

INSTITUTE FOR QUANTITATIVE INVESTMENT RESEARCH

Summary Inquire Europe Seminar

Alternative Investments

22 - 24 September 2002

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GRAND HOTEL, STOCKHOLM, SWEDEN

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Keynote Address: What Have We Learned About Hedge Fund Risk & Return?

David Hsieh

Fuqua School of Business, Duke University

David Hsieh opened the seminar with a keynote address in which the topics and papers discussed on this seminar were put in perspective. The key issues for institutional investors are asset allocation, performance evaluation and risk management. Investors need to know where bets are placed, how returns are generated and what the risks are. In 1992, Sharpe started using factor models to evaluate mutual fund investment styles. When this model is applied to hedge funds several questions arise. The first is that it is not clear what a hedge fund style is and how one defines it. It also is not clear what the systematic risks are. It is well known that hedge funds have low correlation against standard benchmark returns, from which it appears as if there is no systematic risk. In 1997, Fung and Hsieh used a principal component type of model to identify common sources of risks of hedge funds. Five systematic components of risks were identified; three market timing factors, one equity related factor and one event-driven factor. Most of the current research elaborates on this, and aims to build a hedge fund factor model. The two major research issues are the quality of hedge fund data and the diversity of hedge funds styles.

Since hedge funds are basically private investment vehicles, they do not have to disclose much. Hedge fund data is only available if hedge fund managers allow data vendors to use the data. Because of the way data is collected several biases occur. The first is the attrition rate, the frequency of funds dropping out of the database. For hedge funds the attrition rate is about 10% to 20% per year. The second is the survivorship bias. By using currently existing funds, ignoring the ones that have dropped out of the database in the past, the historical performance is overestimated by between 0% to 3% per year. The instant history bias arises from backdating the performance history of a fund that is included in the database. The backdated performance history usually tends to be unusually good. The instant history bias is estimated to be between 0% and 1,5% per year. The last bias, the self-selection bias, occurs because managers themselves decide whether they want to be in the database or not. This decision might of course depend on past performance. As the hedge funds that are not in the database are not observed, the size of this bias is not known. The papers by Amo, Harasty, Hillion and Baquero, ter Horst, Verbeek presented at this seminar are related to data quality.

There are a lot of different hedge funds styles. This is illustrated by some graphs showing different equity hedge fund style average returns per quintile of S&P500

and different fixed income hedge fund style average returns per quintile of a CSFB high yield index. The problem is to identify risk factors for these different styles. A style is defined as a combination of location and strategy. Location describes where a fund trades, the underlying asset category that a fund uses. This includes stocks, bonds, currencies and commodities as well as spreads; long one type of security and short another type of security. Strategy is how a fund trades, whether it has directional or non-directional exposures and whether it uses a static or a dynamic strategy. A style factor is a style that is common for many funds. Historically, style factors have been created from peer-groups, funds with similar self described styles. Problems with peer-group style factors are that style proliferation occurs and that its hard to quantitatively identify whether there is anything common across the funds. By grouping funds with high return correlation, return-based style factors can be created. The last approach, asset-based style factors ('ABSF'), links returns with location and strategy using observed prices. Two papers presented at this seminar use style factor models; the paper by Lhabitant to determine style, the paper by Kouwenberg to determine alpha. Other topics on the hedge fund research agenda are hedge fund impact on markets, hedge fund incentive compensation and hedge fund investment flows. The paper by Argawal and Naik presented at this seminar investigates investment flows.

Research on ABSF include work on trend following and fixed income hedge funds by Fung and Hsieh, as well as the paper by Liodakis and Dowle on pairs trading. A lot of commodity funds call themselves trend following. Ex-post a trend follower will buy low and sell high. This pay-off corresponds to a lookback straddle. By using exchange traded options, portfolios replicating lookback straddles can be constructed. These portfolios explain about 48 percent of the R-squared of trend following funds. The implication is that trend followers bear systematic risks; although their beta is on average zero, their beta changes with the market environment. The success of the out-of-sample tests indicates that it is possible to create external benchmarks for a specific hedge fund style, using only observable market prices. A similar analysis for fixed income hedge funds reveals that they typically hold spread positions; long convertible-, high yield-, mortgage- or emerging market bonds, short treasuries. HFR (Hedge Fund Research) fixed income arbitrage funds are highly sensitive to the change in credit spread. A further analysis of the history of the credit spread reveals that over the period 1987 to 1997 a 1 percent spread change was a very low probability event. Extending the period to 1970 or even to the 1920's reveals that 1 percent credit spread changes are rather realistic. Because only a short period of observed hedge fund returns are available, ABSF can be very useful in assessing potential risks of hedge fund strategies.

Overall a useful classification of hedge fund styles seems to be the following. On the one hand there are market timing or directional strategies, which have a high beta relative to standard asset classes. This category can be subdivided into trend following and reversal strategies, with the traditional asset classes as location. On the other hand the long/short or spread strategies exhibit a low beta to standard asset

classes. This category can be subdivided into equity and fixed income trend following and reversal strategies, with equity- (capitalisation, value/growth) and fixed income (credit, mortgage) spreads as location. In between are event driven strategies like merger arbitrage. Mr. Hsieh concludes that compared to 1997, the use of ABSF has brought great improvements in explaining hedge fund returns. A complete style model looks possible, but more styles remain to be studied.

Hedge Fund Benchmarks: Information Content and Biases

David Hsieh* and William Fung
Fuqua School of Business, Duke University

In his second presentation, David Hsieh presented a paper on hedge fund benchmarks. Various ways of constructing benchmarks and the advantages and disadvantages of doing so for four types of benchmarks are discussed. Three of them, peer-group averages, return-based style factors and asset-based style factors (ABSFs) have been discussed in the previous presentation, the added type of benchmark is fund-of-hedge funds (FoF) averages. The interesting thing about FoF's is that they form a combination of hedge funds that can be observed (that are in the standard databases) and of some that can not be observed. There may be a way of trying to compare performance and infer something about the unobservable funds. A first problem in benchmark constructing is the data. As discussed in the previous presentation, the hedge fund databases suffer from selection-, survivorship-, and instant history biases. Benchmarks constructed from these databases will inherit the same biases.

Peer-group averages suffer from inheritance of database biases. Because they are constructed from individual hedge funds, they offer limited transparency on the risk characteristics. Another unresolved issue is whether equally weighted (which translates into a contrarian investment strategy) or a value-weighted (which translates into a buy-and-hold strategy) weighting schemes should be used. Peer-groups tend to be qualitative defined; it is very hard to invest in the same way. There also is a tension between broad-based benchmarks versus a proliferation of sub-indices, which might mask strategy differences. There also are marked differences in classification. CSFB/Tremont equity market neutral contains 27 funds in the first quarter of 2001. Of these, 18 were in HFR, 6 in HFR equity market neutral, 7 in HFR statistical arbitrage and 5 in other sub-indices. A final problem with peer-group averages is the short history. There may not have been enough observations to investigate tail events, which makes it hard to predict future returns, especially in new economic environments.

Fund-of-funds also have inherited biases from the databases, but in general the biases are smaller than for individual hedge funds. They offer little transparency. Also the FoFs offer few pure styles. It is hard to distinguish between active and passive funds-of-funds, and it is hard to distinguish between style allocation versus manager selection. There is an additional layer of fees, which should be backed out in order to compare the returns to individual hedge funds. The final problem is again the short history.

For return-based style factors the procedure is to extract the common risk by using principal components. Because principal component analysis by construction results in orthogonal factors that are difficult to interpret, it makes sense to start from loosely defined peer-groups. The aim is to investigate what managers actually do, rather than what they say what they do. Return-based style factors inherit the database biases and offer limited transparency. The results are sample dependent and possibly unstable. The return-based styles are not investable and are also constructed from a short history.

Determining asset-based style factors also starts with peer groups and principal component analysis. The additional step is to link the common components to observed asset prices with a model. The advantages of ABSFs is that a lot of bias problems are avoided. ABSFs are transparent, they are based on market prices. Because they are explicit and rule-based, it is possible to replicate the strategies. ABSFs can be used for asset allocation and performance evaluation. Because of longer history of underlying assets they are also more suitable for risk management purposes. The explicit links to the economic environment also allows for determining conditional expected risk and return. Mr. Hsieh concludes that because of all the advantages one should prefer ABSFs as hedge funds benchmarks.

Hedge Funds and Funds of Hedge Funds: Are They Worth the Risk?

Anne-Valère Amo*, H  l  ne Harasty and Pierre Hillion
Lombard Odier Darier Hentsch & Cie.

In the paper presented by Anne-Val  re Amo five topics are discussed. The first objective is to understand why traditional risk management analytics fails to provide a realistic picture of the actual risks of investing in hedge funds. In view of this failure an alternative risk-return framework for hedge funds is suggested. Within this analytic framework, survivorship bias is measured and its significance is tested. Hedge funds will be compared to other asset classes, and finally the diversification benefits of investing in funds of hedge funds are assessed.

Several academic studies have shown empirical evidence that hedge fund returns are not normally distributed. The changes in the value of hedge funds are often released with a great deal of delay. This price staleness leads to high-peaked or fat-tailed empirical distributions and autocorrelation. Moreover, hedge funds exhibit non-linearity which is not captured by linear measures such as correlation coefficients or simple linear multi-factor models. Mrs. Amo illustrates these results that indicate that the Gaussian model is no longer reliable for hedge funds; risk is underestimated and most traditional decision making tools should be used with great caution.

This paper assesses the reward and risk characteristics of hedge funds and fund of hedge funds within a terminal wealth analytic framework. The mean (terminal wealth average, TWA) and dispersion (terminal wealth standard deviation, TWSD) of the end-of-period wealth accumulated from an investment in hedge funds are used as reward and risk indicators. The reward-to-risk ratio (RRR) is defined as the expected average terminal wealth per unit of risk taken (TWA/TWSD). These cross-sectional statistics are derived from simulated terminal wealth paths accumulated from an investment of USD 1 in mock funds of randomly selected and equally weighted hedge funds after a specific holding period, starting from a given launch year. The basket of size 1 corresponds to the case study of single hedge funds. The analysis uses monthly NAVs from January 1978 to 2002 from the TASS+ Active database extended by the TASS+ Graveyard database that keeps the track record of hedge funds that have stopped providing information over time. The attrition rate (the number of dead funds divided by the number of living funds at the beginning of the year) increased after 1998 to currently about 12 percent. The inclusion of graveyard hedge funds tends to temper the usual optimistic picture for hedge funds; the returns tend to be revised downward, the risks upward. The survivorship bias, measured as the annualised median return difference between the active and the

enlarged universe, is time sensitive and becomes more pronounced as the investment horizon lengthens. On average the survivorship bias is about 3 percent and statistically significantly different from zero.

The return/risk profile of single hedge funds has been compared to the profile of other major asset classes. Hedge funds offered a higher reward than equities, bonds or mutual funds. However, this higher reward was obtained by dint of a much higher risk, which implies that the selection process of hedge funds is critical. These results are in contrast to the results obtained from a time series reward-to-risk ratio analysis, where hedge funds appear favourable because of a low standard deviation. The impact of diversification benefits of investing in funds of hedge funds is measured through the percentage reduction in TWSD when the basket composes of more than a single fund. The diversification benefits are substantial and turn out to be more significant for hedge funds than they are for mutual funds. Most of the reduction occurs for relatively small baskets. The use of alternative cross-sectional downside risk measures confirms the important reduction in volatility when investors bet on funds of funds rather than on single hedge funds. The significant positive skewness and excess kurtosis of hedge funds are found to be decreasing according to the number of hedge funds the investor is adding to his basket. Extreme events are less likely to occur as the basket size increases but up to a certain point, depending on the investment horizon.

Assessing Market Risk for Hedge Funds and Hedge Fund Portfolios and Hedge Fund Diversification : Where Should We Stop ?

Francois-Serge Lhabitant

HEC University of Lausanne and Union Bancaire Privée (Geneva)

Francois-Serge Lhabitant presented two papers on hedge fund risk management. The topic of the first paper is assessing market risk for hedge funds and hedge fund portfolios. Although everyone knows what a hedge fund is, there is no real definition of hedge funds. Hedge funds are known for characteristics like manager performance fees, the ability to take short positions, to use leverage, to use derivatives and so on. The difficulty with hedge funds is that they are not transparent. A legal reason for this is that most hedge funds are not registered for distribution. Another reason is the willingness of hedge fund managers to remain not transparent, for example to avoid short squeezes. In order to avoid investing in black boxes, factor models can be used to understand what these hedge funds effectively are doing. The problem in using factor models for hedge funds is to find the right factors, in order to reduce the specific risk as much as possible. Sharpe's return-based style analysis (1988) inverts the causality of multi-factor models and asserts that a fund manager's investment style can be determined by comparing its returns with the returns of a number of selected passive indices. Fung and Hsieh (1998) show that for US mutual funds nine broadly defined asset classes suffice for a large explanatory power. For hedge funds the style factors include dynamic trading strategies and the explanatory power is much lower.

Rather than trying to model these non-linearity's by option payoffs, this paper hides the non-linearity's in the indices themselves. The factors used in this return-based style analysis are 9 CSFB Tremont hedge fund indices. The CSFB Tremont indices are entirely transparent. Two criteria, USD 10 million assets under management as well as audited financial statements, are applied before funds are included in the index. The index includes 300 out of 2600 funds in the database, is asset weighted, and data is available on a monthly basis. The model constraints the betas to be positive; because hedge funds use leverage the weights are not constrained to sum to one. This model has several applications. It allows to monitor a hedge fund manager's investment style, concentration etcetera, dynamically over time and regardless of his claimed exposure or category. It gives a useful indication as to the economic environment in which a given manager is likely to do well or poorly. It can be used for performance evaluation purposes. Finally, it allows for the computation of Value-at-Risk (VaR) and an understanding of its sources.

In this model, the VaR of a specific hedge fund is calculated as the sum of the market

VaR and the specific VaR. The first step is to map the hedge fund on the nine indices that constitute the risk factors. Using these betas and taking into account the correlations between the factors, the market VaR is determined as the aggregate of the impacts of one percent extreme moves of each factor. Extreme value theory is applied to estimate these factor VaR's. The specific VaR is calculated as a one-percentile of the errors of the regression. This style model is empirically tested on almost 3000 hedge funds that are selected because they existed at least 3 years and 1 month and had at least USD 5 million under management. Starting in 1994, three year rolling periods are used to measure the fund's sensitivities to style movements (betas), the correlation between style indices and the extreme moves of style indices. From this, for each fund the 1 month 99 percent VaR is calculated. Radar plots of the betas of a fund at a certain point in time provide a picture of the true style of that fund. By looking at the time series of betas the full movie is revealed. The movie allows for identification of style drifts. The average R-squared of the model is a little over 50 percent. The average 1 month 99 percent market VaR for all funds is 8 percent. The total VaR (99%, 1M) over the full sample is almost 11 percent. Event driven strategies have a slightly lower VaR, for emerging markets strategies the VaR is much higher, especially following the Asian crisis in 1997. On average the VaR is increasing. Back-testing the VaR model out-of-sample reveals a 30 percent exception rate in august 1998, the time of the LTCM collapse. Excluding this month, the exception rate is in line with what one should expect. The conclusion for this paper is that the model, solely based on NAV's, is rather robust and useful to compute VaR and identify its sources.

The second paper presented by Francois-Serge Lhabitant is joint work with Michelle Learned and investigates hedge fund diversification. Often cited reasons for investing in hedge funds are enhanced "risk" adjusted performance and reduced correlation with traditional assets, allowing for an improvement of the efficient frontier. In hedge funds investing diversification seems to be the rule, because of low correlation between managers and reducing the impact of selecting a bad manager. The new questions are to determine the optimal number of hedge funds in a portfolio and determining the marginal impact of adding a new fund to an existing portfolio. Naïve diversification is better for hedge funds than Markowitz optimisation, amongst others because of non-normality of returns. This paper employs a Monte-Carlo simulation, creating equally weighted buy-and-hold portfolios of increasing size by randomly selecting hedge funds from the database. For each portfolio size, this process is repeated 1000 times to obtain 1000 observations of each statistic. Statistics calculated are returns, volatility, skewness, kurtosis, worst monthly return, VaR, maximum drawdown and correlation with an equity and a hedge fund index. The experiment is repeated for two other periods, using only surviving funds, and using a smarter diversification technique. The conclusions are that diversification (naïve or smart) is clearly a protection against ignorance. Diversification brings most of its benefits already with very few, say 10 to 15, funds in a portfolio. From a market risk perspective, funds of hedge funds seem overdiversified.

Survival, Look-Ahead Bias and the Performance of Hedge Funds

Jenke ter Horst*, Marno Verbeek and Guillermo Baquero
Tilburg University and Erasmus University

The paper presented by Jenke ter Horst is joint work with Marno Verbeek and Guillermo Baquero. The question addressed in this paper is whether active selection makes sense in the hedge funds industry, whether there is persistence in performance of hedge funds. Two biases that can arise in persistence studies, survivorship- and look-ahead bias, are introduced. These biases may affect persistence studies if the survival of hedge funds is related to past performance. Using data on US hedge funds, the impact of these biases on persistence studies and ways to eliminate them are examined. The main findings in this paper are that past performance, amongst other factors, affects survival probability of hedge funds. The look-ahead bias affects persistence studies severely. After correcting for both biases, strong persistence at a quarterly horizon and a somewhat weaker persistence at an annual horizon is found. Losers continue to be losers at all examined horizons.

In the hedge funds performance persistence literature, Brown, Goetzmann and Ibbotson (1999) have found no persistence on an annual basis. Agarwal and Naik (2000) did find persistence on a quarterly horizon. Both studies potentially are affected by multi-period sampling biases. Although they take into account the survivorship bias, the look-ahead bias is not taken into account. The hedge fund industry is characterized by a high attrition rate. If hedge fund survival depends on past performance, standard methods of analysis may lead to results that suffer from survivorship bias. Survivorship bias is usually eliminated by using a complete dataset, taking fund returns into account until the moment of disappearance. The look-ahead bias is a methodology related survivorship bias. In persistence studies the question asked is whether the above median performing funds in a given (ranking) period are more likely to be winning funds the next (evaluation) period. So the rankings are conditional upon survival in both the ranking and the evaluation period. The look-ahead bias arises because only funds that survived both the ranking and the evaluation period are selected. This look-ahead bias might lead to spurious performance persistence patterns.

The data used in this paper is US hedge fund data from the TASS database. Because information on defunct funds is only available as of 1994, the sample covers 1994 - 2001/1 on a quarterly basis. The sample includes almost 1800 funds, of which 1200 are still alive in the first quarter of 2000. Some funds with missing style classifications have been classified using discriminant analysis. The annual attrition rate is almost

9 percent on average, increasing to 13 percent in 1999. A contingency table showing the initial and subsequent ranking of the funds indicates that past performance affects fund survival. The worst performing funds in the ranking period have the highest attrition probability and the highest probability of being worst performing in the evaluation period. The decile best performing funds have both a high probability of being best and of being worst performing in the evaluation period. The return on the active sample is on average more than 2 percent higher than the return on the complete sample, due to the fact that the dead funds performed much worse than the active funds. Using a probit specification, possible factors affecting survival probabilities of hedge funds, including past fund returns, investment style, economy wide effects and fund specific variables, are analysed. The estimation results show a significant positive effect of past performance on survival probabilities. Manager incentive fees have a negative impact and personal capital invested by the manager has a positive impact. Only the emerging markets and equity market neutral style have a significant lower survival probability. Knowing that survival is related to past performance the question arises how to eliminate the look-ahead bias.

Knowledge of the survival process is a key to correct for look-ahead bias, as shown in a paper by Ter Horst, Nijman and Verbeek (2001). The corrections involve multiplying the performance measure by a weight factor, which is the ratio of the unconditional and the conditional survival probability of a fund. The intuition behind this correction method is that the weights for funds with high returns are reduced, and the weights for funds with low returns, of which too few are observed, are increased. The results for raw returns show that the impact of look-ahead bias is quite severe, even though positive and negative survival related biases are sometimes suggested to cancel out. At horizons of one and four quarters, clear evidence of positive persistence in hedge fund returns is found. Because positive persistence potentially can be explained by the presence of cross-sectional variation in expected returns due to investment style or risk characteristics, the analysis is also applied on style-adjusted (relative) returns. For relative returns the evidence of positive performance persistence is confirmed.

On Determinants of Money Flow and Risk-taking Behaviour in the Hedge Fund Industry**

Vikas Agarwal*, Naveen Daniel and Narayan Naik
Georgia State University and London Business School

The paper presented by Vikas Agarwal is co-authored by Naveen Daniel and Narayan Naik, and has been sponsored by Inquire Europe. Over the last years a significant amount of money flows into hedge funds has resulted in growth of assets under management as well as in number of funds. This paper investigates the way investors allocate their money to different hedge funds. Does past performance matter in determining flows in the future? If so, do hedge funds strategically change their portfolio risk depending on past returns and flows? How does the fund volatility relate to the managerial compensation features and fund characteristics? Is the money flow and risk-taking behaviour different for funds of hedge funds compared to individual hedge funds?

The data used for this research is a large, comprehensive hedge fund database created by merging the datasets of live as well as dead funds from Hedge Fund Research, TASS and Zurich Capital Markets / Managed Accounts Reports. The database includes almost 2000 (370) live and 1200 (151) dead hedge funds (funds of funds), over a sample period from 1987 to 2000. The overall median management fees are 1% (1.5%) and incentive fees 20% (10%). The percentage of the funds employing a high watermark -managers receive incentive fees only if they make up for the losses in previous periods- is 84% (56%). The percentage of funds having a hurdle rate - incentive fees are only paid if they exceed the hurdle rate- is 19% (29%). The positive skewness of the growth rate implies significant flows in smaller funds.

Three main findings are reported. The first is that past performance matters. A convex flow-performance relation is found; hedge funds and funds of funds that are top performers in the prior year experience higher money flows. Because hedge funds provide limited information and investors look only at performance this effect might be strong. A weak flow-performance relation might occur among others because funds are closed for new investment or because of restricted redemptions. The regression analysis of the flow performance relation controls for strategy-specific as well as fund specific factors like size, volatility, age and fee structure. The findings are that larger and more volatile hedge funds attract less flow. A non-linear relation between age and the growth rate is found, with one to three year old hedge funds experiencing the highest growth. This is consistent with what one would expect from the hedge fund life cycle scenario. Initially, when the fund is young, investors do not have enough information to assess the performance, so there is little

money inflow. During intermediate years the money inflow is highest, and during the later years once again the money flow is low. Flows into hedge funds are positively related to incentive fees, implying that investors prefer funds with better incentive alignment. For funds of hedge funds smaller, well-performing, less volatile funds and funds with recent inflow experience higher flows, implying that investors prefer well-diversified fund of funds.

The second finding is that strategic risk taking does exist in hedge funds. The hypothesis is that if money chases recent performance, then managers with poor first-half year performance would have incentives to increase risk in the second half of the year. The methodology used first divides the managers according to their first-half year performance. Next the ratio of variance of returns during July to December to the variance of returns during January to June is computed and segregated into two categories. Hedge funds with poor returns in the first half of the year significantly increase risk in the second half. Conditional on poor returns in the first half they also increase risk if they have poor flows in the first half. Among fund of funds such behaviour is confined only to those who do not charge incentive fees (asset gatherers). For the funds of funds charging incentive fees no significant result is found.

The third result is that funds change their volatility in response to explicit risk taking incentives that arise from the call-option-like incentive contracts. Younger (less than one year old), larger and poorly performing hedge funds exhibit lower volatility. Hedge funds with incentive fees have higher volatility, implying that managers respond to explicit risk-taking incentives. In general, important differences in money flow and risk-taking behaviour for hedge funds and fund of hedge funds are found. Overall the findings significantly improve the understanding of the behaviour of both investors and managers in the hedge fund industry.

Do Hedge Funds Add Value to a Passive Portfolio? Correcting for Non-Normal Returns and Disappearing Funds

Roy Kouwenberg
AEGON Asset Management

The paper presented by Roy Kouwenberg is part of a project sponsored by Inquire Europe. The paper is motivated by the fact that many insurance companies and pension funds invest in hedge funds to diversify their portfolio. These investors typically face short-sell constraints and other rules which prevents them from replicating hedge funds returns themselves. The questions addressed are whether hedge funds add value to a passive portfolio after correcting for non-normal returns and adjusting for the many disappearing funds and how to recognise good funds.

The data used is the Zurich hedge fund universe (formerly known as the MAR database), provided by Zurich Capital Markets. The database contains monthly data on 2078 hedge fund and 536 fund of funds. The data covers the January 1995 to November 2000 period and is free of survivorship bias. The returns are net of management and incentive fees. The hedge funds are classified into 8 styles by the data provider. During the period 1995 - 2000 new hedge funds appeared in the database at an average rate of 23% per year, while funds disappeared at a rate of 11% per year. The event driven, market neutral and funds of funds styles exhibit low volatility and equity like returns. The global (macro, international and established) and sector funds exhibit high volatility and high absolute returns. Short sellers and emerging markets show high volatility and low (absolute) returns. In general the correlations with the market appear quite low. The hedge fund styles do exhibit some correlation to simple put and call option strategies and to Fama French factors.

In the next part of the presentation the added value of hedge funds is assessed. Jensen's alpha measures the added value of a fund to an efficient passive portfolio, assuming that the investor has mean-variance preferences, ignoring skewness and fat tails. Because hedge funds exhibit non-normal returns, also alphas for an investor with a power utility function (who dislikes large negative outliers and negative skewness) are calculated. The alphas are calculated against an efficient benchmark set that is available to the average passive investor. Two of such sets are considered, the first including cash, the S&P500 and the NASDAQ, the second adding out-of-the-money call and put option selling strategies. For the first benchmark set the average alpha is significantly positive for all hedge fund styles, with about 75 percent of all individual hedge funds alphas being positive. The non-normality of hedge fund returns does not have a uniform and significant impact on the alphas. For the second benchmark set, the average alpha remains significantly positive for all hedge fund

styles. The put option selling strategy reduces the alphas of event-driven funds, funds of funds and emerging market funds. The option strategies increase the R-squared of the alpha regressions, but the majority of return variation remains unexplained.

The next question addressed is that of the disappearing funds. Possible reasons for fund disappearance are that funds become too successful and close to new investors or that funds have disappointing returns. A comparison of disappearing funds with the surviving funds in the database reveals that disappearing funds tend to have significantly lower mean returns, leading to the conclusion that hedge funds mainly disappear after disappointing returns. The question remains whether this is the top of the iceberg: what happens to these funds after they leave the database?

The final part of the paper addresses the question of how to select a winning hedge fund. To do so the sample is split into two periods. To be selected, the fund has to have a 36-month track record, and a positive alpha or an above median Sharpe ratio. The out-of-sample period 1998-2000 is used to determine whether the selected funds survive and whether they continue to have a positive alpha or above median Sharpe ratio. The conclusion is that selecting funds with a good 36-month track record reduces the odds of fund disappearance or underperformance in the out-of-sample period, which is evidence of performance persistence. The chance of a positive alpha was only 55% for market neutral, event driven and fund of funds in the out-of-sample period. About 33% of the funds disappeared out-of-sample, which depresses long-term hedge fund performance.

The conclusion of the presentation is that the non-normality of hedge fund returns reduces alphas, but many funds do not have excess kurtosis and negative skewness, which limits the overall impact. The long run performance is reduced severely by the large number of disappearing funds. Hedge funds seem to add value, but definite conclusions are difficult due to the lack of information about disappearing funds.

International Evidence on Ethical Mutual Fund Performance and Investment Style

Rob Bauer, Kees Koedijk, Rogér Otten*

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The paper presented by Rogér Otten on ethical mutual fund performance is co-authored by Rob Bauer and Kees Koedijk. This research is sponsored by Inquire Europe. The last decade has shown a tremendous rise of investments in mutual funds based on so-called socially responsible (SRI) or ethical investment screens. The paper investigates whether performance and style differences between ethical funds and conventional mutual funds can be observed. SRI portfolios are portfolios that are screened on ethical, social and environmental guidelines. Two broad approaches are negative and positive screening. The negative screens exclude sectors like tobacco, weapons, alcohol and gambling. Positive screens, the so-called best-in-class approach, include the best (or least bad) stocks in every sector.

Turning to SRI fund performance, the big question is whether it costs money to be ethical. Some previous papers on the US market find no statistically significant difference in risk-adjusted return between SRI and conventional funds. For the UK market, some studies indicate statistically significant outperformance of SRI versus conventional funds, later studies however contributed this to a small cap bias. The contributions of this paper are that it uses more ethical funds (103) over a longer sample period (1990-2001) from more countries (US/UK/Germany). It also uses better performance modelling techniques, including conditional multifactor models. With respect to the data, within each country a distinction between funds investing domestically and internationally is made. The average ethical fund size is smaller than the average conventional fund size. Also their expense ratio is a little bit higher, which might have to do with the additional research costs. In this presentation only the results for the UK are shown.

Results for the 1-factor CAPM model show an insignificant outperformance for ethical funds over conventional funds. The ethical funds do have a significant lower beta, so ethical funds take lower market risk than conventional funds. Using ethical rather than conventional indices does not change this result much. Next the results for the Carhart (1997) 4-factor model are presented. Using this model increases the R-squared, so including the size, growth and momentum factors seems to add value, also for ethical funds. Like in the 1-factor model, the market exposure is still significantly smaller for the ethical funds. Ethical funds, both domestic and international, also have a significantly larger exposure to small caps. Also the loading on the value/growth factor is significantly lower for ethical funds, so ethical funds seem

more growth oriented than conventional funds. For the momentum factor there is no clear difference between ethical and conventional funds. After taking out the style exposures, the alphas of ethical funds increased compared to conventional funds, but they remain insignificant. In the conditional model some well known indicators like the lagged T-bill rate, the term-spread, the credit spread and the dividend yield are included in the model to allow for time-varying betas. A first result of this model is that especially for the ethical funds the R-squared increases, indicating that fund managers are changing their style through time. The unconditional alphas are lower compared to the conditional alphas. For the international ethical funds the conditional alpha is significant. The average difference in the time-varying market beta has been negative, so the ethical funds had on average a lower market beta. But at the end of the sample period, starting around 1999, the ethical fund market betas started approaching the betas of the conventional funds. The average difference in the time-varying size beta has been positive, so ethical funds were more exposed to small caps. However, at both the beginning and the end of the sample period this bias is disappearing.

An investigation of the 4-factor alphas for all countries over three sub-periods indicates that most of the underperformance of ethical funds can be found in the beginning of the nineties. In the last sub-period, evidence that ethical funds clearly match the performance of conventional funds is found, pointing into the direction of a “learning-effect”. By separating the ethical funds into two groups, launched before and after 1998, the age effect is further investigated. The older ethical funds significantly outperform younger funds. Younger funds do not deviate from conventional funds with respect to investment style. Difference in strictness of screening might be a possible explanation for this.

In summary, the ethical funds assets under management are still quite insignificant. The performance is not the negative driver in this case, there is no significant difference in performance between ethical and conventional funds, even after correcting for clear distinct investment styles. Ethical funds clearly exhibit style exposures (small cap and growth) which have to be taken into account. In addition to this, younger funds deviate less from conventional funds than the older funds. The older, more strict funds, outperform the younger ethical funds significantly.

Theory of Storage and Pricing of Commodity Claims

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Martin Nielsen presented a paper that is co-authored by Eduardo S. Schwartz on the theory of storage and pricing of commodity claims. The paper is motivated by the fact that the commodity markets use the 2-factor Schwartz model to price forwards and future contracts. This model assumes constant volatility, whereas the common knowledge is that the volatility is dependent on the slope of the forward curve. This paper is an attempt to reconcile these apparent contradictory facts.

One of the predictions of theory of storage is that the volatility of commodity prices is decreasing in the level of inventories. Unfortunately, inventories are not usually observable, nor are their statistical properties well known. Therefore, the opportunity cost of holding inventories will be used as an inverse proxy for inventories. The logic is that agents will hold less inventories when the costs of holding inventories are high and vice versa. The opportunity cost of holding inventories can be determined from the slope of the forward curve. Commodities have both an explicit and an implicit rate of return, which can be determined by comparing forward and spot prices. The implicit return comes from production flexibility and the avoidance of costly production standstills and makes up for the low explicit rate of return. The implicit benefits are referred to as the convenience yield. The market studied in this paper is the copper market but the model would work for other metal markets and the oil market, which is generally considered non-seasonal, as well. The model does not cover seasonal commodities like natural gas and agricultural products, but could be extended in this direction. The situation in mind is that people who hold inventories have declining marginal benefits of holding inventories and concave benefit functions of holding inventories. The assumption is that agents optimise and hold less inventories when the opportunity costs of holding inventories are high. In this situation the marginal benefits of holding inventories must be high and the agent will hold low level of inventories. The marginal benefits of holding inventories (the convenience yield) are usually modelled as a flow rate. Then the dynamics of the spot price, S_t , and convenience yield, δ_t , are

$$\begin{aligned}dS_t &= (r - \delta_t)S_t dt + (\beta_1 \delta_t + \beta_2)^{1/2} S_t dz_1 \\d\delta_t &= (\alpha - \kappa \delta_t) dt + \sigma_2 (\beta_1 \delta_t + \beta_2)^{1/2} S_t dz_2\end{aligned}$$

where dz_1 and dz_2 are allowed to be correlated.

$$dz_1 dz_2 = \rho dt$$

If the β_1 is set to zero this model is identical to the Schwartz model with constant volatility. The solution to the model is that forward prices are given by

$$F_t(T_i) = \exp(A(T_i) + \log S_t + B_2(T_i) \cdot \delta_t)$$

where $A(T_i)$ and $B_2(T_i)$ are functions of time to maturity. These functions are derived in the paper.

The model is estimated using the Kalman filter, which is a linear updating mechanism, that allows for both unobservable state variables and observation errors. When the innovations are not normally distributed, using the correct mean and variance results in quasi-maximum likelihood estimation. The model is estimated on daily spot and forward copper prices from the London Metal Exchange with four different maturities (spot, 3month, 15 month, and 27 month contracts). The sample period is 7/1/89 through 12/31/99. From the estimated parameters, δ_1 appears to be significantly different from zero, so the model is a statistically relevant extension. Furthermore, all parameters are positive, as economic sense would suggest. As is typical in empirical studies of commodity prices, the spot price is found to be the least reliable price in the sense that it has the largest observation error. Among the remaining contracts, the maximum likelihood algorithm fits the first and last of these closely and the intermediate contract reasonably well. An out-of-sample comparison of this model with the constant volatility Schwartz model results in relatively small improvements on two contracts.

The conclusion of the presentation is that the impact of convenience yield on volatility is large and statistically very significant. Accounting for this results in a modest decrease of estimation errors.

The Profitability of Pairs Trading Strategies

Manolis Liodakis* and Matthew Dowle
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Manolis Liodakis presented a paper on the profitability of pairs trading strategies that is joint work with Matthew Dowle. Pairs trading is a simple statistical arbitrage strategy and a typical market neutral strategy. The basic idea is to identify two securities that are moving together and when they diverge from their long term relationship and equilibrium price an opportunity for an arbitrage arises. By buying the undervalued security and selling the overvalued security a bet is made on the mean reversion in the ratio of the security prices. Two stages are distinguished in forming such a trading strategy. The first stage is the identification of pairs, the second stage is determining a trading rule.

Because the 200 largest stocks in the MSCI Europe make up 19900 potential pairs, identifying the pairs is a challenge. To do so, only stocks from the same sector are allowed to form a pair. The second step is to test for mean reversion in the relative prices. The test is whether the natural logarithm of the ratio of the two security prices over the last two years of daily data is following a stationary process. The third step in the selection rule is a test for market neutrality. The rule here is that the difference in beta between the paired securities is less than 20 basis points. Each month on average about 50 pairs of stocks from the same sector, with similar betas and whose relative price exhibits a mean reverting pattern are identified. The next step is to determine when to open or close a trade. The trading rule that has been chosen is based on a simple standard deviation metric. A position is opened when the price ratio hits the 6-months rolling 2 standard deviation band and closed when it hits the mean. For risk control reasons some restrictions are applied. The price ratio has to hit the 2 standard deviation band two consecutive times before a position is opened. The position is also closed at a 20% stop-loss or a 65 days maximum holding period.

Back-testing the strategy is a non-trivial exercise. A different number of pairs passes the selection criteria every month, some of them will not provide a trading opportunity, other will provide several opportunities with different durations. The strategy has been back tested as of 1997. When there is no trade, 0% return is assumed. Round trip transaction costs are assumed to be 50 basis points. Assuming these transaction costs, the pairs trading strategy realised a monthly mean return of 0.98%, with a 2.24% standard deviation. The annualised information ratio for the strategy is 1.48. The performance of the strategy is consistent, negative returns are hardly ever realised. The strategy has a very low correlation with the market. The results of the

strategy by sector indicate that the sectors financials and materials provide the majority of the pair trades. The average holding period per trade is around 35 days. The results of the strategy by country indicate that the majority of the trades are between different countries and that there is some concentration of trades within the UK.

The second part of the paper investigates how the pairs trading strategy can be implemented in an enhanced index fund with low tracking error. The strategy involves a core portfolio closely tracking MSCI Europe and a small part of the fund actively managed using pairs trading. Using 50 basis points bet size and constrained weights the enhanced index strategy is found to outperform the benchmark by 1.2 percent per annum with 70 basis points tracking error. The performance of the strategy is independent from changes in any macroeconomic or market factors and stays economically significant after adjusting for conservative estimates of transaction costs. To find a portfolio construction rule different bet sizes have been tried and the impact of this on the tracking error and the active returns of the portfolio has been measured. Where the benchmark weight of the stock that is to be underweighted was lower than the size of the bet, the bet size is restricted according to the number of shares available in the benchmark on the date of the trade. In order to avoid data snooping issues, the impact of relaxing the assumptions on active return and tracking error has been analysed. Robustness checks with respect to changing the maximum holding period, changing the stop-loss, conducting the trade at the close rather than the open of the following day and changing the open rules have been performed.

Mr. Liodakis concluded that a pairs trading strategy, a very commonly used strategy among hedge funds, can be used by enhanced index managers as well. In both approaches the strategy achieves consistent outperformance with low tracking error.