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Danish Mutual Fund Performance

Selectivity, Market Timing and Persistence

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Abstract

Funds under management by Danish mutual funds have increased by 25% annually during the last 10 years and measured per capita Denmark has the third largest mutual fund industry in Europe. This paper provides the first independent performance analysis of Danish mutual funds. We analyse selectivity applying a single index model and a multi-factor model, respectively. Furthermore, we analyse the timing ability of the Danish mutual funds pursuing both the quadratic regressions of Treynor and Mazuy (1966) and the option approach suggested by Henriksson and Merton (1981). Finally, we analyse performance persistence using parametric as well as non-parametric methodologies. We conclude that in general Danish mutual funds perform neutrally, returns are non-persistent and Danish mutual funds have no timing ability.

Keywords: *Mutual funds, performance evaluation, market timing, performance persistence.*

JEL classification: *G*12, *G*14, *G*23

I. INTRODUCTION

Since Jensen (1968) the research in mutual fund performance has increased significantly and similarly the popularity of mutual fund investments among private investors has grown dramatically during the last 30 years. In Denmark the market value of mutual funds has increased from approximately USD 3 billion in 1990 to USD 58 billion in 2003, which amounts to a yearly increase of 25%. Despite this huge increase in market value, there has only been few analyses of Danish mutual fund performance and the analyses have mainly been pursued by the mutual funds themselves or by the Federation of Danish Investment Associates and their results have never been presented to an international audience. Therefore, the purpose of this study is to provide the first independent analysis of Danish mutual fund performance. The sample includes 47 funds of which 34 are equity funds and 13 are fixed income funds. The sample period is January 1996 to June 2003.

The analysis in this paper is motivated by the fact that to date no serious evidence on Danish mutual fund performance exits. This is partly because previous analyses pursued by the Danish mutual funds themselves and the Federation of Danish Investment Associates are focussed purely on Sharpe ratio comparisons rather than on the Jensen measure, and partly because these studies only compare the mutual funds to each other rather than comparing them to relevant benchmarks. Furthermore, this study supplements recent studies of other European countries.

The main contribution of this study is to provide a thorough analysis of mutual fund performance for a small country such as Denmark, which has not been analysed before. In particular this study provides evidence on performance evaluation for mutual funds that invest purely in the Danish market as well as mutual funds that invest outside Denmark. Furthermore, the Danish results are compared to the results from other European countries and from the US. Mutual fund fees in Denmark are among the lowest in the world, and therefore one might suspect that Danish mutual funds may have better chances of outperforming passive benchmarks than mutual funds in comparable countries.

The study in this paper includes equity as well as fixed income funds. Dependent on the actual investment objective of each fund, we relate an appropriate benchmark to each fund and estimate the Jensen measure. First, we consider the standard CAPM security market line regression and then a multi-factor model is estimated for each fund as well as for equally-weighted portfolios. Our general conclusion is that net of expenses none of the 47 Danish mutual funds have been able to obtain superior performance. Most funds have insignificant Jensen α's and 6 funds (13%) have significantly negative Jensen α's at the 5% level.

Generalising the security market line model to take account of market timing pursuing both the quadratic regression of Treynor and Mazuy (1966) and the option approach of Henriksson and Merton (1981) does not, however, alter the conclusion that Danish mutual funds have performed neutrally. Moreover, concerning market timing we are not able to document significant timing ability on the part of Danish mutual funds. We find that only 2 funds (4%) have possessed market timing ability. Finally, we conclude that Danish mutual fund performance in general is non-persistent applying various parametric as well as non-parametric tests.

The paper is organised as follows. In the next section we provide a literature review and in Section III we give an introduction to the institutional setting in Denmark and compare the Danish mutual fund industry to mutual funds in other markets. Section IV describes our data,

and in Section V we present our methodology. Section VI presents the empirical results, and Section VII concludes.

II. LITERATURE REVIEW

In this analysis we follow the conventional methodology in the literature using the Jensen measure (Jensen's α) to measure mutual fund performance. An important drawback of the Jensen measure is, however, that any conclusion reached about fund performance rests on the asset pricing model chosen. Earlier analyses applied the CAPM model, thus recognising the problems associated with the choice of benchmark following the Roll critique, and newer research concludes that the choice of benchmark has important consequences for the performance evaluation. Lehmann and Modest (1987) show that the Jensen measure differs significantly between a CAPM and an APT asset pricing model, and Kon and Jen (1978) compare the CAPM with Black's zero beta model and argue in favour of the zero beta model. Grinblatt and Titman (1989, 1994) use alternative benchmarks in their analyses and conclude that the Jensen measure differs considerably between these benchmarks. As opposed to these results, Ippolito (1989) finds, using different alternative benchmarks, that US mutual funds have outperformed passive index funds. However, Elton, Gruber, Das and Hlavka (1993) argue that Ippolito includes non-S&P 500 stocks in his sample, and when Elton et al. include a non-S&P 500 benchmark, Ippolito's conclusion is reversed. Besides including the non-S&P 500 benchmark, Elton et al. (1993) also include a bond index in their analysis. Similarly, Gruber (1996) argues in favour of including both equity and bond indices as benchmarks just as he includes factors for size and growth following Carhart (1997), who finds that factors for size, book-to-market equity and the one-year momentum in stock returns affect mutual fund returns. Finally, Kothari and Warner (2001) argue that standard performance measures depend on the benchmarks' ability to mimic the fund style, and therefore benchmarks must be selected carefully.

The general conclusion reached in the literature, e.g. Jensen (1968), Malkiel (1995) and Detzler (1999), is that mutual funds in the US net of expenses have not been able to generate excess returns. However, using gross returns superior performance can be identified, but this is just about equal to the expenses implying a cost elasticity of approximately –1, see Blake, Elton and Gruber (1993) and Detzler (1999). This conclusion is very much in line with the Grossman and Stiglitz (1980) theory of informationally efficient markets, where informed investors are compensated for their information gathering.

Most research on mutual fund performance has been on US mutual funds, whereas there have only been few analyses of non-US mutual funds. Exceptions are analyses by Dermine and

Röller (1992) for French mutual funds, Wittrock and Steiner (1995) for German mutual funds, Ter Horst, Nijman and Roon (1998) for Dutch mutual funds, Cesari and Panetta (2002) for Italian mutual funds, Blake and Timmerman (1998) for UK mutual funds, Dahlquist, Engström and Söderlind (2000) for Swedish mutual funds and Korkeamaki and Smythe (2003) for Finnish mutual funds. Furthermore, the first European cross-country analysis has been performed by Otten and Bams (2002), which includes France, Italy, the UK, Spain, Germany and the Netherlands.

The overall picture of the Otten and Bams analysis is that they confirm the US evidence for the period 1991 to 1998, but with two exceptions. Firstly, there seems to be evidence for France, the UK and the Netherlands that small caps have out-performed their benchmarks even after expenses have been deducted, and secondly UK mutual funds exhibit significant positive Jensen α's for net returns as well as for gross returns. However, for Germany and Italy Otten and Bams conclude in favour of the informationally efficient market conclusion, and this evidence is confirmed by Wittrock and Steiner (1995) and Cesari and Panetta (2002), respectively. However, the Otten and Bams analysis differs significantly from the Blake and Timmermann study, which concludes that UK mutual funds in general have been underperforming their passive benchmarks[1].

In Dahlquist et al. (2000) Swedish mutual fund performance for 210 equity, bond and money market funds are considered. Their sample is, however, restricted to funds investing only domestically. They show that special equity funds, bond and money market funds have neutral to significantly negative performance, whereas regular equity funds seem to have obtained out-performance.

In a recent study by Korkeamaki and Smythe (2003) they analyse the Finnish mutual fund industry from 1993 to 2000, and although they focus on market segmentation and mutual fund expenses, their overall conclusion is that in general Finnish mutual funds have performed neutrally with the exception that equity funds seem to have been underperforming.

Empirically, a number of studies have analysed the ability of US mutual funds to time the market, and most of these analyses seem to agree that mutual funds do not possess timing ability. Using a quadratic equation, Treynor and Mazuy (1966), for example, find that for only 1 out of 57 mutual funds the hypothesis of no timing ability could be rejected, and Veit and Cheney (1982) conclude that in general mutual funds do not change their characteristic lines in bull and bear markets and in particular for a majority of those funds that did change their characteristic

lines, their timing was unsuccessful. In fact, only 3 out of 74 mutual funds obtained a successful timing. These conclusions are confirmed by Henriksson (1984), who applies parametric as well as non-parametric techniques developed by Merton (1981) and Henriksson and Merton (1981). Using an extended version of the Henriksson and Merton model, Connor and Korajczyk (1991) and Hendricks, Patel and Zeckhauser (1993) confirm that US mutual funds do not possess timing ability. Finally, Grinblatt and Titman (1994) analyse performance using the Jensen measure and the Treynor and Mazuy measure, and they conclude that the simple Jensen measure performs as well as the Treynor and Mazuy measure. Also Goetzmann, Ingersoll and Ivkovic (2000) find no evidence of significant timing ability for US mutual funds using an adjusted Henriksson and Merton method.

Exceptions to the general conclusion that mutual funds have no timing ability are Kon and Jen (1978), who argue using a switching regression model, that for most of the 49 US mutual funds analysed, they cannot reject nonstationarity of the systematic risk, although this is not evidence in favour of successful market timing, and Lee and Rahman (1990), who find that out of 93 US mutual funds, 17% show significant timing ability and 15% show a positive and significant Jensen measure. In fact, 10 funds (11%) have both significant timing and selection abilities.

Although, the vast majority of studies of mutual fund performance confirm that performance is neutral, there seems to be evidence in favour of performance persistence, i.e. previous top-performing funds are also likely to be top-performing funds in the short-term future. This phenomenon has been called “hot hands” in mutual funds by Hendricks et al. (1993).

Studies that confirm persistence in short-term performance for US mutual funds include Hendricks et al. (1993) and Elton et al. (1993)[2]. Although, applying various methodologies the general conclusion reached in these articles is the same; performance persistence exists but it is a short-term phenomenon only.

One exception to this general finding of performance persistence is Gupta, Prajogi and Stubbs (1999) who find that US large-cap and small-cap returns are non-persistent. However, they find some evidence in favour of persistence in returns obtained from top-quartile managers in fixed income funds and international (emerging markets) equity funds.

In the cross-country European study by Otten and Bams (2002) they find evidence of strong persistence in UK mutual funds, but no persistence for France, Germany and Italy. The evidence of strong persistence for the UK is confirmed by Blake and Timmermann (1998). Fur-

thermore, Dahlquist et al. (2000) find persistence for Swedish money market funds, but not for equity and bond funds.

III. THE DANISH MUTUAL FUND INDUSTRY

There has been a tremendous increase in the market value of mutual funds worldwide. However, the increase in market value has been higher for Denmark than for the European Union countries as a whole. From 1992 to 2002 the market value in Denmark increased from USD 3 billion to USD 57 billion amounting to a yearly increase of more than 34%, whereas the market value of the European Union countries as a whole increased from USD 920 billion to USD 4,800 billions, which is an average yearly increase of only 18%. Compared to France which is the European country with the highest market value, France only realised a yearly increase of 9% in that period.

If we measure mutual fund market values per capita, Denmark takes a position as number three in Europe with a market value of USD 11,000 per capita in 2003. The equivalent figure for France is USD 20,000, Germany is USD 12,000, Sweden is USD 9,500, and for the UK USD 8,300. However, these numbers are small compared to the US, where assets under management per capita were nearly USD 25,000 in 2003.

If we compare mutual funds according to their investment objective, we find huge differences across countries. In Denmark equity funds and fixed income funds amount to approximately 50% each, and almost no balanced funds exist. Also France has 50% fixed income funds, but only 25% of the funds are equity funds with the remaining 25% of the funds being balanced funds. At the other extreme are Sweden and the UK, where approximately 75% of the funds are equity funds and fixed income funds only amount to 10%, with approximately 15% of the funds being balanced funds. Finally, if we compare to US mutual funds, we find that equity funds amount to 50% as in Denmark, but as opposed to Denmark bond funds only account for 13%, whereas the 50% fixed income funds in Denmark are pure bond funds. In the US 30% of the mutual funds are money market funds.

The mutual fund industry in Denmark is characterised by strong bank dominance, where more than 90% of the market value comes from mutual funds that have a bank relationship. A major difference between Danish mutual funds and mutual funds elsewhere is that Danish mutual funds are traded on an exchange (Copenhagen Stock Exchange) as well as directly through the mutual fund representatives (typically the banks). In most cases, however, the exchange price follows the net asset value, which is reported three times a day, but this may not always be the

case. If there is a demand pressure, the market price may be well above the net asset value and vice versa.

By legislation Danish mutual funds must invest at least 75% of their assets within their main investment objective. The remaining 25% can be invested in other investment areas, but the Danish tax rules are not favourable to balanced funds and therefore an equity fund will never find it worthwhile to invest in fixed income products. Also a fixed income fund will not invest in equities. Furthermore, the Danish funds are not allowed to go short or engage in the futures and option markets, and in particular equity funds are restricted not to invest more than 20% of their assets in the money market. This has the absurd implication that an equity fund cannot reduce its holdings of stocks in bear markets and therefore it has to accept the losses following bear markets. The only possibility the equity fund has to get at least some hedging is to reduce its portfolio beta, i.e. to time the market. Moreover, Danish mutual funds are restricted holding a least 16 single securities in their portfolios, but usually they hold from 30 to 250 securities.

As mentioned in the Introduction the main conclusion from US and European mutual fund performance evaluation studies is that mutual funds net of expenses perform neutrally despite the fact that mutual fund fees differ considerably across countries[3]. However, it is difficult to make international comparisons of mutual fund expenses because no common definition of mutual fund expenses has been agreed upon across countries. Fitzrovia International plc, London has been calculating Total Expense Ratios (TER) for 9 years trying to make a consistent estimate of mutual fund expenses for 11 European countries[4]. For 2002 a simple average of the TER for a sample of 30,800 funds across these countries is 1.41% for equity funds and 0.99% for bond funds. For equity funds the lowest TER is obtained from Belgium (0.97%) and the highest TER is found in Spain (1.90%). Equivalently, for bond funds the lowest TER is found in Sweden (0.59%) and the highest TER is obtained from Spain (1.53%).

Since Denmark is not one of the 11 countries, we do not have a TER for Denmark. However, a total expense ratio measured by the Federation of Danish Investment Associates follows the definition of TER from Fitzrovia very closely, and for 2002 this is 0.80% for equity funds and 0.38% for bond funds based on a sample of 484 funds, i.e. much lower than for most comparable European countries[5].

IV. DATA DESCRIPTION

The sample in this study consists of 47 Danish mutual funds, which is split between 34 equity funds and 13 fixed income funds. The sample period is January 1996 to June 2003, and the 47

funds included comprise virtually all the funds that have been in operation during the whole period (excluding a few balanced funds). In Table 1 the funds are categorised into 10 homogeneous groups according to their investment objectives.

We categorise funds into equity and fixed income funds. Equity funds are further categorised into Danish equity funds and foreign equity funds, where we distinguish between various areas such as: Europe, Eastern Europe, Global, Pacific, Japan, North America, and Latin America. The fixed income funds are further categorised into Danish fixed income funds and foreign fixed income funds. This classification is not based on any statistical analysis, but follows the classification used by the Federation of Danish Investment Associates. An almost identical categorisation is used by Cesari and Panetta (2002) for Italy, although they use cluster analysis. We use net asset values obtained from the Federation of Danish Investment Associates through Fund Collect and returns are determined as log returns using monthly observations, which amount to a total of 90 observations. The net asset values have been corrected to include dividends, and we have assumed that dividends are reinvested the day after the day when dividends were declared. Excess returns are obtained by subtracting the 1-month CIBOR rate from the net asset returns.

Based on the different categories in Table 1, a number of benchmarks will be applied. For Danish equities we use the KAX index, which includes all Danish equities. The KAX index is corrected for dividends and obtained from the Copenhagen Stock Exchange.

Most of the benchmarks applied for the foreign equity funds are obtained from Morgan Stanley. However, for the North American fund we use the S&P 500 index, which is obtained form Datastream. All indices are measured in Danish Kroner, dividends are included and assumed reinvested and excess returns are again determined by subtracting the 1-month CIBOR rate.

On the fixed income side the benchmark applied for the funds which invest in Danish fixed income is a simple average of the JP Morgan Denmark Government Bond index and the Nykredit Markets Danish Mortgage Bond index, and the JP Morgan GBI Broad ex. Denmark index is used for the foreign fixed income funds. These indices include coupon payments, are measured in Danish Kroner, and the JP Morgan indices are obtained from Datastream, whereas Nykredit Markets have supplied their mortgage index[6].

An important issue that has been discussed thoroughly in the literature, see e.g. Brown, Goetzmann, Ibbotson and Ross (1992), is survivorship bias. As argued by Malkiel (1995), an analysis will significantly overstate the returns if non-surviving funds are systematically ignored. Furthermore, if the sample contains a survivorship bias this may produce an apparent persistency in the performance, even though persistence does not exist, see Brown et al. (1992) and Carhart, Carpenter, Lynch and Musto (2002). We believe, however, that this study of Danish mutual funds is free of survivorship bias, because no funds have defaulted during the analysis period and Overgaard (2003) calculates the survivorship bias in Danish mutual funds data to be close to nil.

Table 1 gives summary statistics for the whole sample of 47 mutual funds and the benchmarks used in this analysis. For each of the categories and benchmarks we present the excess return and the excess return standard deviation measured annually. Furthermore, the Jacque-Bera statistic for normality and its probability value have been calculated for each fund and the benchmarks[7].

From Table 1 we conclude that for only approximately half of the funds and the benchmarks normality cannot be rejected. This means that we need to be careful when interpreting the inference of the Jensen measure in the empirical analysis below.

Although we use excess returns, we have also tested for stationarity applying the Augmented Dickey-Fuller test. In our case the critical 5% value is -2.89, and from Table 1 we infer, as expected, that we cannot reject stationarity in all cases.

V. METHODOLOGY

In this section we present the various models that are applied in the analysis. First, we describe the CAPM security market line model and the multi-factor models, which are applied to analyse the performance of Danish mutual funds. Then we define the Treynor and Mazuy and the Henriksson and Merton models that will form the basis for the analysis of the timing abilities of Danish mutual funds. Finally, we present four different models that we use to discover any potential persistence in Danish mutual fund performance. In general, we provide a number of different models and tests in order to validate the robustness of our conclusions.

Performance evaluation models

The CAPM security market line regression can be formalised as:

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \varepsilon_{it} \quad (1)$$

where r_{it}, r_{ft} and r_{mt} are the returns at month t of the i'th fund (the i'th equally-weighted portfolio), the risk-free return and the benchmark return, respectively, α_i is the Jensen measure, and β_i is a measure of the systematic risk of fund (portfolio) i. Finally, ε_{it} is a white noise error term.

The choice of benchmark has been discussed intensively in the literature. In the security market line model only one benchmark is applied, which implicitly assumes that the fund has a well-defined investment objective that can be represented by one single benchmark. Simultaneously, we assume that the relevant underlying asset pricing model is the CAPM.

In Denmark 75% of the investments made by Danish mutual funds must be in assets within their main investment objective. This means that in principle the individual mutual fund is free to invest 25% of its asset value in other investment areas. If Danish mutual funds in fact use this opportunity, a single index model is obviously not appropriate. In order to account for this possibility, we develop a multi-factor model. Due to the different taxation schemes for equity and fixed income funds, we formulate a multi-factor model specifically for equity funds and another multi-factor model for fixed income funds. The multi-factor model for equity funds reads as:

$$r_{it} - r_{ft} = \alpha_i + \beta_{im}(r_{mt} - r_{ft}) + \beta_{iKAX}(r_{KAXt} - r_{ft}) + \beta_{iW}(r_{Wt} - r_{ft}) + \varepsilon_{it} \quad (2)$$

The main motivation for equation (2) is that a fund whose main investment objective is to invest in Danish equities is allowed to invest up to 25% of its assets in foreign equities. In order to measure this possibility, we include the following relevant factors:

- r_{KAXt}: the return on the Danish KAX index at month t
- r_{Wt}: the return on the MSCI World index at month t

In the case of a mutual fund whose main purpose is to invest in Danish equities, $r_{mt} = r_{KAXt}$, and equation (2) becomes a two-factor model, but in the case of a mutual fund that primarily invests in Japan, say, r_{mt} equals the excess return on MSCI Japan, and equation (2) becomes a three-factor model etc.

Equivalently, the multi-factor model for fixed income funds reads as:

$$r_{it} - r_{ft} = \alpha_i + \beta_{iD}(r_{Dt} - r_{ft}) + \beta_{iMB}(r_{MBt} - r_{ft}) + \beta_{iG}(r_{Gt} - r_{ft}) + \varepsilon_{it} \quad (3)$$

where:

- r_{Dt}: the return on the JP Morgan Denmark Government Bond index at month t
- r_{MBt}: the return on the Nykredit Markets Danish Mortgage Bond index at month t
- r_{Gt}: the return on the JP Morgan GBI Broad ex. Denmark index at month t

Compared to the CAPM security market line model, equation (3) is a three-factor model, where we now allow the JP Morgan Denmark Government Bond index and the Nykredit Markets Mortgage Bond index to enter the equation separately, which gives us information about how the fixed income funds separate their investments between Danish government bonds, Danish mortgage bonds and foreign bonds.

Market timing models

Performance evaluation based on the selectivity in terms of the Jensen measure is often referred to as micro forecasting or security analysis as opposed to macro forecasting that concerns forecasts of price movements of the general market as a whole. This is also called market-timing, see Fama (1972).

If fund managers change the fund beta (β) according to their expectations of bull and bear markets, β_i becomes a decision variable which will not be constant. If mutual funds are able to time the market, this has important implications for their performance. Although this was recognised as early as in the study by Jensen (1968), he argued that timing ability would make us overestimate the true α's. But as shown by Grant (1977), in fact, market timing implies that the estimate of Jensen's α becomes downward biased, and we are inclined to underestimate the actual performance of mutual funds.

A number of alternative methods have been suggested in the literature to test the timing abilities of mutual fund managers, and in this analysis we apply both the Treynor and Mazuy (1966) and the Henriksson and Merton (1981) methods to validate the robustness of the results on Danish mutual fund performance. As mentioned above Danish mutual funds are not allowed to go short in the market and in particular equity funds are not allowed to invest more than 20% of their assets in the money market. Moreover, the tax rules imply that an equity fund will never swap into bonds. The main hedging instrument that an equity fund has is to reduce its beta in bear markets. Consequently, market timing plays an important role in Danish mutual fund portfolio management.

Treynor and Mazuy (1966) argue that if the mutual fund manager acts as if he can time the market, he will hold a greater proportion of the market portfolio when he expects the return on the market to be high and vice versa. In fact, he will adjust the portfolio β according to the return on the market portfolio as $\beta_{it} = b_{i0} + b_{i1}(r_{mt} - r_{ft})$ and substituting this relationship into equation (1), we find:

$$r_{it} - r_{ft} = \alpha_i + b_{i0}(r_{mt} - r_{ft}) + b_{i1}(r_{mt} - r_{ft})^2 + \varepsilon_{it} \quad (4)$$

which gives us the quadratic Treynor and Mazuy equation. Compared to the standard security market line model, equation (4) includes a new term, which is the excess market return squared. If α_i is positive and significantly different from zero, we identify selection skills, as in the security market line model, and if b_{i1} is positive and significant, the mutual fund manager possesses timing ability.

The second specification applied in this study follows the Merton (1981) and Henriksson and Merton (1981) option approach. In their model the mutual fund manager is assumed to receive a binary signal, which can take two distinct values depending on the true outcome of the market return. Based on these two distinct signals, the mutual fund manager chooses one of two values of the portfolio β, and they show that this extends the standard CAPM security market line specification to:

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \gamma_i \mathrm{Max}[-(r_{mt} - r_{ft}) ; 0] + \varepsilon_{it} \quad (5)$$

where the new term represents an informational advantage represented by a no cost put option on the market portfolio. Henriksson and Merton (1981) argue that if α_i is significantly positive, we identify selection skills, and for a positive and significant γ_i the mutual fund manager possesses timing ability.

The two different specifications given by equations (4) and (5) are able to provide us with an estimate of the performance (selection skills) of the Danish mutual funds analysed. Furthermore, we can separate selection and timing ability.

Performance persistence models

As a first and preliminary test of persistence in Danish mutual fund performance, we consider the autocorrelations of mutual fund returns. Hendricks et al. (1993) argue that if the autocorre-

lation coefficients are significantly positive, returns are persistent. We, therefore, estimate a 12^{th} order autocorrelation structure for the total returns.

To test more directly whether Danish mutual fund returns are persistent, we determine a Winner-Loser test. We follow Brown et al. (1992), Goetzmann and Ibbotson (1994) and Malkiel (1995) dividing the sample period into sub-samples and ranking the funds according to their performance. Using this method, we can identify winners (W) and losers (L) in each sub-period and analyse to what extent winners in a former period turn out also to be winners in the following period. Specifically, we split our sample period up into three intervals each representing a 2½ year period amounting to 30 observations. These sub-periods include 1996.1-1998.6, 1998.7-2000.12 and 2001.1-2003.6. For the first sub-sample 1996.1-1998.6 we rank the funds and identify winners as those funds with a return equal to or higher than the median return, and losers as those funds with a return below the median return. An equivalent ranking is performed for the second sub-sample 1998.7-2000.12, and based on these rankings we then determine the number of funds being winners (losers) in both periods and the number of funds being winners (losers) in the first period and losers (winners) in the following period. The same procedure is applied for the sub-periods 1998.7-2000.12 and 2001.1-2003.6. The exercise is done for total returns, and risk-adjusted returns based on both the security market line model in equation (1) and the multi-factor models given by equations (2) and (3).

Based on this Winner-Loser categorisation, we develop two-way tables and calculate a traditional χ^2-test for independence as well as a LOR-statistic, which is a Log Odds Ratio test defined as:

$$\mathrm{LOR} = \ln\left[\frac{\mathrm{WW}\cdot\mathrm{LL}}{\mathrm{WL}\cdot\mathrm{LW}}\right] \tag{6}$$

The odds ratio will be equal to 1 under the null-hypothesis of no performance persistence and then the LOR statistic equals 0. Equivalently, a positive LOR statistic indicates positive persistence, while a negative LOR statistic indicates negative persistence. The significance of the LOR statistic can be tested as a t-statistic given as:

$$\mathrm{t-statistic} = \frac{\mathrm{LOR}}{\sigma_{\mathrm{LOR}}} \tag{7}$$

which approximately follows a standard normal distribution, where σ_{LOR} is given by:

$$\sigma_{LOR} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}} \quad (8)$$

The winner-loser test is non-parametric and in order to analyse the robustness of the results, we also present two parametric tests. Grinblatt and Titman (1992), Brown et al. (1992) and Elton et al. (1993) test performance persistence by regressing returns obtained in a latter period on returns obtained in the previous period. If the return in the latter period can be predicted by the previous period return, performance is persistent. Equation (9) presents the regression equation:

$$r_2 = a_0 + a_1 r_1 + e \quad (9)$$

where r_1 and r_2 are the returns (total and risk-adjusted returns) from the former and the latter periods, respectively, and a positive a_1 is consistent with positive persistence. Again the sample is split up into the three sub-periods 1996.1-1998.6, 1998.7-2000.12 and 2001.1-2003.6, and for each sub-period we calculate total and risk-adjusted returns.

Finally, Hendricks et al. (1993) suggest that performance is persistent, if a portfolio of previous top-performing funds has an above-average return in the next period and equivalently a portfolio comprised of the worst-performing funds has a below-average return. In order to test this hypothesis we determine a portfolio comprised of the 20% best-performing funds and a portfolio comprised of the 20% worst-performing funds for equities and fixed income funds, respectively, i.e. four portfolios in all. The portfolios are rebalanced each year based on the yearly total returns the previous year. The equity portfolios comprise 6 funds each, and the fixed income portfolios comprise 3 funds each [8].

The four portfolio returns are then tested against the multi-factor models given by equations (2) and (3). If performance is persistent, the rebalanced best-performing portfolios should yield a significantly positive Jensen's α and the rebalanced worst-performing portfolios should yield a significantly negative Jensen's α.

VI. EMPIRICAL RESULTS

In this section we present our empirical results. First, we analyse the selectivity of Danish mutual funds, and then we separate their selection skills from their market timing abilities. Finally, we consider whether Danish mutual fund performance is persistent.

Performance evaluation results

First, we estimate the Jensen measure of performance based on the standard CAPM security market line given by equation (1). We estimate the security market line for each of the 47 mutual funds as well as for equally-weighted portfolios within each of the 10 investment categories.

Equation (1) is estimated by OLS and in order to account for potential serial correlation and heteroskedasticity, we use Newey-West corrected standard errors. In Table 2 we present the estimation results, but only the average results within each of the 10 fund categories are presented. However, taking simple averages within each group does not yield meaningful standard errors and t-statistics. Therefore, the reported t-statistics, the β's and the adjusted coefficients of determination (R^2-adj) are obtained from the equally-weighted portfolios.

The general conclusion in Table 2 is that none of the 47 mutual funds have been able to outperform their passive benchmarks. The Jensen measure is in most cases negative and not statistically significant. Only the Danish equity category shows a significantly negative performance, and from the individual regressions we find that only 6 funds have a significantly negative Jensen measure at the 5% level. No funds have a significantly positive Jensen measure. Therefore, we can conclude that net of expenses the performance of Danish mutual funds has been neutral.

This is further confirmed by Figure 1, which presents the frequency distribution of the α's, and we infer that most α's lie in the neighbourhood of zero.

Thus, these preliminary results indicate that Danish mutual funds net of expenses have not been able to out-perform the market. On the other hand, most funds have performed neutrally i.e., they have been able to obtain gross returns that are just only sufficient to cover their expenses, leaving the fund members with net returns that are not significantly different from the passive benchmark returns. In order to validate the robustness of this conclusion, the asset pricing model is extended to a multi-factor model.

In Table 3 we present the results of the two multi-factor models given by equations (2) and (3). Again standard errors are Newey-West corrected and t-statistics and R^2-adj. are obtained from the equally-weighted portfolios.

The general conclusion to be drawn from Table 3 is that these results are almost similar to the results obtained from the CAPM security market line model in Table 2. Most of the Jensen α's are negative and not significantly different from zero. From the individual regressions we find that 7 funds have performed significantly negative at the 5% level and 5 of these 7 funds are identical to 5 of the 6 funds with significantly negative α's in the security market line model in Table 2. Considering funds as a group, we again find that the Danish equity category has a significantly negative α, but also the North American fund turns out to have performed significantly negative in the multi-factor model.

However, we find that in special cases the multi-factor model provides superior information to the security market line model. E.g. Table 3 reveals that the European equity funds have been investing not only in European equities but also in Danish and global equities, and that the global equity funds have been investing in Danish equities as well. For the rest of the equity funds, only the primary benchmark plays a significant role and in these cases the multi-factor model becomes equivalent to the security market line model.

For the fixed income funds whose primary market is Danish fixed income, we see from Table 3 that both the JP Morgan Danish Government Bond index and the Nykredit Markets Mortgage Bond index have a positive and significant influence on the fund excess return. Considering the funds that primarily invest outside Denmark, we find that only the JP Morgan GBI Broad ex. Denmark index plays a positive and significant role. Consequently, Danish fixed income funds do not invest outside Denmark, and global fixed income funds do not invest in Danish bonds.

Market timing results

The estimation results on selection and market timing obtained from equation (4) and (5) are presented in Table 4. Again t-statistics are based on Newey-West corrected standard errors to correct for potential serial correlation and heteroskedasticity. In this case, it is particularly important to obtain heteroskedasticity consistent standard errors, because adding a quadratic term to the regression equation (4) imposes a heteroskedasticity type of problem into the model.

Compared to the previous analyses, Table 4 does not provide much new evidence on selectivity. We infer that most of the estimated α's are still negative and for all of the 10 categories α is not significantly different from zero. In fact only 2-3 individual funds have performed significantly negative, thus leaving the remaining 44 funds with a neutral performance.

In addition, Table 4 shows that only 1 of the 10 investment categories has been able to time the market, which is the Pacific equity group, but this evidence is only confirmed by the Treynor and Mazuy model. On the other hand, both models confirm that market timing seems to have been significantly unsuccessful for the Danish equity category. Looking at the individual funds, we find that only two funds have possessed market timing ability, which is confirmed by both models, and these two funds are the same across the quadratic and the option-based models. Based on this evidence, we conclude that Danish mutual funds in general are not able to time the market, since the majority of funds show an insignificant timing ability parameter.

The main conclusion to be drawn is that taking account of a potential market timing ability on the part of Danish mutual fund managers, our estimates of their selection skill parameter α are insignificant, and still the overall picture is that most funds have performed neutrally. Exceptions are 2-3 funds that have performed significantly negative, whereas no funds have performed significantly positive. Furthermore, we find no general tendency that mutual funds have been able to time the market. Exceptions are 2 funds out of a total sample of 47 mutual funds.

Although we analyse the selection and timing ability of the Danish mutual funds applying two different models, the results are very similar, and furthermore the results concerning selectivity are almost identical to the results obtained from the security market line and the multi-factor models. On this basis, we believe that our conclusion that the Danish mutual funds have performed neutrally with no particular selection and timing ability is robust. The Danish evidence is therefore very much in line with the evidence for the US and for a number of other European and Scandinavian countries both concerning mutual fund selectivity and market timing abilities.

Performance persistence results

First, we determine up to 12 autocorrelations of the total returns for each of the 47 funds in the sample, but since the autocorrelation pattern was almost identical across the 47 funds, we only report the average coefficients for each of the 10 investment categories in Table 5 assuming indirectly that each category comprises an equally-weighted portfolio.

We see from Table 5 that only a few of the autocorrelations are significantly positive and only for Danish fixed income funds, we find a significant F-test. Therefore, these preliminary results do not lend much support to performance persistence in Danish mutual fund returns.

To test more directly whether Danish mutual fund returns are persistent, we now create two-way tables for total returns as well as for the risk-adjusted returns obtained from the security market line and the multi-factor models. The results are presented in Table 6[9].

In Table 6 χ^2 is a standard Chi-square statistic for independence, which in this case has 1 degree of freedom yielding a 5% critical significance value of 3.84, and the LOR test is the Log Odds Ratio test statistic.

In order to confirm positive persistence, most observations must be in the diagonals, but from Table 6 we infer that this is not generally the case. In fact the majority of the test statistics are insignificant. Two exceptions prevail, however. In the Pacific case we cannot reject some kind of persistence in total returns as well as in the multi-factor risk-adjusted returns, but this conclusion only goes for one of the two time periods analysed, and for foreign fixed income funds positive persistence cannot be rejected for 4 out of 6 cases. But the overall picture shows no general evidence in favour of positive performance persistence.

The winner-loser test is non-parametric and in order to analyse the robustness of the conclusion of no positive persistence, we now present the results of the two parametric tests. First, we consider the regression test, where returns from a latter period are regressed on the returns from the former period, see equation (9). In Table 7 the results of these regressions are presented.

The evidence in table 7 does not lend much support to the persistence hypothesis. Out of 36 cases we only find 7 cases with a significant regression parameter (a_1), and only 4 of these are positive. Two of these positive parameters are found in the foreign fixed income category, which to some extent is consistent with the evidence in the two-way tables in table 6. Again we conclude in favour of non-persistence concerning the Danish mutual fund returns.

Our final test is based on total returns only. Again we divide the sample into sub-samples but contrary to the previous tests, we now calculate total returns for each year separately. We then form a top-performing portfolio comprising the 20% funds that realised the highest returns in the previous year. Similarly, we form a portfolio comprising the 20% worst performing funds each year. The portfolios are rebalanced each year. Due to the limited amount of funds available in this sample, we cannot form portfolios for each investment category separately, but instead we form two equity portfolios based on the 32 equity funds (Latin American funds are excluded here), and two fixed income portfolios based on the 13 fixed income funds. We then

determine Jensen's α for each of the four portfolios based on the multi-factor models given by equations (2) and (3). In table 8 we present the results of the four multi-factor regressions.

Table 8 provides only weak evidence of performance persistence. In fact, we see that neither the best-performing equity portfolio nor the best-performing fixed income portfolio yield a significant Jensen's α, i.e. even though the investor selects the 20% best performing securities on a yearly basis, he is not able to out-perform the passive benchmarks. Similarly, the worst-performing equity portfolio has an insignificant Jensen's α. Only for the worst-performing fixed income portfolio we find a significantly negative Jensen's α, i.e. some evidence of performance persistence.

It is worth pointing out that the portfolios formed here are determined on basis of all of the equity funds and the fixed income funds, respectively, and obviously the portfolio risk may vary during the investment period. However, we see from table 8 that the regressions explain around two thirds of the portfolio return variation, and we believe that any biases due to a time-varying portfolio risk during the investment period are small.

Furthermore, this test is specifically directed towards a test of short-term persistence focusing on one-year intervals as opposed to the former tests that considered 2½ years periods. However, we are not able to confirm short-term persistence, which is consistent with the results for most other European mutual funds, i.e. the evidence of short-term persistence found in most US analyses cannot be confirmed for Danish mutual funds.

VII. CONCLUSIONS

Although the assets under management by Danish mutual funds have grown by 25% annually since 1990, this study is the first independent analysis of Danish mutual fund performance. We have analysed a survivorship free sample of 47 funds divided into 34 equity funds and 13 fixed income funds that have been in operation since January 1996. Applying various models as the standard CAPM security market line model, a multi-factor model incorporating national and global equity and fixed income benchmarks, the quadratic Treynor and Mazuy (1966) model as well as the option model of Henriksson and Merton (1981), we have analysed the selection and timing abilities of these funds. Furthermore, tests for performance persistence have been carried out.

The general conclusion is that we have not been able to identify significant performance, i.e. Danish mutual funds have not possessed selection skills, although they are among the funds in

Europe that have the lowest expenses. In most cases, their performance has been neutral and in a few cases we find even significantly negative performance. Concerning timing ability the general conclusion is also negative, despite the fact that Danish mutual funds due to various institutional restrictions are very focussed on market timing. Only for two individual funds, we find evidence in favour of significant timing ability. Finally, we conclude that Danish mutual fund returns are non-persistent.

Our results on performance concerning selection and timing abilities are very much in line with the US evidence and the evidence from a number of other European countries. We cannot reject that Danish mutual funds net of expenses have performed neutrally, which is consistent with the Grossman and Stiglitz theory of informationally efficient markets. However, on performance persistence our results are consistent with the results for a number of other European mutual funds, but not with the US evidence.

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FOOTNOTES

1. However, this difference may be due to the fact that the Otten and Bams analysis only includes European funds that are pure domestic equity funds.

2. Other analyses are Blake et al. (1993), Goetzmann and Ibbotson (1994), Malkiel (1995), Brown and Goetzman (1995), Elton, Gruber and Blake (1996), Gruber (1996), Carhart (1997) and Droms and Walker (2001).

3. All funds available to the public are front-end load funds, and the maximum load charge differs among funds, but at present the highest load charge is 3.5%. Equally, all load funds charge a redemption fee, which is usually between 0.15% and 1.50%. Distribution fees equivalent to the 12b-1 fee in the US are charged separately by the selling agents (the banks), and typically these fees are between 0.10% and 0.50%.

4. The 11 countries are Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, Spain, Sweden, Switzerland, and the UK.

5. This evidence is sustained by Morningstar, who compares an average management fee for 2002 of 1.32% (equities) and 0.84% (bonds) for 26,627 European mutual funds to an expense ratio of 1.21% (equities) and 0.70% (bonds) based on a sample of 366 Danish mutual funds, and the Danish expense ratio includes other fees than just management fees.

6. We have also applied various EFFAS indices obtained from Bloomberg, but the results are almost identical to the results obtained using the JP Morgan indices. However, the JP Morgan indices provide a better goodness-of-fit, and only results based on the JP Morgan indices will be reported below.

7. Dybvig and Ross (1985) and Grinblatt and Titman (1989) show that the Jensen measure is biased if the fund and benchmark returns are not jointly normal or are non-linear. This motivates the test for normality in this sample.

8. Considering all equities and all fixed income funds, respectively, when the portfolios are determined, the portfolio risk may change from year to year.

9. The Eastern European fund is merged into the European equities category, the North American fund is merged into the Global equities category, and the Japanese fund is merged into the Pacific equities category.

Table 1

Mutual fund categorisation and summary statistics

Excess returns and the excess return standard deviations are measured annually. The augmented Dickey Fuller test is the t-statistic of γ in the following regression:

$$\Delta y_t = \kappa + \gamma y_t + \phi_1 \Delta y_{t-1} + \phi_2 \Delta y_{t-2} + \varepsilon_t$$

where the 5% critical significance value is -2.89. The augmented Dickey Fuller test tests for stability and the Jacque-Bera test tests for normality. The second to last column gives the probability of the Jacque-Bera test and the last column gives the number of funds in each category that pass the normality test.

	No. of funds	Excess return	Standard deviation	Aug. Dickey Fuller	Jacque-Bera	Prob-ability	No. passed
Mutual funds							
Danish equities	9	3.32	17.56	-7.94	13.25	0.00	0
Foreign equities							
- Europe	6	2.10	20.46	-7.79	4.87	0.09	5
- Eastern Europe	1	3.16	36.04	-8.75	126.85	0.00	0
- Global	9	1.36	19.91	-7.77	5.99	0.05	7
- Pacific	5	-2.78	26.41	-7.24	0.17	0.92	5
- Japan	1	-9.43	23.65	-7.43	1.50	0.47	1
- North America	1	0.74	20.06	-8.24	6.19	0.04	0
- Latin America	2	1.05	39.10	-8.41	62.61	0.00	0
Danish fixed income	9	2.29	2.21	-8.15	5.84	0.05	5
Foreign fixed inc.	4	2.74	4.35	-10.34	0.49	0.78	3
Benchmarks							
KAX		6.40	17.65	-8.81	7.76	0.02	0
MSCI Europe		3.51	19.33	-8.14	7.74	0.02	0
MSCI East. Euro		3.42	41.96	-8.49	182.87	0.00	0
MSCI World		1.91	18.42	-7.58	5.30	0.07	1
MSCI Pacific		-5.40	24.71	-7.34	6.75	0.03	0
MSCI Japan		-10.83	22.42	-7.61	2.85	0.24	1
MSCI Latin Am.		1.71	34.75	-8.94	54.07	0.00	0
S&P 500		5.60	20.00	-7.75	4.44	0.11	1
JPM Denmark		3.42	3.13	-9.04	5.07	0.08	1
Nykredit Mortgage		4.47	3.61	-9.20	10.91	0.00	0
JPM Global		3.74	5.69	-9.75	0.50	0.78	1

Table 2

Summary statistics of the Jensen measure

The security market line model

The Jensen measure is reported annually in the third column. In the fourth column we indicate the number of funds in each category, which have a significantly positive (negative) α at the 5% level. In the fifth column the β_i estimates are presented, and the values below the α_i and β_i estimates are Newey-West corrected t-statistics. The last column gives the goodness-of-fit statistic. A * indicates statistical significance at the 5% level.

Mutual funds	**No. of funds**	**α**	**No. significant**	**β**	**R^2-adj.**
Danish equities	9	-2.94* (-2.39)	(3)	0.98* (36.07)	0.97
Foreign equities					
- Europe	6	-1.30 (-0.51)	(1)	0.97* (23.89)	0.83
- Eastern Europe	1	0.48 (0.11)		0.80* (21.56)	0.82
- Global	9	-0.52 (-0.23)		0.99* (18.87)	0.83
- Pacific	5	2.64 (0.98)		1.00* (22.21)	0.88
- Japan	1	0.95 (0.33)		0.96* (22.58)	0.82
- North America	1	-4.25 (-1.84)		0.89* (18.63)	0.79
- Latin America	2	-0.78 (-0.23)		1.07* (19.49)	0.90
Danish fixed income	9	-0.33 (-1.58)	(2)	0.66* (26.73)	0.93
Foreign fixed income	4	0.26 (0.33)		0.66* (11.00)	0.75
Total	47	-0.58	(6)	0.90	0.85

Figure 1

Frequency distribution of estimated Jensen α's

The estimated α's from the security market line model are sorted in ascending order and grouped into intervals of 1 percentage point. The figure gives the frequency distribution of the α's.

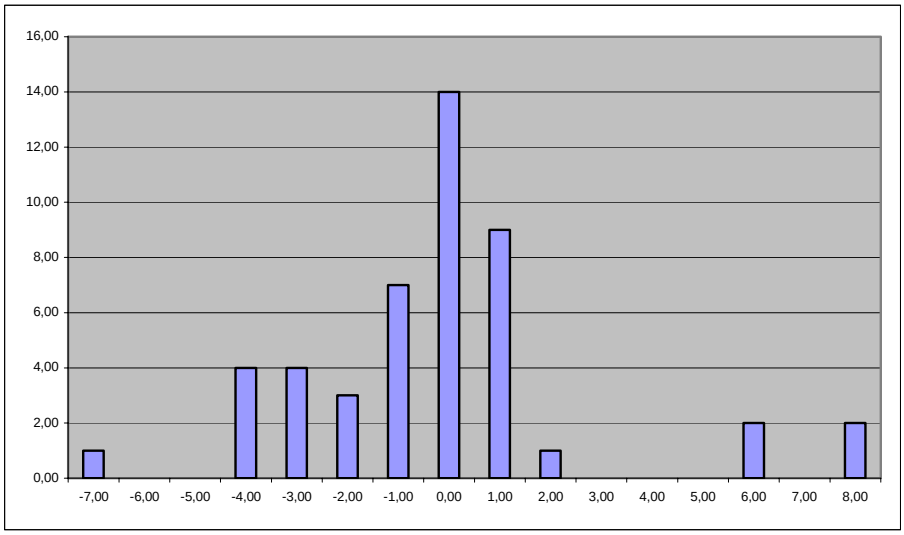

Table 3

Summary statistics of the Jensen measure

The multi-factor model

The β_{KAXt} and β_{Wt} are the betas related to the return on the Danish KAX index and the MSCI world index, respectively, and $\beta_{Dt,}$ β_{MBt} and β_{Gt} are the betas related to the return on the JP Morgan Denmark Government Bond index, the return on the Nykredit Markets Danish Mortgage Bond index and the return on the JP Morgan Global Broad ex. Denmark index, respectively. The Jensen measure for the i'th fund is α_i, which is reported annually in the third column. In the fourth column we indicate the number of funds in each category, which have a significantly positive (negative) α at the 5% level. In the fifth to seventh columns the β_i estimates are presented, and the values below the α_i and β_i estimates are Newey-West corrected t-statistics. The last column gives the goodness-of-fit statistic. A * indicates statistical significance at the 5% level.

Equity funds	**No. of funds**	**α**	**No. significant**	**β_m**	**β_{KAX}**	**β_W**	**R^2-adj.**
Danish equities	9	-2.90*	(3)		0.97*	0.01	0.97
		(-2.40)			(25.45)	(0.45)	
Foreign equities							
- Europe	6	-1.81	(1)	0.55*	0.22*	0.30*	0.86
		(-0.79)		(4.87)	(3.94)	(2.39)	
- Eastern Europe	1	-0.05		0.75*	0.09	0.04	0.82
		(-0.01)		(15.19)	(0.54)	(0.20)	
- Global	9	-1.46			0.19*	0.85*	0.84
		(-0.64)			(2.68)	(13.06)	
- Pacific	5	2.31		1.01*	0.07	-0.06	0.88
		(0.83)		(14.10)	(0.98)	(-0.67)	
- Japan	1	0.11		0.94*	0.11	-0.02	0.83
		(0.04)		(15.46)	(1.23)	(-0.21)	
- North America	1	-5.48*	(1)	1.10*	0.10	-0.31	0.79
		(-2.15)		(4.10)	(1.48)	(-1.06)	
- Latin America	2	-1.34		1.05*	0.11	-0.04	0.90
		(-0.36)		(19.94)	(0.86)	(-0.46)	
Fixed income funds	**No. of funds**	**α**	**No. significant**	**β_D**	**β_{MB}**	**β_G**	**R^2-adj.**
Danish fixed inc.	9	-0.27	(1)	0.46*	0.23*	-0.02	0.94
		(-1.36)		(11.96)	(6.36)	(-1.38)	
Foreign fixed inc.	4	-0.86	(1)	0.23	0.17	0.55*	0.81
		(-1.20)		(1.74)	(1.67)	(11.48)	
Total	47	-1.18	(7)				0.86

Table 4

Summary statistics of selection and timing ability

Selectivity is measured by Jensen's α, which is reported annually in the third column (Treynor and Mazuy) and in the seventh column (Henriksson and Merton). In the fourth and the eighth columns we indicate the number of funds in each category, which have a significantly positive (negative) α at the 5% level. In the fifth and ninth columns the timing ability parameters (b_1 and γ) are presented, where evidence of timing ability requires that b_1 and γ, respectively, are positive. The sixth and tenth columns give the number of significantly positive b_1's and γ's within each group. The values in parentheses below the estimated parameters are Newey-West corrected t-statistics. A * indicates statistical significance at the 5% level.

Mutual funds	**Treynor and Mazuy**					**Henriksson and Merton**			
	No. of funds	**α**	**No. sign.**	**b_1**	**No. sign.**	**α**	**No. sign.**	**γ**	**No. sign.**
Danish equities	9	-1.15	(1)	-0.55*	(1)	0.04	(1)	-0.12*	
		(0.80)		(-2.01)		(0.02)		(-2.03)	
Foreign equities									
- Europe	6	-2.16		0.23		-1.71		0.02	
		(-0.65)		(0.42)		(-0.38)		(0.11)	
- Eastern Europe	1	2.16		-0.09		2.43		-0.04	
		(0.43)		(-1.00)		(0.32)		(-0.29)	
- Global	9	0.30	(1)	-0.24		0.15		-0.03	
		(0.09)		(-0.33)		(0.04)		(-0.18)	
- Pacific	5	-1.24		0.66*	1	-4.57	(1)	0.23	1
		(-0.42)		(2.05)		(-1.04)		(1.84)	
- Japan	1	0.09		0,17		-1.01		0.06	
		(0.02)		(0.27)		(-0.14)		(0.35)	
- North America	1	-1.28		-0.72		1.03		-0.19	
		(-0.38)		(-1.21)		(0.21)		(-1.17)	
- Latin America	2	-0.05		-0.06		-2.36		0.04	
		(-0.01)		(-0.32)		(-0.47)		(0.28)	
Danish fixed inc.	9	-0.20		-1.10	1	-0.30	(1)	-0.01	1
		(-0.72)		(-0.73)		(-0.77)		(-0.07)	
Foreign fixed inc.	4	-0.22		1.62		-0.66		0.12	
		(-0.24)		(0.58)		(-0.49)		(0.64)	
Total	47	-0.52	(2)		2 (1)	-1.02	(3)		2

Table 5

Autocorrelations

The table reports the 1st to 12th order autocorrelation coefficients for total returns. The table also presents the sum of the autocorrelation coefficients, the adjusted-R^2 and a traditional F-test testing for joint insignificance of all the autocorrelation coefficients. A * indicates significance at the 5% level.

Total returns	**AR(1)**	**AR(2)**	**AR(3)**	**AR(4)**	**AR(5)**	**AR(6)**	**AR(7)**	**AR(8)**	**AR(9)**	**AR(10)**	**AR(11)**	**AR(12)**	**∑ AR(i)**	**R^2-adj.**	**F-test**
Danish equities	0.13	0.08	0.05	0.04	0.17	0.09	-0.14	-0.02	0.00	0.20	-0.16	-0.11	0.33	0.01	1.05
Foreign equities - Europe	0.17*	-0.13	0.04	-0.14	0.03	-0.04	0.03	-0.09	-0.00	0.05	-0.04	0.05	-0.07	-0.08	0.42
- Eastern Europe	0.08	-0.12	0.01	-0.12	-0.02	-0.02	0.05	-0.16	-0.01	-0.00	-0.02	-0.01	-0.34	-0.09	0.37
- Global	0.16	0.03	-0.04	-0.04	0.06	-0.00	-0.04	0.23*	0.05	0.11	-0.07	0.08	0.53	-0.02	0.83
- Pacific	0.22*	0.03	0.01	-0.05	0.02	-0.08	0.13	0.07	0.05	-0.02	-0.22*	-0.01	0.15	0.02	1.14
- Japan	0.25*	0.02	0.08	-0.14	0.22*	-0.07	-0.01	0.05	0.16	-0.13	-0.09	0.10	0.44	0.02	1.11
- North America	0.10	-0.04	-0.04	-0.06	0.06	-0.04	0.03	0.06	0.25*	0.10	-0.09	0.12	0.45	-0.02	0.85
- Latin America	0.12	-0.07	-0.03	0.05	-0.05	-0.12	0.04	0.02	-0.02	0.10	-0.08	0.01	-0.03	-0.10	0.34
Danish fixed inc.	0.25	-0.03	-0.05	0.01	0.22*	-0.32*	-0.02	0.21*	-0.15*	0.17*	0.19	-0.03	0.45	0.21	2.95*
Foreign fixed inc.	-0.05	0.01	-0.06	-0.05	0.30*	-0.11	-0.03	0.13	-0.01	0.02	0.13	0.13	0.41	0.06	1.46
Total	0.19	-0.01	0.01	-0.05	0.07	-0.01	-0.06	0.13	0.04	0.15	-0.14	0.05	0.37	-0.05	0.62

Table 6

Two-way table of total returns and risk-adjusted returns over successive time intervals

The sample of total returns is split up into three time periods 1996.1-1998.6, 1998.7-2000.12 and 2001.1-2003.6 and the two-way tables present the number of funds being winners and losers in two successive periods, respectively and the number of funds being winners (losers) in the first period and losers (winners) in the following period. For each investment category the first part concerns total returns, the second part concerns risk-adjusted returns (CAPM) and the third part concerns risk-adjusted returns (multi-factor model). Persistence requires that the majority of funds lie in the diagonal. The χ^2-statistic is the traditional Chi-square statistic for independence, which has a critical 5% value of χ^2 (1) = 3.84, and LOR is a Log Odds Ratio test defined as LOR = ln[WW·LL/(WL·LW)].

	WW	LL	WL	LW	χ^2	Prob.	LOR	Prob.
Danish equities								
Total returns								
96/98 – 98/00	3	2	2	2	0.09	0.76	0.30	0.76
98/00 – 01/03	3	2	2	2	0.09	0.76	0.30	0.76
CAPM α								
96/98 – 98/00	2	1	3	3	1.10	0.29	-1.02	0.31
98/00 – 01/03	3	2	2	2	0.09	0.76	0.30	0.76
Multi-factor α								
96/98 – 98/00	1	0	4	4	5.76*	0.02	NA	NA
98/00 – 01/03	3	2	2	2	0.09	0.76	0.30	0.76
European equities								
Total returns								
96/98 – 98/00	2	1	2	2	0.19	0.66	-0.44	0.66
98/00 – 01/03	2	1	2	2	0.19	0.66	-0.44	0.66
CAPM α								
96/98 – 98/00	2	1	2	2	0.19	0.66	-0.44	0.66
98/00 – 01/03	2	1	2	2	0.19	0.66	-0.44	0.66
Multi-factor α								
96/98 – 98/00	2	1	2	2	0.19	0.66	-0.44	0.66
98/00 – 01/03	2	1	2	2	0.19	0.66	-0.44	0.66
Global equities								
Total returns								
96/98 – 98/00	3	3	2	2	0.40	0.53	0.63	0.53
98/00 – 01/03	2	2	3	3	0.40	0.53	-0.63	0.53
CAPM α								
96/98 – 98/00	2	2	3	3	0.40	0.53	-0.63	0.53
98/00 – 01/03	3	3	2	2	0.40	0.53	0.63	0.53
Multi-factor α								
96/98 – 98/00	1	1	4	4	3.60	0.06	-1.75	0.08
98/00 – 01/03	3	3	2	2	0.40	0.53	0.63	0.53
Pacific equities								
Total returns								
96/98 – 98/00	1	1	2	2	0.67	0.41	-0.80	0.42
98/00 – 01/03	3	3	0	0	6.00*	0.01	NA	NA
CAPM α								
96/98 – 98/00	1	1	2	2	0.67	0.41	-0.80	0.42
98/00 – 01/03	2	2	1	1	0.67	0.41	0.80	0.42
Multi-factor α								
96/98 – 98/00	1	1	2	2	0.67	0.41	-0.80	0.42
98/00 – 01/03	3	3	0	0	6.00*	0.01	NA	NA
Danish fixed income								
Total returns								
96/98 – 98/00	4	3	1	1	2.72	0.10	1.55	0.12
98/00 – 01/03	3	2	2	2	0.09	0.76	0.30	0.76
CAPM α								
96/98 – 98/00	3	2	2	2	0.09	0.76	0.30	0.76
98/00 – 01/03	3	2	2	2	0.09	0.76	0.30	0.76
Multi-factor α								
96/98 – 98/00	3	2	2	2	0.09	0.76	0.30	0.76
98/00 – 01/03	4	3	1	1	2.72	0.10	1.55	0.12

Table 6

Two-way table of total returns and risk-adjusted returns over successive time intervals

(Continued)

	WW	LL	WL	LW	χ^2	Prob.	LOR	Prob.
Foreign fixed income								
Total returns								
96/98 – 98/00	2	2	0	0	4.00*	0.05	NA	NA
98/00 – 01/03	0	0	2	2	4.00*	0.05	NA	NA
CAPM α								
96/98 – 98/00	2	2	0	0	4.00*	0.05	NA	NA
98/00 – 01/03	2	2	0	0	4.00*	0.05	NA	NA
Multi-factor α								
96/98 – 98/00	2	2	0	0	4.00*	0.05	NA	NA
98/00 – 01/03	1	1	1	1	0.00	1.00	0.00	1.00

Table 7

Regressions of return persistence

The sample is split up into three time intervals 1996.1-1998.6, 1998.7-2000.12 and 2001.1-2003.6 and in the two cross section regressions the latter period is regressed on the former period. Part I concerns regressions of total returns, Part II concerns regressions of risk-adjusted returns (CAPM alpha) and Part III concerns regressions of risk-adjusted returns multi-factor alpha). Positive persistence requires that the slope coefficient is significantly positive. Numbers in parentheses are Newey-West corrected t-statistics.

	a_0	Prob.	a_1	Prob.	R^2-adj.
Danish equities					
Total returns					
96/98 – 98/00	-0.007*	0.013	0.60*	0.002	0.44
98/00 – 01/03	-0.015*	0.000	0.04	0.806	-0.14
CAPM α					
96/98 – 98/00	0.000	0.780	-0.40*	0.022	0.06
98/00 – 01/03	-0.004*	0.000	0.07	0.728	-0.13
Multi-factor α					
96/98 – 98/00	0.001	0.636	-0.39*	0.045	0.06
98/00 – 01/03	-0.004*	0.000	0.02	0.930	-0.14
European equities					
Total returns					
96/98 – 98/00	-0.017*	0.000	0.90*	0.000	0.52
98/00 – 01/03	-0.015*	0.013	-1.41	0.083	0.54
CAPM α					
96/98 – 98/00	-0.002	0.189	-0.54	0.110	0.21
98/00 – 01/03	-0.003*	0.049	0.04	0.780	-0.19
Multi-factor α					
96/98 – 98/00	-0.002	0.236	-0.30	0.604	-0.14
98/00 – 01/03	-0.002	0.106	0.33	0.379	0.08
Global equities					
Total returns					
96/98 – 98/00	0.009*	0.015	-0.04	0.844	-0.12
98/00 – 01/03	-0.020*	0.001	-0.13	0.576	-0.12
CAPM α					
96/98 – 98/00	-0.001	0.587	-0.15	0.172	-0.09
98/00 – 01/03	-0.001	0.259	-0.07	0.667	-0.11
Multi-factor α					
96/98 – 98/00	-0.009	0.286	-0.20*	0.039	-0.06
98/00 – 01/03	-0.003*	0.024	-0.01	0.972	-0.12
Pacific equities					
Total returns					
96/98 – 98/00	0.016	0.111	0.12	0.729	-0.18
98/00 – 01/03	-0.034*	0.015	1.57	0.251	0.06
CAPM α					
96/98 – 98/00	0.003*	0.037	-0.02	0.972	-0.25
98/00 – 01/03	0.001	0.661	-0.15	0.477	-0.23
Multi-factor α					
96/98 – 98/00	0.004	0.263	0.03	0.895	-0.24
98/00 – 01/03	-0.002	0.366	0.32	0.112	-0.16
Danish fixed income					
Total returns					
96/98 – 98/00	-0.000	0.087	0.13	0.100	-0.02
98/00 – 01/03	0.003*	0.000	0.59	0.330	0.03
CAPM α					
96/98 – 98/00	-0.001*	0.004	-0.13	0.527	-0.07
98/00 – 01/03	-0.000	0.875	0.56	0.100	0.18
Multi-factor α					
96/98 – 98/00	-0.001*	0.003	-0.18	0.441	-0.02
98/00 – 01/03	0.000	0.579	0.80	0.055	0.24

Table 7

Regressions of return persistence

(Continued)

	a_0	Prob.	a_1	Prob.	R^2-adj.
Foreign fixed income					
Total returns					
96/98 – 98/00	-0.009	0.265	1.65	0.192	0.49
98/00 – 01/03	-0.001	0.298	-0.10	0.721	-0.49
CAPM α					
96/98 – 98/00	-0.001*	0.020	0.69*	0.006	0.92
98/00 – 01/03	0.001	0.505	0.59	0.255	-0.15
Multi-factor α					
96/98 – 98/00	-0.001	0.098	0.46*	0.030	0.77
98/00 – 01/03	-0.000	0.857	0.42	0.579	-0.42

Table 8

Jensen's α for the rebalanced portfolios

The β_{KAXt} and β_{Wt} are the betas related to the return on the Danish KAX index and the MSCI world index, respectively, and $\beta_{Dt,}$ β_{MBt} and β_{Gt} are the betas related to the return on the JP Morgan Denmark Government Bond index, the return on the Nykredit Markets Danish Mortgage Bond index and the return on the JP Morgan Global Broad ex. Denmark index, respectively. The Jensen measure for the i'th portfolio is α_i, which is reported annually in the second column. In the third to fifth columns the β_i estimates are presented, and the values below the α_i and β_i estimates are Newey-West corrected t-statistics. The last column gives the goodness-of-fit statistic. A * indicates statistical significance at the 5% level.

Equity portfolios	**α**	**β_{KAX}**	**β_W**		**R^2-adj.**
Best-performing	-4.76 (-1.08)	0.49* (3.52)	0.44* (4.00)		0.68
Worst-performing	-1.18 (-0.16)	0.23 (1.49)	0.81* (5.57)		0.66
Fixed income portfolios	**α**	**β_D**	**β_{MB}**	**β_G**	**R^2-adj.**
Danish fixed income	-0.40 (-0.43)	0.18 (1.22)	0.35* (2.63)	0.36* (5.94)	0.72
Foreign fixed income	-1.34* (-2.20)	0.33* (3.08)	0.16 (1.76)	0.11* (2.23)	0.62

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