtlicher Handel)* of the Frankfurt Stock Exchange.[4] As the risk-free rate of return, we used the one-month *Frankfurt Inter-Bank Offered Rate (FIBOR)*, as published by Deutsche Bundesbank.[5]

We use three measures of mutual fund investment performance. The first of these performance measures is the straight recorded return of the fund. Although this "raw return" is an inappropriate measure from an asset-pricing perspective, investors may base their decisions on it (see Sirri and Tufano, 1998). Our second measure is the one developed by Jensen (1968)—Jensen's alpha. Finally, the third measure is a variation of Jensen's alpha—the adjusted alpha. This adjusted alpha factors out the share of assets under management invested in cash (which, we assume, earns the risk-free rate). The advantage of the adjusted alpha is that it insulates the measured systematic risk of a fund from the cash flow into and out of the fund (see, e.g., Ferson and Warther, 1996).

Our three measures of investment performance are concepts of predicted performance, not actual performance. We chose these concepts of predicted performance because we are interested in studying the effect of mutual fund performance on market share, hypothesizing a causal link between current investment record and future market share. We model the investor as an individual running the Kalman filter on a state-space model of mutual fund returns. The Kalman filter framework offers predictions for the time-$t+1$ values of the state variables—these predictions use all information available at time $t,\ t \leq T$. There is a Bayesian interpretation to the Kalman filter that reads these predicted values as expected values of a rationally updating decision-maker (see Carlin and Louis, 2000).

For the raw return, we estimate a local level model (Harvey, 1989) with an AR(1) process in the measurement error. Such a local level model implies that the investors' expectations of future performance rest on past performance, and that these expectations are being updated as new information arrives. The investors believe that all innovations to the level of performance are permanent. Although the local level model assumes a random walk in the mutual fund returns, there is an important difference between the concept of the observed time-t return as a predictor for the time-$t+1$ return and the concept of the Kalman filter $t+1|t$ predictor for the "level." This difference lies in measurement noise, which the Kalman filter is able to strip out.

In state-space notation, the local level model reads as follows, starting with the measurement equation:

$$r_{i,t}^{mf} = \mu_{i,t} + \varepsilon_{i,t} \ , \ t = 1,...,T, \ \forall i = 1,...,N$$

$$\mu_{i,t+1} = \mu_{i,t} + \eta_{i,t} \ , \ \eta_{i,t} \sim N(0, \sigma_{\eta,i}^2), \ t = 1,...,T-1$$

$$\varepsilon_{i,t+1} = \rho_i \cdot \varepsilon_{i,t} + \upsilon_{i,t} \ , \ -1 < \rho_i < 1 \ , \ t = 1,...,T-1, \ \upsilon_{i,t} \sim N(0, \sigma_{\upsilon,i}^2)$$

$$\mu_{i,1} \sim N(0, \kappa), \ \kappa \text{ large},$$

where the index i indicates fund i. The variable $r_{i,t}^{mf}$ is the monthly logarithmic return of the mutual fund, and $\mu_{i,t}$ is the "level" in the return, of which the investors assumes it follows a random walk. The variable $\varepsilon_{i,t}$ embodies measurement noise, which is allowed to be autoregressive.

We obtain Jensen's alpha (and, when accounting for cash holdings, the "adjusted alpha") from a time-varying CAPM (see Zivot, Wang, and Koopman, 1994), again with an AR(1) process in the measurement error. In state-space notation, this model reads, again starting with the measurement equation:

$$\left(r_{i,t}^{mf} - r_t^{rf}\right) = \alpha_{i,t} + \beta_{i,t} \cdot \left(r_t^m - r_t^{rf}\right) \cdot f_{i,t} + \varepsilon_{i,t} \ , \ t = 1,...,T, \ \forall i = 1,...,N$$

$$\alpha_{i,t+1} = \alpha_{i,t} + \eta_{i,t} \ , \ \eta_{i,t} \sim N(0, \sigma_{\eta,i}^2), \ t = 1,...,T-1$$

$$\beta_{i,t+1} = \beta_{i,t} + \upsilon_{i,t} \ , \ \upsilon_{i,t} \sim N(0, \sigma_{\upsilon,i}^2), \ t = 1,...,T-1$$

$$\varepsilon_{i,t+1} = \rho_i \cdot \varepsilon_{i,t} + \upsilon_{i,t} \ , \ -1 < \rho_i < 1 \ , \ t = 1,...,T-1, \ \upsilon_{i,t} \sim N(0, \sigma_{\upsilon,i}^2)$$

$$\alpha_{i,1} \sim N(0, \kappa), \ \kappa \text{ large}$$

$$\beta_{i,1} \sim N(0, \tau), \ \tau \text{ large},$$

where, for the adjusted alpha (the third performance measure), $f_{i,t}$ equals the fraction of assets under management invested in the stock market; for the standard alpha (the second performance measure),

$f_{i,t}$ is set to 1. The variables r_t^{rf} and r_t^m represent the logarithmic returns on the risk-free asset and the market portfolio, respectively.

Charts 1 through 3 exhibit the Kalman filter predictions for the local level model (the "raw return" performance concept, Chart 1) and for the alphas (standard and cash-adjusted) of the time-varying CAPM. The alphas (Chart 2) and adjusted alphas (Chart 3) vary greatly in cross-section and over time. In the late 1980s, following the 1987 stock market, most predicted alphas are positive. In the early 1990s, the predicted alphas hover at around zero, before turning negative during the stock market boom in the late 1990s.

Table 2 displays the innovation variances of the level for the raw return and the alphas (standard and adjusted), along with the AR(1) coefficients, as obtained by means of ML (maximum likelihood estimation) from the Kalman filter. The moment-smoothed estimates for the alpha and the adjusted alpha are exhibited in Charts 4 and 5; for moment-smoothing, see Harvey (1989). These charts show that the chosen set of mutual funds tends to outperform the market during times of high expected returns (in the wake of the stock market crash) and tends to under-perform the market during times of low excepted returns (during the stock market enthusiasm of the late 1990s). During "normal times," the moment-smoothed alphas center on zero.

Charts 6 and 7 display the moment-smoothed betas for the model with the standard alpha (Chart 6) and the cash-adjusted alpha. There is a striking upward drift in the betas of the studied set of mutual funds, with only one exception. At the beginning of the observation period, most funds had betas of less than unity; at the end of that period, most betas were larger than unity.

3. Investment Performance and Market Shares

In this section, we empirically investigate the relation between investment performance and retail performance for our set of mutual funds.

We apply all three performance concepts introduced in the preceding section, and we test if cross-sectional performance differences bear on market shares. In this analysis, the market share of a fund is defined relative to the studied set of funds, not the population of funds in the market.

We use two alternative gauges of market share. The first gauge rests on assets under management. As investors buy or sell fund certificates, capital flows into or out of the fund, which mirrors the fund's retail performance. We label the market share measure that is based on assets under management "absolute market share." The drawback of this gauge of retail performance is that assets under management are affected not only by inflow and outflow of cash, but also by appreciation and depreciation of the existing stock of assets. Thus, we use a second concept of market shares, which, based on the observed price changes of the fund certificates, adjusts for the price effect of capital appreciation and depreciation of the assets under management" (see e.g. Ber, Kempf, and Ruenzi, 2005). This second concept of market share we call "relative market share". Note that, for any period t, the market shares add up to 1 across the chosen sets of funds. In the econometric model, this add-up constraint is explicitly imposed.

Similar to the market share concepts, the employed concepts of investment performance (the raw return, the alpha, and the adjusted alpha) are defined relative to the mean performance of the set of funds in the respective period. For instance, when we use alpha as a measure of investment performance, the pertinent explanatory variable is the difference of the fund's alpha to the mean alpha in the set of funds for the applicable period t.

We estimate the market share model by means of simulating the posterior of a Bayesian model using the Metropolis-Hastings algorithm; for the computer code, see the appendix. The state-space model reads as follows:[6]

$$z_{i,t} = \gamma_{i,t} + \lambda \cdot \pi_{i,t} \; , \; t = 1,...,T, \; i = 1,..., N-1$$

$$\boldsymbol{\gamma}_t \sim N(\boldsymbol{\gamma}_{t-1}, \boldsymbol{\Sigma}_\gamma) \; , \; t = 1,...,T$$

$$z_{N,t} = 1 - \sum_{i=1}^{N-1} z_{i,t} \; , \; t = 1,...,T$$

$$\mathbf{ms}_t \sim N(\mathbf{z}_t, \boldsymbol{\Sigma}_{ms}) \; , t = 1,...,T$$

$$\lambda \sim N(0, \tau)$$

$$\tau \sim Ga(r, \mu)$$

$$\boldsymbol{\gamma}_1 \sim N(\mathbf{0}, \boldsymbol{\Sigma}_1)$$

$$\boldsymbol{\Sigma}_\gamma \sim W(\boldsymbol{\Omega}_\gamma, N-1) \; , \boldsymbol{\Omega}_\gamma \; diagonal$$

$$\boldsymbol{\Sigma}_{ms} \sim W(\boldsymbol{\Omega}_{ms}, N) \; , \boldsymbol{\Omega}_{ms} \; diagonal$$

$$\boldsymbol{\Sigma}_1 \sim W(\boldsymbol{\Omega}_1, N-1) \; , \boldsymbol{\Omega}_1 \; diagonal \; .$$

The model above specifies the market share of fund i, $ms_{i,t}$, as the sum of a random walk (the "local level" $\gamma_{i,t}$) and a standard regression component $\lambda \cdot \pi_{i,t}$ that comprises the influence of the expected investment performance, $\pi_{i,t}$. The prior for the vector of market shares is a multivariate normal. The prior for the vector of innovations to the level (and the prior for the vector of initial states of these levels) are multivariate normal distributions as well. The covariance matrices of these multivariate normal distributions are modeled as draws from Wishart distributions. The parameter of interest is λ, which gauges the market share effect of mutual fund investment performance.

We used a burn-in of 9,999 iterations, followed by a 40,001 iteration sample. Table 3 exhibits for λ major characteristics of the posterior, along with information on the Monte Carlo (MC) error for the parameter of interest. For all six specifications (combinations of investment performance measure and market share concept), the MC error is well below 5 percent of the standard deviation of the simulated parameter distribution, thus indicating a sufficient description of the posterior. We also inspected the MC errors of the states of all state variables—there are 12 state variables, generating a total of 1,728 states for each of the six specifications. For all states, the MC error is less than 5 percent of the standard deviation.

Chart 8 displays the posterior distributions of λ. For none of the six specifications do the posterior distributions indicate a "significant" impact of cross-sectional performance differences on market shares. Our results thus do not indicate that investors base their mutual fund investments on expected future mutual fund performance as described by any of the three employed investment performance measures. The most plausible explanation for the missing link between investment performance and retail performance is the rigid mutual funds distribution network that was in place at the time in Germany. All mutual funds in our data set were distributed by banks, mostly at the shop floor of the banks' brick-and-mortar retail locations. Online brokers were still in their infancy at the end of our period of observation.

Chart 9 exhibits the histories of the Markov chains, and Chart 10 displays their autocorrelations—these autocorrelations trail off only slowly with the lag, thus necessitating a high number of iterations for the Markov chain to traverse the parameter space. We visually inspected the posteriors of all states; these posteriors indicate that the priors are well chosen.

4. Conclusion

For a set of open-end mutual funds, we investigated if cross-sectional differences in investment performance affect the market shares of these funds. We employed three concepts of investment performance, each of which is a measure of expected performance based on past returns. These market shares were modeled in state space as the sum of a random walk and a standard regression component, the latter comprising the influence of the investment performance. The market share model was estimated using the Metropolis-Hastings algorithm, thus accounting for parameter uncertainty, contemporaneous covariance, and add-up constraints.

We estimated Jensen's alpha (standard and adjusted for cash holdings) using a time-varying CAPM. We could show that these alphas vary greatly in cross-section and over time. In the late 1980s, following the 1987 stock market, most predicted alphas were positive. In the early 1990s, the predicted alphas hover at around zero, before turning negative during the stock market boom in the late 1990s. Although we observe stark differences in investment performance across mutual funds (and over time), we find no evidence that cross-sectional performance differences bear on the market shares of these funds.

The absence of evidence of a causal link between investment performance and retail performance for German mutual funds during the period 12/1987-12/1998, when compared with contrary evidence for the United States, points to a retail market segmented by bank affiliation. As most German households with brokerage accounts keep these accounts with their banks, and online brokers still being in their infancy during our period of observation, competition among funds of different bank affiliation was severely limited. Although somewhat speculative, the increase in the betas of the mutual funds over time may indicate growing competitive pressure. In a bid to exceed each others' advertised (raw) returns, the funds may have felt encouraged to take on more systematic risk.

[1] For data on the German mutual funds industry and how it compares to the United States, see the annual publication *Jahrbuch*, issued by *Bundesverband Investment und Asset Management e.V.* and available online at *http://www.bvi.de.*

[2] This institution is now known as *Bundesverband Investment und Asset Management e.V.*

[3] The total expense ratios of the sample funds are in the range 0.5 to 0.72 percent, with one exception (1.27 percent). In addition to these expenses, the funds charge a sales load. For investments below 50,000 Deutschmarks, two funds charge 3 percent, nine funds charge 5 percent, and the remaining three funds charge 5.26, 6.38, and 7.53 percent, respectively. Some funds charge lower sales loads on investments greater than 50,000 Deutschmarks. Source: *Vademecum der Investmentfonds,* published by *Hoppenstedt Verlag*, Darmstadt, Germany.

[4] Note that earnings are taxed at the corporate level whereas dividends are taxed at the investor level. To avoid double taxation of dividends, domestic investors are allowed to deduct from their personal income tax the amount of corporate income tax paid. Thus, earnings that are distributed as dividends are eventually taxed at the rate of the investor's personal income tax. The mutual fund returns include this tax shield, whereas the returns on the stock market index do not. Hence, there may be a difference of up to one percentage point in the annual total return between the mutual fund and the respective stock index benchmark.

[5] The one-month Fibor has been available since 1990. Prior to 1990, we used the monthly average of the daily recorded one month inter-bank rates, as published by Deutsche Bundesbank.

[6] Here, the scale parameters or the normal distributions are expressed in terms of precision, not variance.

References

Ber, M., A. Kempf, and S. Ruenzi (2005) "Determinanten der Mittelzuflüsse bei deutschen Aktienfonds," *Zeitschrift für betriebswirtschaftliche Forschung*, forthcoming.

Bergstresser, D., and J. Poterba (2002) "Do After-Tax returns Affect Mutual Fund Inflows?" *Journal of Financial Economics* **63**, 381-414.

Berk, J., and R. Green (2004) "Mutual Fund Flows and Performance in Rational Markets," *Journal of Political Economy* **112**, 1269-95.

Capon, N., G. Fitzsimons, and R.A. Prince (1996) "An Individual Level Analysis of the Mutual Fund Investment Decision," *Journal of Financial Services Research* **10**, 59-82.

Carlin, B.P., and T.A. Louis (2000) *Bayes and Empirical Bayes Methods for Data Analysis*, 2nd ed. Cambridge (UK): Cambridge University Press.

Chen, J., H. Hong, M. Huang, and J. Kubik (2004) "Does Fund Size Erode Mutual Fund Performance? The Role of Liquidity and Organization," *American Economic Review* **94**, 1276-1302.

Droms, W., and D. Walker (1996) "Mutual Fund Investment Performance," *Quarterly Review of Economics and Finance* **36**, 347-63.

Edelen, R., and J. Warner (1999) "Why Are Mutual Fund Flows and Market Returns Related? Evidence from High-Frequency Data," Working Paper, University of Pennsylvania and University of Rochester, March 1999.

Ferson, W., and V. Warther (1996) "Evaluating Fund Performance in a Dynamic Market," *Financial Analysts Journal* **52**, 20-28.

Gruber, M. (1996) "Another Puzzle: The Growth in Actively Managed Mutual Funds," *Journal of Finance* **51**, 783-810.

Harvey, A.C. (1989) *Forecasting, Structural Time Series Models and the Kalman Filter*, Cambridge (UK): Cambridge University Press.

Ippolito, R. (1992) "Consumer Reaction to Measures of Poor Quality: Evidence from the Mutual Fund Industry," *Journal of Law and Economics* **35**, 45-70.

Jensen, M. (1968) "The Performance of Mutual Funds in the Period 1945-64," *Journal of Finance* **23**, 389-416.

Lakonishok, J., A. Shleifer, and R. Vishny (1992) "The Structure and Performance of the Money Management Industry," *Brookings Papers*, 339-79.

Patel, J., R.J. Zeckhauser, and D. Hendricks (1994) "Investment Flows and Performance: Evidence from Mutual Funds, Cross-Border Investments, and New Issues," in: R. Sato, R.M. Levich, and R.V. Ramachandran, eds., *Japan, Europe, and International Financial Markets*, Cambridge (UK): Cambridge University Press, 51-72.

Sharpe, W.F. (1966) "Mutual Fund Performance," *Journal of Business* **39**, Supplement, 119-38.

Schmidt, H., and M. Schleef (2001) "Schlägt sich die Prinzipal-Agent-Beziehung zwischen Anlageinstitution und Bank in überhöhten Transaktionskosten nieder?" *Zeitschrift für betriebswirtschaftliche Forschung* **53**, 663-89.

Sirri, E., and P. Tuffano (1998) "Costly Search and Mutual Fund Flows," *Journal of Finance* **53**, 1589-1622.

Warther, V. (1995) "Aggregate Mutual Fund Flows and Security Returns," *Journal of Financial Economics* **39**, 209-35.

Zheng, L. (1996) "Is Money Smart? A Study of Mutual Fund Investors' Fund Selection Ability," Working Paper, Yale School of Management.

Zivot, E., J. Wang, and S.J. Koopman (2004) “State Space Modelling in Macroeconomics and Finance Using SsfPack in S+Finance,” in: A. Harvey, S.J. Kopman, and N. Shephard, eds., *State Space and Unobserved Component Models – Theory and Applications*, Cambridge (UK): Cambridge University Press, 284-335.

Table 1: Mutual Fund Market Shares

Fund No.	Fund Name	Assets under Management (Million Deutschmarks)		Market Share (Percent)	
		December 1986	December 1998	December 1986	December 1998
1	*DIT Spezial*	121.7	244.3	1.65	0.72
2	*Investa*	1441.3	5,543.3	19.53	16.31
3	*Adifonds*	644.8	1,410.6	8.74	4.15
4	*Concentra*	1024.6	3,133.1	13.88	9.22
5	*Dekafonds*	893.7	7,617.8	12.11	22.41
6	*DIT Fonds für Vermögensbildung*	97.3	2,847.7	1.32	8.38
7	*DIT Wachstumsfonds*	107.8	411.2	1.46	1.21
8	*Fondak*	791.6	1,298.7	10.73	3.82
9	*FT Frankfurt-Effekten-Fonds*	43.3	4,027.1	0.59	11.85
10	*MK Alfakapital*	79.5	610.6	1.08	1.80
11	*SMH-Specialfond I*	75.6	254.3	1.02	0.75
12	*Thesaurus*	153.4	1092.2	2.08	3.21
13	*Unifonds*	1905.9	5,506.0	25.82	16.20
	Total	7380.5	33,996.9	100.0	100.0

Source: *Bundesverband Deutscher Investmentgesellschaften (BVI)*, Frankfurt a.M.

Table 2: Kalman Filter ML Estimates of Local Level Model and Time-Varying CAPM

			Time-Varying CAPM			
	Local Level Model		Not Adjusted for Cash Holdings		Adjusted for Cash Holdings	
Fund No.	$\hat{\sigma}_{\mu}^2$	$\hat{\rho}$	$\hat{\sigma}_{\alpha}^2$	$\hat{\rho}$	$\hat{\sigma}_{\alpha}^2$	$\hat{\rho}$
1	8.282E-15	0.244	1.940E-32	0.075	1.939E-7	0.059
2	3.351E-7	0.093	4.318E-7	0.013	4.686E-7	0.021
3	2.829E-7	0.080	8.754E-7	-0.061	1.192E-6	-0.054
4	3.848E-13	0.072	7.633E-7	-0.026	8.568E-7	-0.051
5	1.488E-7	0.119	1.865E-6	-0.014	1.353E-6	-0.008
6	8.160E-14	0.121	2.728E-6	-0.216	2.429E-6	-0.230
7	1.029E-6	0.145	1.681E-6	-0.322	1.946E-6	-0.332
8	4.940E-14	0.132	8.607E-7	-0.124	9.613E-7	-0.119
9	2.885E-14	0.102	1.177E-6	0.019	1.138E-6	-0.045
10	7.313E-7	0.100	7.582E-7	-0.038	8.924E-7	-0.047
11	1.853E-13	0.067	2.100E-6	0.081	1.874E-6	0.066
12	1.302E-13	0.101	4.705E-7	-0.063	4.434E-7	-0.088
13	4.866E-13	0.126	1.069E-6	-0.079	9.506E-7	-0.119

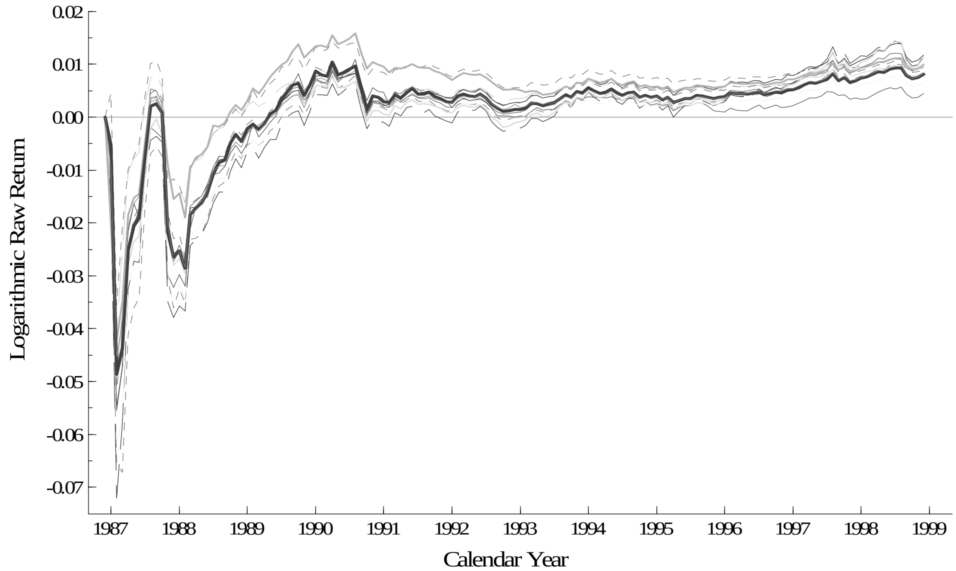
Note: The order in which the funds are listed is random and not necessarily identical to the order displayed in Table 1. The parameter σ_{μ}^2 indicates the innovation variance of the random walk in the level (μ). The parameter σ_{α}^2 indicates the innovation variance of the random walk in α. The parameter ρ is the AR(1) coefficient (auto-regressive coefficient of order 1).

Table 3: Posterior Distributions of Lambda

Specification	Mean	SD	MC Error	2.5%	Median	97.5%	Start	Sample
(1)	-0.02782	0.4403	0.01296	-0.9016	-0.02379	0.8295	10000	40001
(2)	0.04564	0.5519	0.01697	-1.045	0.04982	1.121	10000	40001
(3)	0.03611	0.5615	0.01734	-1.075	0.0392	1.134	10000	40001
(4)	0.003388	0.4404	0.01297	-0.87	0.007243	0.8607	10000	40001
(5)	0.1038	0.552	0.01697	-0.9876	0.1075	1.18	10000	40001
(6)	0.09593	0.5617	0.01735	-1.016	0.09914	1.194	10000	40001

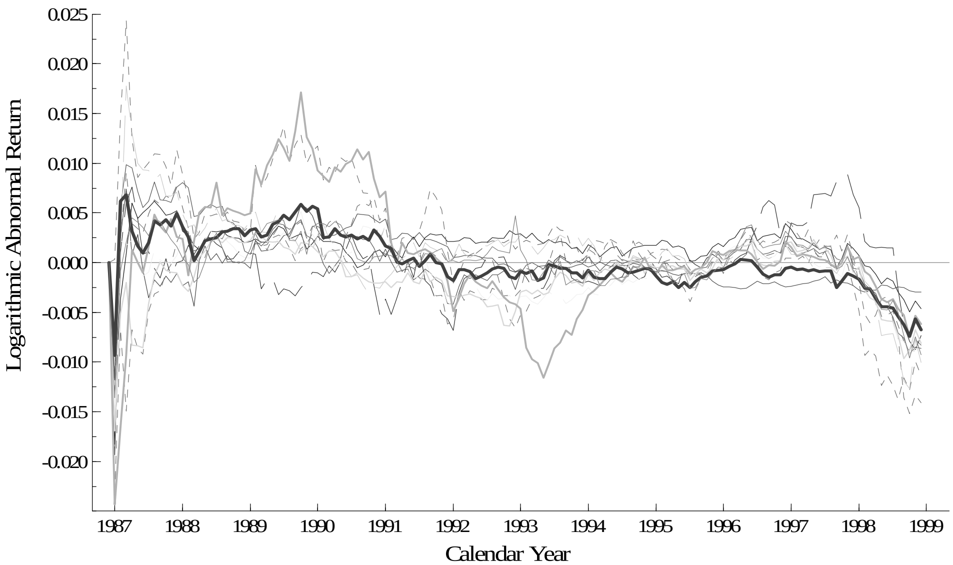
Note: The column header SD indicates the standard deviation; the headers 2.5% and 97.5% indicate percentiles. Sampling starts at iteration #10,000 and ends at iteration #40,000. (1): Absolute Market Share, Raw Return; (2) Absolute Market Share, Alpha; (3) Absolute Market Share, Alpha Adjusted; (4): Relative Market Share, Raw Return; (5) Relative Market Share, Alpha; (6) Relative Market Share, Alpha Adjusted.

Chart 1: Kalman-Filter Predicted Logarithmic Raw Return, Monthly, 12/1986-12/1998



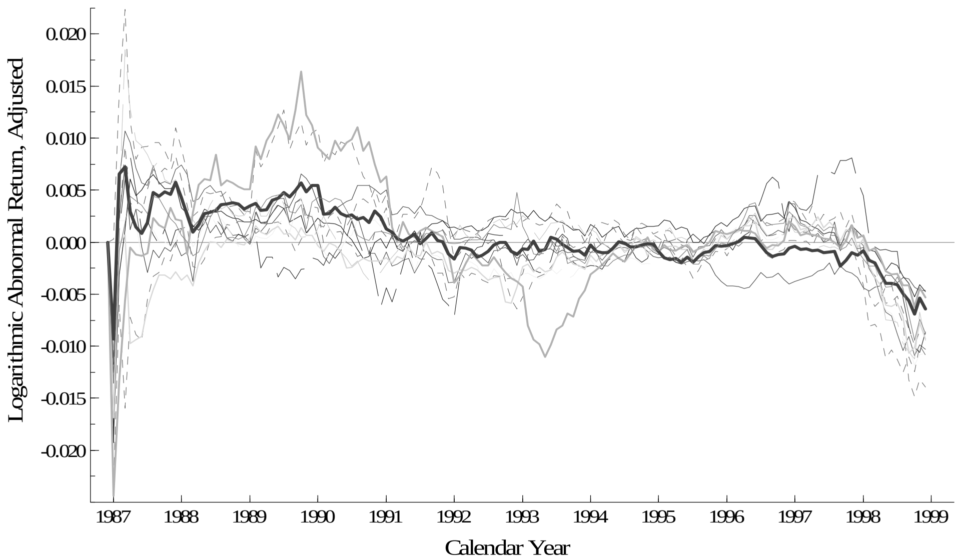
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year. There is a horizontal grid line at the zero value.

Chart 2: Kalman-Filter Predicted Alpha, Monthly, 12/1986-12/1998



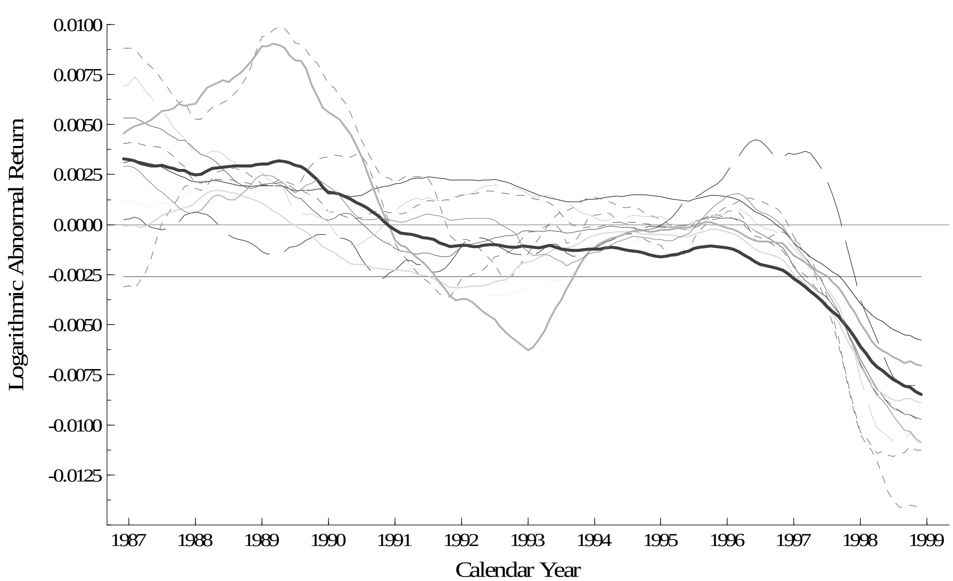
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year. There is a horizontal grid line at the zero value.

Chart 3: Kalman-Filter Predicted Alpha, Adjusted for Cash Holdings, Monthly, 12/1986-12/1998



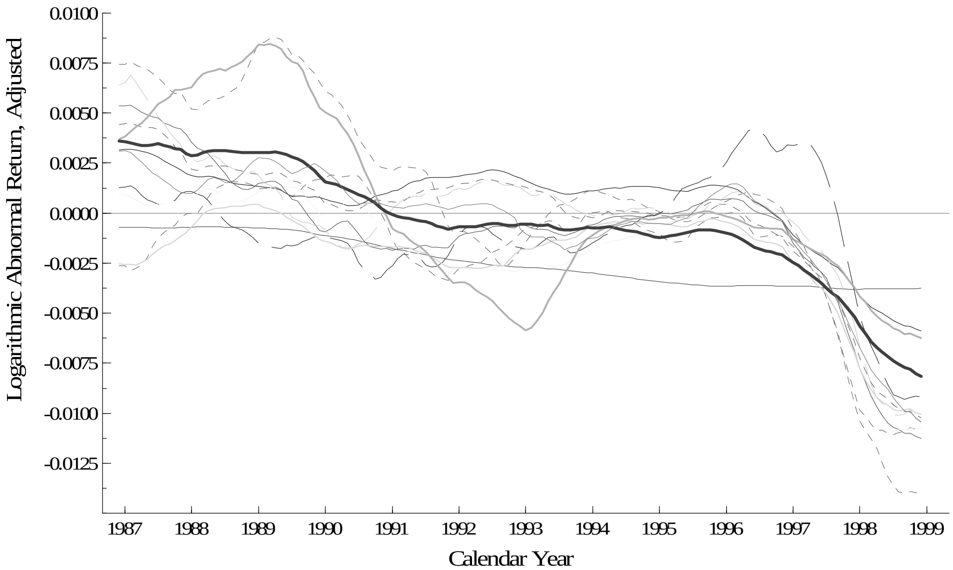
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year. There is a horizontal grid line at the zero value.

Chart 4: Moment-Smoothed Alpha, Monthly, 12/1986-12/1998



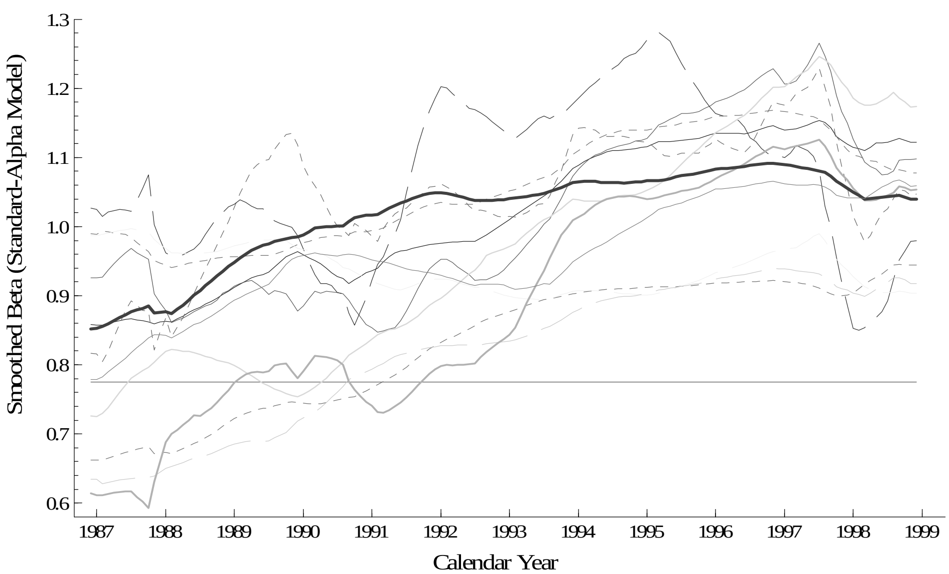
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year. There is a horizontal grid line at the zero value.

Chart 5: Moment-Smoothed Alpha, Adjusted for Cash Holdings, Monthly, 12/1986-12/1998



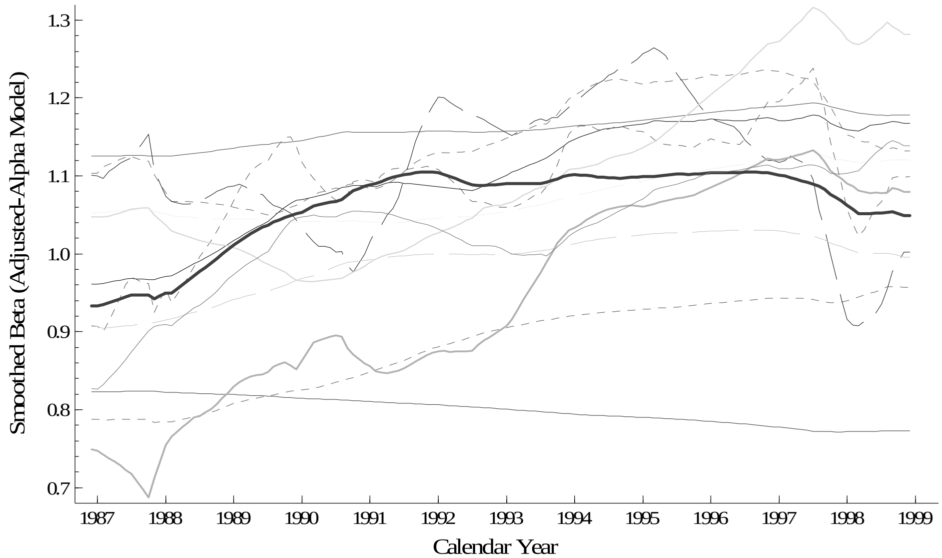
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year. There is a horizontal grid line at the zero value.

Chart 6: Moment-Smoothed Beta, Monthly, 12/1986-12/1998



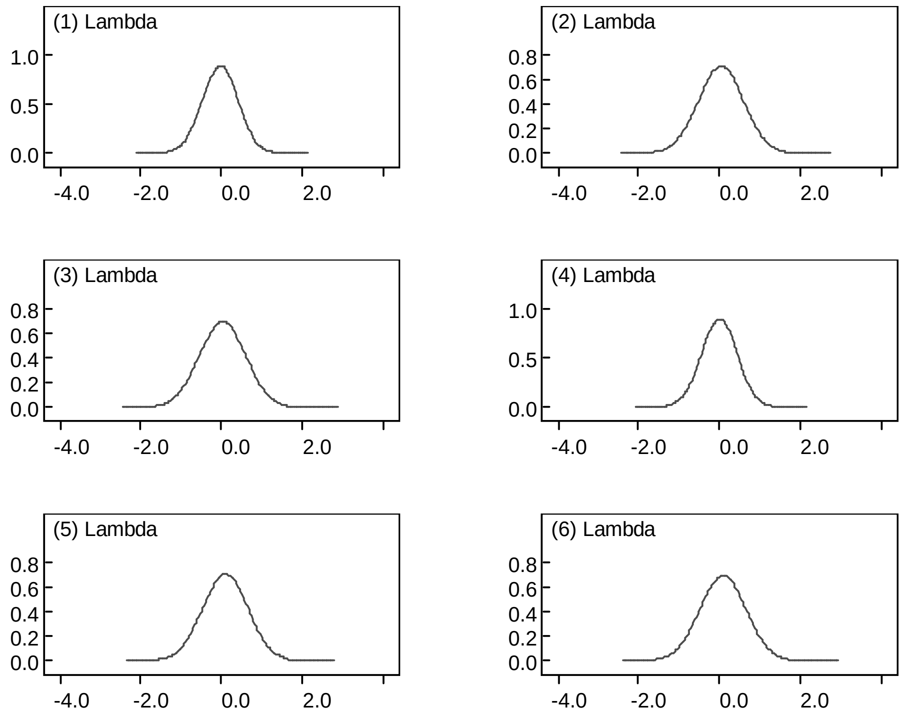
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year.

Chart 7: Moment-Smoothed Beta, Adjusted for Cash Holdings, Monthly, 12/1986-12/1998



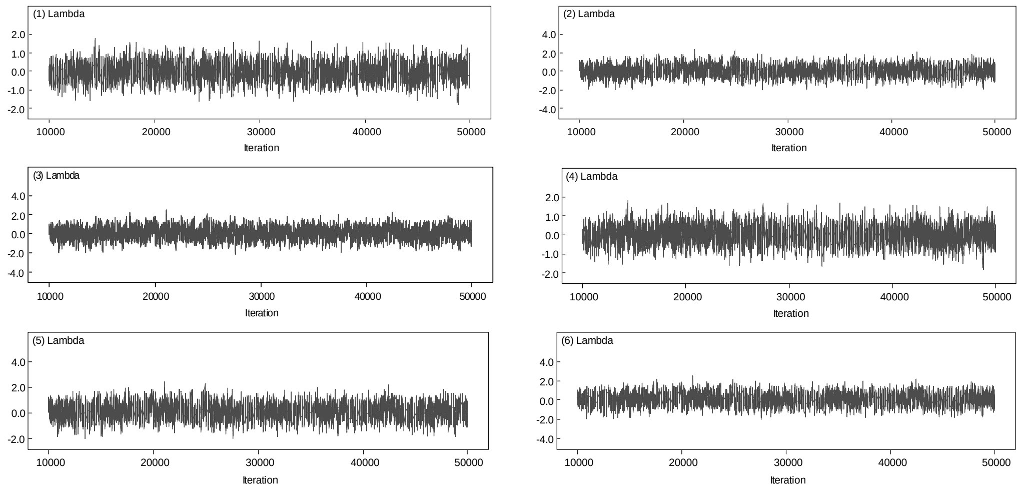
Note: The tick marks on the horizontal axis indicate the start of the respective calendar year.

Chart 8: Lambda, Posterior Kernel Density Estimates



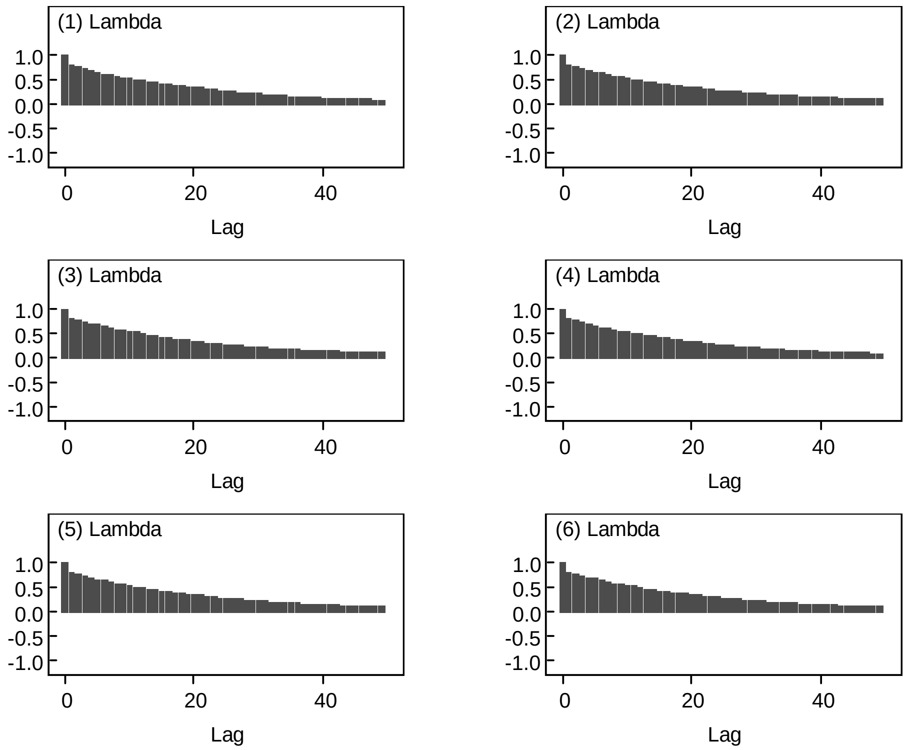
Note: (1): Absolute Market Share, Raw Return; (2) Absolute Market Share, Alpha; (3) Absolute Market Share, Alpha Adjusted; (4): Relative Market Share, Raw Return; (5) Relative Market Share, Alpha; (6) Relative Market Share, Alpha Adjusted.

Chart 9: Lambda, Markov Chain Histories



Note: (1): Absolute Market Share, Raw Return; (2) Absolute Market Share, Alpha; (3) Absolute Market Share, Alpha Adjusted; (4): Relative Market Share, Raw Return; (5) Relative Market Share, Alpha; (6) Relative Market Share, Alpha Adjusted.

Chart 10: Lambda, Markov Chain Autocorrelations



Note: (1): Absolute Market Share, Raw Return; (2) Absolute Market Share, Alpha; (3) Absolute Market Share, Alpha Adjusted; (4): Relative Market Share, Raw Return; (5) Relative Market Share, Alpha; (6) Relative Market Share, Alpha Adjusted.

Appendix: WinBUGS Code, Market Share Model

Model

```
{
	for (t in 1:T)
	{

	for (h in 1:H1)
	{
	#market share as sum of a random walk and a standard regression component
	z[t,h] <- svar[t,h] + lambda*re[t,h]
	}

	#add-up constraint
	z[t,H2] <- 1-sum(z[t,1:H1])

	#posterior
	ms[t,1:H2] ~ dmnorm(z[t,1:H2],T3[,])

	}

	#innovations to state variable
	for (t in 2:T)
	{
	svar[t,1:H1] ~ dmnorm(svar[t-1,1:H1],T1[,])
	}

	#priors
	lambda ~ dnorm(0,tau)
	tau ~ dgamma(1.0E+2,1.0E+2)
	T1[1:H1,1:H1]~dwish(Omega1[,],H1)	#innovations
	T2[1:H1,1:H1]~dwish(Omega2[,],H1)	#initial states
	T3[1:H2,1:H2]~dwish(Omega3[,],H2)	#dependent variable

	#initial states
	svar[1,1:H1] ~ dmnorm(mu[,],T2[,])

}
```

Data

S-Plus Format:

```
list(T = 144, H1 = 12,H2 = 13,
            Omega1 = structure(.Data =
 c(0.0001,0,0,0,0,0,0,0,0,0,0,0,
   0,0.0001,0,0,0,0,0,0,0,0,0,0,
            0,0,0.0001,0,0,0,0,0,0,0,0,0,
            0,0,0,0.0001,0,0,0,0,0,0,0,0,
            0,0,0,0,0.0001,0,0,0,0,0,0,0,
            0,0,0,0,0,0.0001,0,0,0,0,0,0,
            0,0,0,0,0,0,0.0001,0,0,0,0,0,
            0,0,0,0,0,0,0,0.0001,0,0,0,0,
            0,0,0,0,0,0,0,0,0.0001,0,0,0,
            0,0,0,0,0,0,0,0,0,0.0001,0,0,
            0,0,0,0,0,0,0,0,0,0,0.0001,0,
            0,0,0,0,0,0,0,0,0,0,0,0.0001), .Dim = c(12,12)
            ),
            Omega2 = structure(.Data =
 c(0.001,0,0,0,0,0,0,0,0,0,0,0,
   0,0.001,0,0,0,0,0,0,0,0,0,0,
            0,0,0.001,0,0,0,0,0,0,0,0,0,
            0,0,0,0.001,0,0,0,0,0,0,0,0,
            0,0,0,0,0.001,0,0,0,0,0,0,0,
            0,0,0,0,0,0.001,0,0,0,0,0,0,
            0,0,0,0,0,0,0.001,0,0,0,0,0,
            0,0,0,0,0,0,0,0.001,0,0,0,0,
            0,0,0,0,0,0,0,0,0.001,0,0,0,
            0,0,0,0,0,0,0,0,0,0.001,0,0,
            0,0,0,0,0,0,0,0,0,0,0.001,0,
            0,0,0,0,0,0,0,0,0,0,0,0.001), .Dim = c(12,12)
            ),
            Omega3 = structure(.Data =
 c(0.001,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0.001,0,0,0,0,0,0,0,0,0,0,0,
            0,0,0.001,0,0,0,0,0,0,0,0,0,0,
            0,0,0,0.001,0,0,0,0,0,0,0,0,0,
            0,0,0,0,0.001,0,0,0,0,0,0,0,0,
            0,0,0,0,0,0.001,0,0,0,0,0,0,0,
            0,0,0,0,0,0,0.001,0,0,0,0,0,0,
            0,0,0,0,0,0,0,0.001,0,0,0,0,0,
            0,0,0,0,0,0,0,0,0.001,0,0,0,0,
            0,0,0,0,0,0,0,0,0,0.001,0,0,0,
            0,0,0,0,0,0,0,0,0,0,0.001,0,0,
            0,0,0,0,0,0,0,0,0,0,0,0.001,0,
            0,0,0,0,0,0,0,0,0,0,0,0,0.001), .Dim = c(13,13)
            ),
            mu = structure(.Data =
 c(0,0,0,0,0,0,0,0,0,0,0,0), .Dim = c(1,12)
            )
            )
```

Rectangular format:

```
ms[,1]   ms[,2]   ms[,3]   ms[,4]   ms[,5]   ms[,6]   ms[,7]   ms[,8]   ms[,9]   ms[,10]   ms[,11]   ms[,12]   ms[,13]
         re[,1]   re[,2]  re[,3]    re[,4]   re[,5]   re[,6]   re[,7]   re[,8]   re[,9]    re[,10]   re[,11]   re[,12]
-0.026350624
…
0.000923524 END
```

CFS Working Paper Series:

No.	Author(s)	Title
2006/06	**Jan Pieter Krahnen** **Frank A. Schmid** **Erik Theissen**	Investment Performance and Market Share: A Study of the German Mutual Fund Industry
2006/05	**Jan Pieter Krahnen**	Die Stabilität von Finanzmärkten: Wie kann die Wirtschaftspolitik Vertrauen schaffen?
2006/04	**Jan Pieter Krahnen** **Christian Wilde**	Risk Transfer with CDOs and Systemic Risk in Banking
2006/03	**Panos Parpas** **Berc Rustem** **Volker Wieland** **Stan Zakovic**	Mean Variance Optimization of Non–Linear Systems and Worst–case Analysis
2006/02	**Christoffer Carroll** **Miles S. Kimball**	Precautionary Saving and Precautionary Wealth
2006/01	**M. Hashem Pesaran**	Market Efficiency Today
2005/33	**Fulvio Corsi** **Uta Kretschmer** **Stefan Mittnik** **Christian Pigorsch**	The Volatility of Realized Volatility
2005/32	**Sumit Agarwal** **Souphala Chomsisengphet** **Chunlin Liu** **Nicholas S. Souleles**	Do Consumers Choose the Right Credit Contracts?
2005/31	**Guenter W. Beck** **Axel A. Weber**	Inflation Rate Dispersion and Convergence in Monetary and Economic Unions: Lessons for the ECB
2005/30	**Axel A. Weber** **Guenter W. Beck**	Price Stability, Inflation Convergence and Diversity in EMU: Does One Size Fit All?

Copies of working papers can be downloaded at http://www.ifk-cfs.de