EDHEC RISK AND ASSET MANAGEMENT RESEARCH CENTRE
400 promenade des Anglais - 06200 Nice - Email : research@edhec-risk.com – Web : www.edhec-risk.com

Hedge Fund Indices for the Purpose of UCITS: Answers to the CESR Issues Paper

EDHEC Risk and Asset Management Research Centre

November 29th, 2006

Summary

This document contains our participation in the consultation process initiated by the CESR on the eligibility of hedge fund indices for the purpose of UCITS (CESR/06-530). In order to be eligible, hedge fund indices have to be classified as "financial indices" according to the CESR's definition. The remainder of this document addresses the detailed questions put forward by the CESR (CESR/06-530) and gives EDHEC's views on these issues.

In our replies to the detailed questions from the CESR, we argue that hedge fund indices should not be required to offer more controls and more transparency than existing financial indices such as stock market indices. Likewise, their construction should not be subjected to detailed rules for choosing constituents and implementing rebalancing and weighting mechanisms. In fact, there is no reason to discriminate against hedge fund index providers in this sense.

Rejecting hedge fund indices seems to be inconsistent with the treatment of indices for other asset classes which face the same types of problems as hedge fund indices. A more promising approach would be to accept hedge fund indices in principle and to require a number of quality criteria, including:

- Transparency of the method
- A methodology that guarantees a high degree of representativity as well as precise classification of components (such as factor analysis)
- Minimum liquidity of the indices
- Investability of index components
- Prohibition of practices such as backfilling
- Information on risk factor exposure

This alternative seems to be more convincing than to either reject hedge fund indices on the basis of their shortcomings or to make all hedge fund indices eligible without considering the specific quality of each index. Wide use of high quality hedge fund indices for investment and risk analysis would mark an important step towards proper information for investors on the level of risk in hedge fund products.

As a complement to our answers to the questions raised by the CESR, please note our reply to the CESR published earlier (Amenc and Goltz, 2006) and available at http://www.edhec-risk.com/latest_news/Alternative%20Investments/RISKArticle.2006-09-21.4924/attachments/cesr%20amenc%20goltz.pdf

Questions and Answers

Q1: What are your views on the potential biases described in this section and on how they can affect HFIs? Please explain your comments.

The biases of hedge fund databases (self-reporting, selection, survivorship and backfill bias) are a well known problem in hedge fund research. We fully agree with the CESR's view that these biases are important when using information on hedge fund returns and assessing hedge fund performance. However, we believe that raising the issue of database biases stems from confusion over the distinction between investable and non-investable indices. Surely, the problem of database biases is important when considering the information from non-investable hedge fund indices. These indices are based on large databases of hedge fund returns and the reported performance of such an index is indeed subject to the biases mentioned above. However, such indices do not give rise to actual investment products tracking them, as it is not feasible to actually invest in the large number of funds that the index contains (due to operational limits of the index provider as well as due to the fact that the funds may be closed for new investment). Such indices are used instead to represent the broad hedge fund universe or in order to benchmark hedge fund performance. Therefore, the only indices that could potentially be used in the context of UCITS are investable hedge fund indices. Such investable hedge fund indices typically rely on a small number of funds in order to allow for investability. The actual track record of such investable indices corresponds to the true returns that have been generated for investors by holding the index, and in that sense, are free of any biases. For example, a fund will be accounted for upon entering the index, with no possibility of "backfilling". Likewise, there is no possibility to exclude a defunct fund that has been included in the index. It is important to note that biases in the sense of "measurement error" do not occur for truly investable hedge fund indices, as far as the true track record is concerned.

However, some of the biases mentioned do not refer to an actual "measurement error", but rather to the fact that an index may not give a "good" representation of the entire universe of hedge funds. This is the case for the "classification bias" and for the "sample bias", mentioned by the CESR. The fact that investable hedge fund indices use only a limited number of funds that have been selected from the entire universe potentially leads to a representativity problem. Likewise, the difficulty of style classification potentially leads to a problem of "style purity" of these indices. As a consequence, the different indices available on the market give a very different view of hedge fund performance.

The concern over existing hedge fund indices not being representative of the universe should however be put into perspective. In fact, a lack of representativity is not necessarily specific to hedge funds. In order to show this, we compared the heterogeneity of hedge fund style indices to that of equity style indices (see Amenc and Goltz, 2006). The table below reproduces the results.

Heterogeneity of Equity Style and Hedge Fund Strategy Indices.

	Equity Style Indices		Hedge Fund Strategy Indices				
	Growth	Value	Convertible Arbitrage	CTA	Event Driven	Equity Market Neutral	Long/Short Equity
Max. Return Difference	2.9%	7.8%	2.0%	7.2%	2.7%	2.2%	2.9%
Index 1 (Return)	4.7%	-3.3%	-1.7%	7.6%	4.0%	2.6%	0.5%
Index 2 (Return)	1.8%	-11.1%	-3.7%	0.4%	1.3%	0.4%	3.4%
Index 1 (Provider)	Stoxx	FTSE	MSCI	FTSE	HFRX	MSCI	FTSE
Index 2 (Provider)	MSCI	S&P	Dow Jones	CSFB/Tremont	FTSE	Dow Jones	CSFB/Tremont
Month of occurrence	Nov. 2002	Feb. 2001	April 2005	Oct. 2003	Nov. 2004	Jan. 2006	Sept. 2004

The data used are monthly returns data for the period 01/1999 to 12/2005 for the growth and value indices. For the hedge fund strategy indices, we use monthly returns from 07/2003 to 04/2006 for all strategies except CTA and Long/Short. For Long/Short, we use data from 01/2003 to 04/2006. For CTA, we use data from 07/2003 to 02/2006. These differences are due to data availability. For example, the monthly data for the S&P CTA index is last available for 02/2006.

The table reveals that equity style indices appear to be as heterogeneous as hedge fund strategy indices. The degree of heterogeneity is important in magnitude. For example, looking at the February 2001 returns for value stocks, an investor using the S&P index would have observed a return of -11.1% while an investor using the FTSE index, would have observed a return of -3.3%, a difference of 7.8 percentage points in terms of the monthly return.

The case of real estate indices is another case of indices that are not free of representativity problems. Indices tracking the performance of listed property should not be regarded as representative of institutional investments in real estate which is predominantly executed on the private market. Inclusion criteria for listed property indices focus on free float market capitalisation and liquidity of real estate securities and no attempt is made to select and weight components to build an index that would be representative of institutional investment practices in terms of investment styles or sectors. Likewise, international indices of listed property companies are constructed without regard for the economic weight of regions; as a result countries with developed listed real estate sectors or large property companies are overweighted and vice-versa. Indices built on appraisal values contributed by institutional investors sample from a significantly larger population and need not suffer from these limitations.

From this evidence, we conclude that the problem of representativity is not limited to hedge fund indices. Rather, even equity style indices and real estate indices which seem to be well established as underlyings for derivatives show a low degree of representativity.

What is more, in the case of broad market indices, the underlying logic behind these indices is the single factor model (CAPM). Therefore, the predominance of capitalisation weighted equity indices suggests that investors subscribe to the notion that a single factor explains the risk of stocks, which is in strong contradiction to the consensus in academic finance that more general, multifactor models do a better job at capturing the risk of stocks. Essentially, so-called broad stock market indices may be able to reflect a particular market segment, namely large-cap stocks, rather than represent the entire stock market and thus, the market portfolio of the CAPM. However, such indices completely ignore the importance of style factors, such as growth and value. A more promising technique of index construction is to reproduce the systematic risk factors of the equity universe.

It is actually possible to construct such indices for the case of hedge funds. It has recently been shown that even with a very restricted number of funds, it is possible to construct truly representative hedge fund indices that reflect the risk factors in the alternative investment universe, given that the funds are appropriately selected and the indices are constructed in order to maximise the representativity dimension (see Goltz, Martellini and Vaissié, forthcoming 2007).

Q2: Are there any other material sources of bias affecting HFIs that CESR should consider?

-

Q3: Should an HFI have to meet certain additional quantitative criteria other than level 2 requirements, or should compliance with the level 2 requirement of sufficient diversification be left to the UCITS to assess? Please explain precisely the grounds underlying your comments.

The CESR puts forward two possible additional requirements for hedge fund indices as examples. These examples are

- minimum number of index constituents for an HFI
- a particular weighting scheme that should be used by the index

We argue that neither of these additional criteria appears to be necessary.

Minimum number of constituents:

Since any index has to fulfil sufficient diversification in the sense that "the index is composed in such a way that price movements or trading activities regarding one component do not unduly influence the performance" (see CESR /06-530, p. 9), an additional requirement in terms of a minimum number of components seems to be redundant. It should also be noted that increasing the number of funds does not necessarily lead to better diversification or better representativity, depriving such a criterion of its sense.

In addition, Learned and Lhabitant (2002) show that there is a risk of "diversification overkill"; In fact, the authors show that by increasing the number of hedge funds in a portfolio, the correlation with the general stock market increases. This indicates that such "over-diversification" reintroduces dependence on the stock market and thus reduces the risk-reduction benefits of mixing such portfolios with traditional asset classes. The authors argue that 5 to 10 hedge funds are sufficient in order to reap the benefits of diversification without falling into the pitfalls of "over-diversification".

Rather, the properties of the funds used have to be taken into account. The table below borrowed from Amenc and Goltz (2006) shows that hedge funds show less co-movement than the components of a broad stock market index. Hence, one can conclude that even with a low number of funds, significant diversification can be achieved.

Co-movement between index components: hedge funds vs. stocks

	CISDM Funds	Stoxx 600 Index Components
Average Correlation	0.17	0.25
Variance explained by PC1	0.24	0.29

The data used are monthly returns data for the period 01/1999 to 12/2005 for the hedge funds from the CISDM database and for components of the Stoxx 600 index for European stocks.

In addition, it has been shown that even with a small number of components, truly representative hedge fund indices may be constructed. Recent research (Goltz, Martellini and Vaissié, forthcoming 2007) examines how modern portfolio theory and factor analysis techniques can be used to build investable, yet representative, hedge fund indices. The results suggest that designing sound (i.e., both representative and investable) hedge fund indices is a feasible task given the specific features of the industry, provided that funds are suitably selected and an optimally designed portfolio is designed with the objective of replicating the common trend in hedge fund returns for a given strategy. Amenc and Goltz (2006) contains a summary of the results.

Particular Weighting Scheme

The definition of a weighting scheme is often cited as a problem for hedge fund indices. In particular, capitalisation weighting, which is the standard in equity index construction, is difficult to implement in the hedge fund universe which is characterised by scarcity of information on assets under management. However, it should be noted that even in the case of equity indices, different weighting schemes exist. First, while most indices use capitalisation weighting, additional criteria are often taken into account, such as sales/revenue and net income (see the "Guide to the Dow Jones Global Titan 50 Index", January 2006). Second, capitalisation weighting has been subject to severe criticism (see e.g. Haugen and Baker 1991, Amenc, Goltz, and Le Sourd 2006, or Hsu 2006), pointing out that the mechanics of capitalisation weighting lead to trend-following strategies that provide an inefficient risk-return trade-off. As an answer to such critiques, equity indices with different weighting schemes have emerged, such as "fundamental"-weighted (Arnott, Hsu and Moore 2005), "diversity"-weighted (Fernholz, Garvy, and Hannon 1998) or equal-weighted indices. This freedom of innovating in terms of index construction has led to new solutions in the area of equity indices, and there seems to be no good reason to constrain hedge fund indices to a particular weighting scheme.

It should also be noted that sufficient diversification is an issue with other indices such as real estate indices. While commercial property indices computed from the appraisal values of thousands of real estate assets and hedonic indexes constructed from large numbers of transactions in the housing market appear to be sufficiently diversified, the same cannot be said of indices based on the share price of companies investing in property. In spite of the rapid growth of the listed real estate market, it currently represents but a fraction of the overall investable property universe. At the country level, it is nonsensical to compute an index of listed property companies in most of Europe given the scarcity of eligible components. In large European countries with developed listed property sectors and at the European level, concentration in industry still results in the possibility of a component unduly influencing the performance of the index.

Q4: What requirements on weighting should HFIs have to fulfil to qualify as financial indices? Please explain precisely the grounds underlying your comments.

Rather than imposing a certain weighting scheme, indices should be required to be representative of the hedge fund strategy which they reflect. In fact, the main distinction between active investment vehicles (such as funds of hedge funds) and indices is the representativity of the latter. It seems to be the case that especially some providers of so-called investable hedge fund "indices" conduct fund selection based on past performance, leading to poor representativity.

Q5: Is the definition of the representative group of underlyings made by the index provider sufficient to satisfy the criterion of "adequate benchmark"? Please provide comments.

First, since the CESR raises the question of hedge fund indices being "adequate benchmarks", a general distinction should be made between benchmarks and indices.

A benchmark is defined as a reference portfolio and, consequently, it is supposed to be representative of the risks of the managed portfolio. It is widely accepted that the choice of the benchmark plays an important role in explaining portfolio performance. Construction of a benchmark allows objectives to be fixed in terms of the systematic risk exposure of the portfolio, which is reflected in its strategic asset allocation. The benchmark also serves to evaluate portfolio performance.

An index is a portfolio that is representative of one or more risk factors. For example, a geographic index has the objective to be representative of the risk of the stock market of the country considered, while a style index and a sector index are respectively representative of the risks of the investment style or industry sector considered. We speak of indexed management when the index is the benchmark of the portfolio. However, it is important to underline that the two terms indices and benchmarks, often inappropriately used as synonymous, do not mean the same thing. While an index is representative of the market as a whole or a certain segment of the market, a benchmark has to be representative of the risks chosen by an investor over the long term. Instead of simply choosing an index as a benchmark, a portfolio manager can for example choose to use a combination of indices or any other portfolio. Thus, even though an index can be used as a benchmark, the benchmark is not necessarily an index.

With respect to hedge fund indices, we can state that a hedge fund index should be representative of the hedge fund strategy it covers. This means that the index should fully reflect the risk and return characteristics of the given hedge fund strategy. This requirement seems to correspond to the requirement stated by the CESR (CESR/06-530, p.9), that "the index measures the performance of a representative group of underlyings."

Q6: Is there a role for any quantitative assessment of the 'breadth' of coverage of the HFI? If so, how would this work?

There are a few measures that may be used in order to measure the breadth of a portfolio. First, breadth can be seen as the opposite of concentration, which is often measured by the Herfindahl index. Another way of assessing breadth would be to define breadth as the tracking quality with respect to a representative portfolio. In this sense, correlation analysis with representative

portfolios (that are not necessarily investable) may be used. In what follows, we present these two methods in more detail.

A measure that is commonly used to address the concern over the possibility of highly concentrated portfolios, is the Herfindahl Index. The Herfindahl Index (HI) is a measure of concentration. It is given by the sum of the squares of the weights of all funds included in the FRP. Formally, let w_j denote the portfolio weight of the j-th fund. We then have for a portfolio of n funds:

$$\text{HI} = \sum_{j=1}^{n} w_j^2$$

The functional form of the Herfindahl Index penalises large individual weights. For example, a portfolio where 2 funds have a 25% allocation each and the rest is equal weighted will have a lower HI (HI=0.16) than a portfolio where one fund has 40%, one has 10%, and the rest is equal weighted (HI=0.20). Generally speaking, the index takes on values between $1/n$ and 1. High values indicate high concentration, with a value of one indicating the extreme case of one single fund in the portfolio with the rest of the weights being set to zero.

Principal Component Analysis (PCA) may be used in the following way in order to assess the breadth of a hedge fund index. Starting with a large database of hedge fund returns, one may extract the combination of individual funds that capture the largest possible fraction of the information contained in the data. Technically speaking, this amounts to using the first component of a PCA of fund returns as a candidate for a pure style index. One may use the method to describe each variable as a linear function of a reduced number of factors. To that end, one needs to select a number of factors, such that those factors capture a large fraction of asset return variance, while the remaining part can be regarded as statistical noise. By choosing just one factor, this method can be used to generate "the best one-dimensional" summary of a set of individual funds. Once the common factor has been extracted, the correlation coefficient of the hedge fund index with that common factor can be calculated and can be used in order to assess the tracking quality of the hedge fund index with respect to the broad non-investable portfolio.

Q7: Should backfilling be banned for HFIs to qualify as financial indices? If not, why not? Please explain precisely the grounds underlying your comments.

Backfilling should not be allowed as it distorts performance. However, backfilling is not much of an issue as it does not occur with investable hedge fund indices as outlined above, at least not for the true track record beginning from the launch date. The issue of backfilling applies to non-investable hedge fund indices, which, by definition, would not be destined to become underlyings for derivatives.

Q8: Should CESR set criteria for the treatment of defunct funds by HFIs for them to qualify as financial indices? If so, what should they be? Please explain precisely the grounds underlying your comments.

Defunct funds are necessarily excluded from investable hedge fund indices as of the occurrence of the event that causes the fund to be defunct. Exluding defunct funds from the track record obviously distorts performance but this is not much of an issue as it does not occur with investable hedge fund indices.

It should be noted that misrepresentation of funds in the hedge fund databases (funds that are defunct or omitted for other reasons or included through backfilling by the database provider) leads to representativity problems with the databases and with non-investable indices based on those databases. Investable indices on the other hand, are largely free of such biases, since they have a more modest proposal, namely representing the investable (and observable) part of the hedge fund universe rather than the (unobserved) entire hedge fund universe.

In addition, emphasis should be put on the fact that the omission of assets is a generic problem with any index: one may as well blame stock market indices for the fact that they do not include stocks that have been delisted or stocks that are to be listed in the future!

Q9: Is disclosure of the index revision methodology sufficient or should controls be placed on the frequency, method or amount of due diligence the index provider must carry out regarding ongoing constituent classification? If so, what should they be? Please explain precisely the grounds underlying your comments.

The construction methodologies (weighting information, rules of return calculation, etc), as well as the selection criteria (i.e. rules of inclusion of assets), should be made available to the public. Sufficient and timely information about the index can help the index users understand the index better and use it appropriately. The transparency of index can also increase the reliability of the data and reduce the investors' risk in their choice of management style.

In addition to this basic transparency requirement, hedge fund indices should not be put at a disadvantage with respect to stock market indices. The latter are not constrained to respect certain frequencies, methods of rebalancing or amount of due diligence on index constituents, as long as they respect the defined construction methodology.

Furthermore, a judgement on the best frequency or the best method for rebalancing is impossible without taking into account the specific characteristics of each index, as well as parameters such as transaction costs. Therefore, we do not see how investors would benefit from additional requirements for controls on selection of constituents of hedge fund indices.

Q10: Can the UCITS assess the revision methodology of the HFI adequately or should an independent third party be required to review the HFI's methodology? If the latter, how would this work? Please explain precisely the grounds underlying your comments.

Again, the comparison with equity indices may be helpful. Transparency with respect to the index construction methodology is a prerequisite for any good index (see Bailey, J.V., 1992, "Evaluating Benchmark Quality", *Financial Analysts Journal* 48, 33-39). However, equity index providers are not required to subject their index construction methodologies to a third party review. We do not see any elements that would allow for discrimination against hedge fund index providers in the sense that they should be treated with more controls than equity index providers.

Q11: Is passive versus active selection of constituents the key difference between an HFI and a fund of hedge funds respectively? What could be the other differences? Please explain precisely the grounds underlying your comments.

The selection of constituents of a hedge fund index is not necessarily "passive" in the sense that components are chosen randomly. Components of an index should be chosen so as to maximise the representativity of the hedge fund index. This is the main difference with funds of funds, who try to create outperformance of a representative index through fund selection.

When investing in a fund of hedge funds, the investor necessarily reduces his coverage of the hedge fund universe to a very limited proportion of the population. Typically, this is something that is done deliberately, as investors or fund of funds managers hope to select the good funds and avoid the bad. This selection decision, however, should be separated from the asset allocation decision, since the aim is no longer to optimise the risk return trade-off but to create outperformance, i.e. create alpha benefits.

In addition, it should be underlined that selection of funds leads to a major risk for the investor. Large dispersion in the returns of funds in a given hedge fund strategy can be observed historically. Therefore, choosing only a few funds may leave the investor with returns that no longer resemble the aggregate return of managers following that strategy. An investment in hedge fund indices, on the other hand, protects the investor from this selection risk. Just like indices for stocks or bonds, these indices deliver the "normal" returns of the asset class or investment style.

In addition to a selection bias, a fund of hedge fund leaves the investor with an exposure to different hedge fund strategies that results from the fund manager's choice rather than the investor's choice. While the resulting allocation may not be optimal for a given investor, it also varies over time according to the rebalancing done by the fund of funds. Therefore, in order to be in control of his allocation, the investor would prefer to use hedge fund indices.

However, it should be stressed that hedge fund indices often have opaque selection criteria and some providers have used the suspicious practice of creating in-sample track records which show appealing performance based on fund selection with hindsight. Therefore, some indices even conduct "active selection". However, this should disqualify such indices as "funds of funds" rather than disqualifying the benefits of hedge fund indices in general. The regulator should require that an index provider's selection method is systematic and based on achieving representativity rather than maximum performance.

It should be noted that certain equity indices have also adopted selection criteria that resemble active investment strategies (such as dividend strategy indices) and thus constitute systematic stock picking strategies rather than indices. Also, listed property indices include minimum liquidity constraints in their component screening process which ensure that direct replication is feasible, but which leads to selection biases.

While we stress that any selection of components that is not purely in the interest of achieving representativity should not have its place in the construction methodology of an index, one has to

recognise that "active selection" is present in a wide range of indices today, but does not usually lead to a questioning of the status of such indices.

Q12: Should only HFIs where constituent selection depends solely on publicly available objective rules qualify as financial indices? If not, why not? What sort of subjective judgments could be used to select underlying constituents? Please explain precisely the grounds underlying your comments.

It should be noted that stock market indices have a range of discretion on defining their constituents as long as they remain within their predefined methodology. Häberle and Ranaldo show that a considerable share of index-related investment management, which is usually considered to be passive investment management, can in fact hide a form of active management. The most well known indices are actually made up of a more restricted number of assets, which are selected using defined rules and are managed in a dynamic way. Likewise, criteria that require interpretation lead to discretionary decisions of index inclusion. S&P for example assess the "financial viability", "adequate liquidity" and "reasonable price" of constituent companies (see the "S&P U.S. Indices Methodology", March 2006). A large number of indices that are provided directly by stock exchanges that are supposed to fully reflect the respective stock market do not always contain all stocks, since inclusion in the index is a commercial argument of the stock exchange vis-à-vis the issuers. Any index that involves discretionary decisions by an index committee is susceptible to inherent selection biases and this problem is not at all specific to hedge funds. There is no obvious reason for constraints for hedge fund index providers in excess of what is required for equity indices.

Q13: Are there any competition aspects CESR should consider in the context of hedge fund indices compared to funds of hedge funds? Please explain precisely the grounds underlying your comments.

See the answer to question 22.

Q14: Do respondents agree that the ability to verify the value of the index given price data and the HFI methodology satisfies the replicability criterion? If not, why not?

An index does not necessarily become replicable once price data and the construction methodology are available. Even for stock market indices, full transparency is not always granted. For example, the full composition of MSCI Equity indices is not available free of charge to investors, which renders replication impossible, given that the components and the component weights are not known. However, it should be noted that the index does not necessarily have to be replicable by any market participant. Taking again the example of MSCI indices, they may be replicated by market participants who do have access to the full composition (by paying the index provider for this information) but are not replicable by other market participants. As the example of MSCI equity indices shows, the full transparency of indices is not a question that is specific to hedge funds.

This problem exists generally in the case of indices that are constructed from proprietary databases. By construction of the business model of such index and database providers, it is forbidden for market participants (even those who pay for access to the database) who have not

entered into additional license agreements with the database provider, to create or to replicate such indices. This is for example the case for investable real estate indices for which the CESR has left the possibility to be recognised as financial indices. Also, some of the listed property index providers do not freely disclose components and component weights to the public.

Q15: Should CESR set requirements for verification of NAV calculation and independent custody arrangements/robust governance structures for the underlying constituents of HFIs to qualify as financial indices; or as an alternative, should the UCITS be required to assess the due diligence procedures of the index provider in respect of the underlyings in this regard? Please explain precisely the grounds underlying your comments.

Operational risk is a major source of risk for investors in portfolios of hedge funds. A possible way of mitigating this risk is through the use of managed account platforms. Essentially, in a managed account, investors with significant assets to manage ask hedge fund managers to replicate their trading strategy outside of the fund's books but instead in an account that remains in the name of the investor. This concept of "managed accounts" has been derived in numerous forms that offer different features:

- Standard custodial arrangements: assets are held in the name of the fund in a dedicated account operated by the manager of the hedge fund;
- Prime brokerage custody: assets are held in the name of the fund in a dedicated account operated by the manager, the bank can act as an independent provider of controls on behalf of the board of directors;
- Basic managed accounts: assets are held in the name of the investor within the books of a custodian bank and the manager receives the right as part of his management mandate to operate the account. The bank has no duty of control on the assets held, nor on the investment decisions, but reporting independent from the manager can be issued by the bank directly to the investor;
- Managed account platforms: assets are held in the name of the investors in a segregated account and the bank operates back office and risk control functions on behalf of the board of directors of the hedge fund. It is important for investors to identify the contractual arrangements the fund has taken with its custodial bank in order to assess the level of protection and independence it will benefit from with the "managed accounts".

However, it may not be necessary to impose a certain way of mitigating operational risk on UCITS or on index providers, given that operational risk measurement and management techniques are still evolving.

Q16: Should a minimum monthly publication frequency be a requirement for HFIs to qualify as financial indices? If not, why not, and what frequency would be suitable?

To the best of our knowledge, none of the existing hedge fund indices, either investable or non-investable, publishes less frequently than monthly. Any frequency that is lower than monthly would be unacceptable for meaningful analysis of the data. We think that increasing the data frequency to weekly frequency is an absolute necessity. Given that hedge fund risk characteristics cannot be captured by the mean and variance but higher moments have to be taken into account, weekly data is needed in order to increase the accuracy of the estimates. In addition, weekly data

frequency and weekly liquidity are necessary for dynamically managing the betas of hedge fund strategies for the purpose of asset allocation. As beta management is the principal use of hedge fund indices (see the reply to question 11), these indices should provide weekly data frequency and liquidity.

Q17: Should CESR require an independent audit of the calculation of HFIs to qualify as financial indices, or should the market be left to decide whether this would be an attractive option for an index provider to put in place? Please explain precisely the grounds underlying your comments.

To our knowledge, such an independent audit is not required for other financial indices, such as stock market or bond indices. We do not see any reason why hedge fund index providers should have to comply with additional control mechanisms.

Q18: Should it be a requirement for an HFI to qualify as a financial index that its full rules are publicly available (rather than just material rules)? If not, why not?

Again stating the arguments from above, full transparency of hedge fund indices should not be a requirement when this is not the case for other financial indices such as stock market indices. It is important to note that for investors, the usefulness of full position transparency may be limited. Analysis of the risk and returns of a given hedge fund index becomes possible as soon as return data is available. For example, risk analysts now widely use techniques such as returns-based style analysis and regression on risk factor exposures when measuring and comparing the performance of different investments. The results of such analysis on the index level may be more useful than detailed qualitative analysis of components.

Lhabitant (2003), for example, shows that such returns-based risk analysis can be applied to hedge fund portfolios, and provides a strong tool to understand the style behaviour portfolios of hedge funds, thus facilitating tasks such as classification, monitoring, and risk measurement.

Q19: To qualify as financial indices, should HFIs be required to disclose at all times details of their constituents (e.g. list of underlyings, their classification, and the weight applying to them, if appropriate)? Is there other information about the HFI that should be disclosed? Would this be done via the index provider's website? Please explain precisely the grounds underlying your comments.

It should be noted that one of the largest providers of equity indices, MSCI, does not provide information on the full composition of its equity indices. This information is sold at a high price which is out of reach of retail investors and even many institutional investors, which means that the information is effectively unavailable (see the answer to question 14 above). Also see the answer to question 18 above.

Q20: Should a UCITS which intends to invest in derivatives based on HFIs have to disclose this fact in its prospectus or other documents? What degree of information should a UCITS which intends to invest in derivatives based on HFIs have to disclose in its prospectus? Please explain precisely the grounds underlying your comments.

-

Q21: Do you have any other comments relating to hedge fund indices that CESR should consider? What are they?

Stemming from a lack of official recognition, hedge fund indices currently do not have the status of a major reference for most hedge fund or fund of hedge fund managers. Instead, most of these managers use the risk-free rate, as represented by the rate of return of short-term treasury bills or money market instruments, as a reference. This practice constitutes the worst of all choices, given that it assumes that hedge funds are completely free of systematic risk exposures. Such a practice leads therefore to performance measures that lack any pertinence and lead investors into the error of omitting to balance returns for the associated risk exposure. Establishing hedge fund indices as truly recognised references therefore appears to be an important step towards proper information for investors on the level of risk in hedge fund products.

Therefore, we propose to adopt an approach that accepts hedge fund indices in principle and requires hedge fund indices to fulfil a range of quality criteria, including

- Transparency of the method
- A methodology that guarantees a high degree of representativity as well as precise classification of components (such as factor analysis)
- Minimum liquidity of the indices
- Investability of index components
- Prohibition of practices such as backfilling
- Information on risk factor exposure

Q22: From the regulatory and retail investors' point of views, how do you assess the situation of competition between funds investing in derivatives based on HFIs and funds of hedge funds? Please explain precisely the grounds underlying your comments.

Since hedge fund strategies are exposed to a range of risk factors, they may provide the investor with two types of reward, just like any risky investment strategy. These rewards are the return that constitutes a fair reward for the risk taken (beta benefits) and the return that is due to the manager's skill in generating returns in excess of the reward for risk (alpha benefits).

Since hedge funds are not subject to tracking error constraints, as is the case in the mutual fund industry, and since they enjoy freedom in choosing the assets and markets they invest in, the managers' potential for generating alpha can be fully exploited.

In terms of beta, hedge funds offer risk exposure that differs from those an investor can achieve by holding stocks and bonds, and thus have low correlation with these assets. Therefore, adding hedge funds to a portfolio composed of such traditional assets allows for diversification benefits. It is worth noting that the low correlation of hedge fund returns with stock and bond returns has a tendency to remain stable over different stages of the market. This is notably different to international diversification, where benefits tend to disappear in unfavourable market conditions. In this respect, hedge funds constitute an answer to the poor conditional correlations of stock market investments in different countries. Adding hedge funds to a portfolio of stocks and bonds not only allows volatility to be reduced (because of low correlation) but also allows the

asymmetry to be improved and the extreme risks to be reduced (because of favourable co-kurtosis and co-skewness).

Indices seem to be the natural investment vehicle for beta management. In equity investing, decisions such as transition management or management of cash inflows are usually dealt with by using index products. Likewise market timing and tactical asset allocation strategies are typically implemented with index futures or tracking funds.

Funds of hedge funds, on the other hand, aim to provide alpha by selecting the best funds (fund picking) or by implementing tactical bets on certain hedge fund styles (tactical allocation). This difference between the value proposition of hedge fund indices (beta benefits) and funds of hedge funds (alpha benefits) allows for the potential of both of these investment vehicles to co-exist.

References

Amenc, N., and F. Goltz, 2006, "A Reply to the CESR Recommendations on the Eligibility of Hedge Fund Indices for Investments of UCITS", EDHEC Position Paper

Amenc, N., F. Goltz, and V. Le Sourd, 2006, "Assessing the Quality of Stock Market Indices", EDHEC Publication

Arnott, R.D., J. Hsu, and P. Moore, 2005, "Fundamental Indexation", *Financial Analysts Journal* 60(2), 83-99.

Fernholz, R., R. Garvy, and J. Hannon, 1998, "Diversity-Weighted Indexing", *Journal of Portfolio Management*, 24(2), 74-82

Goltz, F., L. Martellini, and M. Vaissié, forthcoming 2007, "Hedge Fund Indices: Reconciling Investability and Representativity", *European Financial Managemen*t, scheduled for publication March 2007

Haugen, R.A., and N.L. Baker, 1991, "The Efficient Market Inefficiency of Capitalization-Weighted Stock Portfolios", *Journal of Portfolio Management*

Hsu, Jason, 2006, "Cap-Weighted Portfolios are Sub-optimal Portfolios", *Journal of Investment Management*, 4(3), 1-10

Lhabitant, F.S, and M. Learned, 2002, "Hedge Fund Diversification: How Much is Enough?". FAME Research Working Paper No. 52

Lhabitant, F.S., 2003, "Evaluating Hedge Fund Investments: The Role of Pure Style Indices", Working Paper, EDHEC Risk and Asset Management Research Centre

EDHEC RISK AND ASSET
MANAGEMENT RESEARCH CENTRE

393-400 promenade des Anglais
06202 Nice Cedex 3
Tel.: +33 (0)4 93 18 78 24
Fax: +33 (0)4 93 18 78 41
E-mail: research@edhec-risk.com
Web: www.edhec-risk.com

A Reply to the CESR Recommendations on the Eligibility of Hedge Fund Indices for Investments of UCITS

Noël Amenc
Professor of Finance and Director of
the EDHEC Risk and Asset Management Research Centre

Felix Goltz
Senior Research Engineer at
the EDHEC Risk and Asset Management Research Centre

EDHEC
BUSINESS SCHOOL
Lille - Nice

Abstract

In this paper, the authors examine the question of the eligibility of hedge fund indices as financial instruments for use by European investment funds. Following recent advice given to the European Commission by the Committee of European Securities Regulators (CESR), it was decided to suspend such eligibility for a period of twelve months. The authors review this decision and comment on the problems identified by the CESR in relation to hedge fund indices. They go on to provide an analysis of these indices in consideration of three of the general criteria proposed by the CESR for financial indices: representativeness, transparency and diversification. The problems surrounding each criterion are addressed and it is shown that the reservations of the CESR in relation to hedge fund indices are not always well-founded. The problem of representativeness, for example, is a problem that is also observed in the case of equity style indices. With regard to diversification, the authors suggest that confusion between the terms 'benchmark' and 'index' leads to misguided criticism of a hedge fund index's inadequacy to fulfil this requirement. Finally, possible solutions — such as managed account platforms for higher transparency — are proposed to address the problems related to the three criteria.

Noël Amenc is Professor of Finance and Director of Research and Development at the EDHEC Graduate School of Business, where he heads the Risk and Asset Management Research Centre. He has conducted active research in the fields of quantitative equity management, portfolio performance analysis and active asset allocation, resulting in numerous academic and practitioner articles and books. He is an Associate Editor of the *Journal of Alternative Investments* and a member of the scientific advisory council of the AMF (French financial regulatory authority).

Felix Goltz is a senior research engineer with the EDHEC Risk and Asset Management Research Centre and a PhD student in finance at the University of Nice Sophia-Antipolis. His research focus is on the use of derivatives in portfolio management and the econometrics of realised and implied volatility. He has studied economics and business administration at the University of Bayreuth, the University of Nice Sophia-Antipolis and EDHEC.

EDHEC is one of the top five business schools in France owing to the high quality of its academic staff (100 permanent lecturers from France and abroad) and its privileged relationship with professionals that the school has been developing since its establishment in 1906. EDHEC Business School has decided to draw on its extensive knowledge of the professional environment and has therefore concentrated its research on themes that satisfy the needs of professionals.

EDHEC pursues an active research policy in the field of finance. Its "**Risk and Asset Management Research Centre**" carries out numerous research programs in the areas of asset allocation and risk management in both the traditional and alternative investment universes.

1. Introduction

Hedge fund indices have seen widespread growth over the past years, reflecting both the general growth of the hedge fund industry and the strengthening position of indices in relation to other investment vehicles, such as funds of funds. The interest in indices is mainly driven by institutional investors, who have a strong preference for low fee, transparent and risk-controlled investments. Derivatives such as exchange-traded certificates based on hedge fund indices have also been launched. In principle, European investment funds could use such instruments in their investment portfolio. For this to be the case, however, these instruments must be made eligible by the regulator. Recent advice given by the Committee of European Securities Regulators (CESR)[1] to the European Commission tries to clarify the definition of eligible assets, and also offers advice on hedge fund indices, the eligibility of which has now been suspended for a period of 12 months. This document reviews this decision and comments on the problems with hedge fund indices as outlined by the CESR, as well as reviewing hedge fund indices along three criteria named by the CESR for financial indices, namely representativeness, transparency and diversification.

In the Directive 2001/108/EC, the definition of the financial instruments eligible for investment by European investment funds under the UCITS (Undertakings for Collective Investments in Transferable Securities) regulation was widened. The aim of the amendment was to allow UCITS to employ modern investment strategies for the purposes of performance enhancement and risk management. Concerning the clarification of definitions of eligible assets, the Committee of European Securities Regulators (CESR) prepared a consultation paper in March 2005 and asked for comments from the industry on their draft advisory document. Because of the complexity of modern financial instruments and various concerns from different market participants, the responses given raised further considerations. The CESR then issued a second consultation paper in October 2005 which tried to clarify the definition of 'Transferable Securities' (within the scope of relevant techniques and instruments), 'Money Market Instruments', 'Embedded Derivatives', 'Other Collective Investment Undertakings', 'Financial Derivative Instruments' and 'Index Replicating UCITS', with the advice on the eligibility of derivative instruments on financial indices provoking criticism from the industry.

In their draft technical advice to the European Commission, the CESR recommended the eligibility of investment in derivative instruments on indices that comply with certain criteria. Such indices are referred to as 'financial indices'. In consideration of the complexities of hedge fund indices, the CESR recommended the twelve-month suspension of the eligibility of hedge fund indices as financial indices.

1.1 General criteria for an eligible index

We first propose a review of the general criteria for an eligible financial index. The following (stated in the 2nd Consultation Paper, Level 2, Box 14, Para. 1) are the main requirements for an index:

- Transparency The relevant rules, which include the methodologies involved in the construction of the index (i.e., calculation methodology, weighting methodology, rebalancing methodology, etc.), and the component selection principle, should be clearly disclosed. Any further changes in these areas should be announced before being executed and any operational difficulties that will lead to inaccurate information should also be revealed. In addition, to reach the required transparency standards, an index is also required to be published promptly.

[1] *CESR's Advice to the European Commission on Clarification of Definitions concerning Eligible Assets for Investments of UCITS, THE COMMITTEE OF EUROPEAN SECURITIES REGULATORS, Ref: CESR/06-005 , January 2006*

• Diversification The index should be sufficiently diversified; in other words, the underlying portfolio of the index cannot be concentrated on a single body, so that the index will not be influenced by changes in any small components. The foundation of an index's diversification is the design of its construction methodologies, especially the weighting principle. Article 25 of the Directive establishes the weighting limits for the investment pools and should also be considered as the instructions for the indices.

• Representativeness As a benchmark of the relevant market, the index should provide its users with meaningful and useful market information. The fluctuation of the index must describe the real changes in the related market. Maintaining the representativeness of an index requires constant work, including periodical reviewing and rebalancing.

1.2 Specified concerns about hedge fund indices

In consideration of hedge fund characteristics, Para.122 of the CESR document highlights specific concerns about hedge fund indices with regard to the abovementioned general issues.

• Selection bias The result of selection bias is unpredictable. The particularity of the construction of hedge fund indices is that hedge funds can decide whether they are to be included in an index or not. Because they lack subjective selection standards, hedge funds may make the decision to their own benefit: they can decide not to be included in an index so as to avoid the exposure of their unsatisfactory performance or to hide their extremely good performance. Consequently, index providers cannot measure bias or even estimate in which direction it points.

• Survivorship bias This bias results from the inclusion in the index of surviving funds only. The funds that stop reporting to the database are often excluded from the index calculation ex-post. Since most funds probably stop reporting returns because they close down following poor performance, this typically leads to an upward bias of returns. Respective estimations of 3% and 2.75% made by Fung and Hsieh (2000) and Brown, Goetzmann and Ibbotson (1999) are the most frequently used estimations in studies on hedge fund performance. However, survivorship bias could also be negative, since funds may stop reporting to the database because they are not actively seeking new investments and prefer to avoid disclosure of information. Such funds have typically been the most successful in the past, leading to a downward bias from survivorship. Géhin and Vaissié (2004) cite estimations of survivorship bias ranging from -1.32% to 6.67%, depending on the observation period, the sample or the definition used to calculate the survivorship bias.

• Back-fill bias This bias (also called instant history bias) is the consequence of adding a hedge fund whose earlier returns are backfilled between the fund's inception date and the date on which it enters the database. Again, different databases will handle this issue differently and, as a result, the impact of this bias will depend on the index provider. The back-fill bias has also been measured in a number of academic studies. Géhin and Vaissié (2004) cite a range of 0.05% to 4.2% in different studies.

• Investability The index should be available for tracking, whereby investors can replicate the underlying portfolio with a certain level of tracking error; this depends on their ability to do so and other restrictions. A specific concern about the investability of hedge fund indices is that some hedge funds with outstanding performance tend to close off the fund to new investors, thereby making it non-investable.

- Consistency of the hedge fund sector A sector index should appropriately reflect the relevant and important information of the subgroup of hedge funds to which it refers. Owing to the complexity of the underlying assets of hedge fund and investment strategies, the consistency of the sector is also thought to be one of the specific issues affecting the eligibility of hedge fund indices.

1.3. Responses from the industry on the eligibility of hedge fund indices

The responses to the CESR's second consultation paper vary according to the perspectives of major index providers and asset management associations.

A few primary concerns are put forward. Asset management associations such as the IMA highlight that the CESR appears to be more concerned with 'non-investable hedge fund indices' than 'investable hedge fund indices'. This is apparent from the problem of biases outlined by the CESR. Biases such as survivorship bias are actually inherent in non-investable hedge fund indices but, by definition, do not apply to the true track record of an investable index. The realised return of an investable index includes —by definition — the performance of funds that close down and leave the index. The problem of survivorship bias is therefore nonexistent. Likewise, Standard & Poor's confirms that the hedge fund indices it manages have been constructed specifically to avoid the issue of biases. S&P argues that the CESR should treat hedge fund indices just as it does other assets which are eligible for UCITS investment.

In addition, S&P remarks that hedge fund indices can provide UCITS investors with the qualification of risk diversification, additional attractive return and extra performance, which up to now was only available to a limited number of investors.

Likewise, Morgan Stanley Capital International (MSCI) confirms that survivorship bias on investable indices has no impact on the calculating period, because MSCI investable hedge fund indices are live indices reflecting the performance of all constituent funds at all times. Nor can historical information lead to back-fill bias, because MSCI investable indices are announced in advance and any new constituents do not affect the index performance before the publicly announced inclusion date. With regard to selection bias, MSCI uses an approach that is similar to that used in other asset classes, where incomprehensible selection criteria, such as statistical selection techniques, are not used for the inclusion of an index.

Since it is clear that the CESR's comments seem to be driven in part by misperception of investable hedge fund indices and in part by confusion over the differences between non-investable and investable hedge fund indices, this document will further discuss the general requirements for a financial index and to what extent hedge fund indices fulfil these general requirements. The remainder of this document is organised as follows: section two clarifies the issues by making the basic distinction between an index and a benchmark; sections three to five respectively cover representativeness, transparency and diversification; and section six provides a conclusion.

2. Conceptual remarks: Indices vs Benchmarks

It is useful to start with a conceptual view of the issues raised in the CESR consultation paper. In particular, a distinction should be made between the terms 'index' and 'benchmark', which is not always the case in the CESR document.

A benchmark is defined as a reference portfolio and, consequently, is supposed to represent the risks of the managed portfolio. It is widely accepted that the choice of the benchmark plays an important part in explaining portfolio performance. Construction of a benchmark allows objectives to be set in terms of the systematic risk exposure of the portfolio, which is reflected by its strategic asset allocation. The benchmark also serves to evaluate portfolio performance. A widespread practice in the industry is to look at a manager's performance in relative terms, i.e., with respect to a benchmark. Even if the portfolio management process is said to be 'benchmark-free', it is always possible to derive ex-post a benchmark that mimicks the returns and risk exposure of the portfolio.

An index is a portfolio that is representative of one or more risk factors. For example, a geographic index aims to represent the stock market risk in the country considered, while a style index or a sector index represent the respective risks of the investment style or industry sector considered. We speak of indexed management when the index is the benchmark of the portfolio. However, it is important to highlight the fact that the terms 'index' and 'benchmark', which are often inappropriately used as synonyms, do not mean the same thing. While an index is representative of the market as a whole or a certain segment of the market, a benchmark has to be representative of the risks chosen by an investor over the long term. Instead of simply choosing an index as a benchmark, a portfolio manager can for example choose to use a combination of indices or any other portfolio. Thus, even though an index can be used as a benchmark, the benchmark is not necessarily an index. And using a benchmark in the investment process does not necessarily mean that one resorts to passive or indexed management.

With respect to hedge fund indices, it can be said that a hedge fund index should be representative of the hedge fund strategy it covers. This means that the index should fully reflect the risk and return characteristics of the given hedge fund strategy. For the purposes of performance measurement, a combination of such strategy indices should be used. In fact, a customised combination of such indices will be able to reflect the risk exposure of a given fund or manager. Such a customised benchmark is a convincing alternative to a global index that arbitrarily mixes all existing strategies.

In particular, it is usually not the case that a given index is able to reflect a manager's entire risk spectrum, especially if that manager follows a range of strategies. In the example of a fund of hedge funds that includes a multitude of very different hedge fund strategies, it is obvious that the risks cannot be fully reflected by a single index. However, this is not only true for hedge fund managers, but also in the traditional long-only world. A recent study by EDHEC (Amenc and Picard (2006)) finds that the appropriate style benchmark for the top 50 French mutual funds is usually very different from the reference index cited by the fund's management. The divergence ranges from 13% to more than 70% in terms of style exposure. The average is 35%. These very high figures show that using a single reference index in performance measurement is inappropriate for most funds.

It may be useful to review the definition of a 'good index'. What criteria should a good index satisfy? Bailey (1992) provides us with some principles for the assessment of an index as a benchmark in the public securities investment industry. Based on these principles, we have reorganised the criteria slightly to identify four requirements:

• Representativeness In order to support asset allocation decision-making, indices should provide adequate market information. Consequently, a high level of coverage is the basic element for an index to provide good representation. In order to achieve the ideal representation, indices should include all components of the target market's investment universe; in other words, it is better to have a 'complete' index.

• Purity The basic function of an index is to provide a benchmark for the measurement of investments. If the index cannot truly reflect the risk and return characteristics of a given category, investors cannot use it to evaluate the performance of their investment. For asset managers, wider coverage does not mean a better index. The ideal index is one which meets their specific needs and can reflect the characteristics of the asset class in which they are interested. An ideal index should provide the asset managers with a reflection of the properties of a certain style category. Investors or managers can then create the most appropriate customised benchmark for comparison and analysis based on such an index.

• Investability Indices provide asset managers and investors with the option of investing in a certain asset classes at low cost or adopting passive strategies by replicating the market portfolio or the portfolio that can reflect the performance of a market sector. To do so, indices should fulfil the requirements both of 'available liquidity' and 'position size'. The former represents the consideration on the average volume of the transactions while the latter can be explained as the reasonable proportion of an individual index component. In addition, an investable index should be easily tracked, a quality for which low turnover and transaction costs are two important factors.

• Transparency There are two aspects related to the transparency of an index. The first is the distribution and accessibility of updated index information (e.g. price information, name of the components, return information, etc.). The second is the construction methodologies (weighting information, rules of return calculation, etc.) and selection criteria used (rules for the inclusion of certain assets); these should be clearly identified for the public. Sufficient and timely information can help index users to better understand the index and use it appropriately. The transparency of an index can also increase the reliability of data and reduce investors' risk in their choice of management style.

It should be noted at this stage that these index quality criteria are quite similar to the CESR's considerations. Two of the general criteria put forward by the CESR, namely transparency and representativeness, are included in this list. Likewise, two of the specific issues of hedge fund indices are in fact general quality requirements for indices. These criteria are the investability and purity of an index, which the CESR calls 'sector consistency'. However, we have not included diversification in this list, while it does appear in that of the CESR. We argue that the inclusion of a diversification criterion actually results from confusion between the terms 'index' and 'benchmark'. We will address this question in further detail below. The remainder of this paper considers the problems of representativeness, transparency and diversification.

3. Representativeness Problem

3.1. A problem that is specific to hedge funds?

Due to the scarcity of information, the logic of representativeness through market capitalisation is difficult to apply to the alternative universe. As a result, finding an index that is representative of a particular management universe is not a trivial problem. The various indices available on the market are constructed from different data, according to diverse selection criteria and construction methods, and they evolve at differing paces. Because of this heterogeneity, investors cannot rely on competing hedge fund indices to obtain a 'true and fair' view of hedge fund performance.

The concern over existing hedge fund indices not being representative of a particular universe should however be put into perspective. In fact, a lack of representativeness is not necessarily specific to hedge funds. In order to show this, we compare the heterogeneity of hedge fund style indices to that of equity style indices.

With the help of an indicator, we can attempt to evaluate the degree of heterogeneity of the different hedge fund strategies and different equity styles. We use the maximum return difference in any given month. If return differences in a given month are pronounced, this implies that investors who choose exposure to a given style will obtain very different results depending on which index provider they choose. Observing pronounced heterogeneity as indicated by a high maximum return difference between indices would lead to the conclusion that the indices have a lack of representativeness. If they are all different, it is impossible that all of them represent the universe of securities or funds reliably.

For hedge fund strategies, we use existing investable indices from different providers. The providers considered are FTSE, S&P, HFR, CSFB Tremont and Dow Jones. These indices are the largest of the investable hedge fund indices currently available. The table below gives an overview.

Overview of Major Investable Hedge Fund Indices as of June 2006

Index Provider	Launch Date	Strategy	Fund Weighting	No of Funds in the Global Index	Rebalancing Frequency	Pricing Frequency	Sub-indices by Strategy/Style
CSFB/Tremont	Aug. 03	V.W.	V.W.	60	Semi-annual	Monthly	10
Dow Jones	Nov. 03	n.a.	E.W.	40	Quarterly ***	Daily	6
FTSE	Apr. 04	I.W.	I.W.	40	Annual ****	Daily	8
HFRX	Mar. 03	V.W	*	n.a.**	Quarterly	Daily	8
MSCI	Jul. 03	Adj. Med. Asset Weighted	E.W.	138	Quarterly	Daily	8
S&P	May 02	E.W.	E.W.	40	Annual *****	Daily	9

* Fund weightings are optimised to maximise correlation with their group.
** Optimal number of funds for strategy replication is determined using Monte Carlo simulation.
*** Additions or deletions can occur without notice at the complete and absolute discretion of Dow Jones.
**** Funds may be added/deleted more frequently in response to changing market conditions or fund-specific events.
***** Annual at the strategy level and periodical at the fund level.

For equity style indices, we chose value and growth indices for the European region. In particular, we chose the S&P/Citigroup growth/value indices for Europe, the MSCI Europe growth/value indices, the FTSE Style Indices for Europe and the Dow Jones Euro Stoxx TMI growth/value indices.

The table below indicates the maximum return difference and the indices and month in which this difference occurred.

Heterogeneity of Equity Style and Hedge Fund Strategy Indices

	Equity Style Indices			Hedge Fund Strategy Indices			
	Growth	Value	Convertible Arbitrage	CTA	Event Driven	Equity Market Neutral	Long/Short Equity
Max. Return Difference	3.0%	7.8%	1.9%	7.2%	2.7%	2.1%	2.9%
Index 1 (Return)	4.7%	-3.3%	-1.7%	7.6%	4.0%	2.6%	0.5%
Index 2 (Return)	1.8%	-11.1%	-3.7%	0.4%	1.3%	0.4%	3.4%
Index 1 (Provider)	Stoxx	FTSE	MSCI	FTSE	HFRX	MSCI	FTSE
Index 2 (Provider)	MSCI	S&P	Dow Jones	CSFB/Tremont	FTSE	Dow Jones	CSFB/Tremont
Month of occurrence	Nov. 2002	Feb. 2001	Apr. 2005	Oct. 2003	Nov. 2004	Jan. 2006	Sep. 2004

The data used are monthly returns data for the period of 01/1999 to 12/2005 for the growth and value indices. For the hedge fund strategy indices, we used monthly returns from 07/2003 to 04/2006 for all strategies except CTA and Long/Short. For Long/Short, we used data from 01/2003 to 04/2006. For CTA, we used data from 07/2003 to 02/2006. These differences are due to data availability. For example, the monthly data for the S&P CTA index is last available for 02/2006.

The analysis reveals that equity style indices appear to be as heterogeneous as hedge fund strategy indices. The degree of heterogeneity is important in magnitude. For example, looking at the February 2001 returns for value stocks, we see that an investor using the S&P index would have observed returns of -11.1%, while an investor using the FTSE index would have observed returns of -3.3%, a difference of 7.8 percentage points in terms of the monthly return.

From this evidence, we conclude that the problem of representativeness is not limited to hedge fund indices. Rather, even equity style indices, which seem to be well established as underlyings for derivatives, show a low degree of representativeness leading to heterogeneous returns behaviour.

3.2. Possible solutions

The success of investable hedge fund strategy indices, and their differentiated positioning with funds of hedge funds, will greatly depend on the capacity of index providers to improve the investability of their indices without sacrificing the representativeness dimension. This is not a minor task, because to be fully representative an index has to cover a whole universe or a whole strategy, including closed funds.

Recent research (Goltz, Martellini and Vaissié (2006)) examines how modern portfolio theory and factor analysis techniques can be used to build investable yet representative hedge fund indices. The results suggest that designing sound (i.e., both representative and investable) hedge fund indices is a feasible task given the specific features of the industry, in particular the lack of capacity and transparency.

A well-known method from empirical research in finance — the use of factor replicating portfolios — is employed to construct representative indices based on a limited number of funds, provided that funds are suitably selected and an optimal portfolio is designed with the objective of replicating the common trend in hedge fund returns for a given strategy. Implementation of this technology would allow investors to reap the benefits of investing in hedge funds, without being subject to selection biases and implicit allocation choices of investment vehicles that are not fully representative. Appendix A of this document provides a summary of the results from this study.

4. Transparency Problem

The transparency of the construction methodology is an obvious requirement. In fact, it seems somewhat surprising that there are some index providers, and not only in the hedge fund industry, that refuse to publish details on how their index is constructed. In our opinion – and this is consistent with the general requirements for an index – anyone who does not publish a construction methodology cannot claim to provide an 'index'.

While we fully agree with the CESR's standpoint that the index methodology must be transparent, there is a further issue worth considering – the transparency of the risk of the underlying funds themselves. One may argue that if a given fund does not disclose information concerning its strategy, the risk of misclassification will be high, which is unfavourable for inclusion in a hedge fund strategy index. Obviously, such a misclassification will lead to the index lacking in purity or 'sector consistency'. In other words, rather than being representative of the given strategy, the index will include returns that are attributable to the fact that part of the index portfolio represents the characteristics of a different style. Higher transparency is therefore a requirement for reducing the risk of a style drift and enhancing the style purity or 'sector consistency' of the index.

One tool that may help to mitigate this lack of transparency exists in the form of managed account platforms.

Essentially, in a managed account, investors with significant assets to manage ask hedge fund managers to replicate their trading strategy outside of the fund's books, in an account that remains in the name of the investor. This concept of 'managed accounts' has been developed in numerous forms offering different features:

- Standard custodial arrangements: assets are held in the name of the fund in a dedicated account operated by the manager of the hedge fund.
- Prime brokerage custody: assets are held in the name of the fund in a dedicated account operated by the manager, whereby the bank can act as an independent controller on behalf of the board of directors.
- Basic managed accounts: assets are held in the name of the investor within the books of a custodian bank and the manager receives the right to operate the account as part of his management mandate. The bank has no duty to control the assets held or the investment decisions, but the bank can report directly to the investor independently of the manager.
- Managed account platforms: assets are held in the name of the investors in a segregated account and the bank operates back-office and risk-control functions on behalf of the board of directors of the hedge fund. It is important for investors to identify the contractual arrangements the fund has made with its custodial bank in order to assess the level of protection and independence it will benefit from under the 'managed accounts'.

Managed accounts should not be confused with prime brokerage, which represents a very important dimension of the hedge fund industry. Prime brokers have developed on the back of hedge fund growth over the last five years as a single source of services for hedge funds willing to consolidate their brokerage and banking relationships in a single location. The prime broker can be defined as the primary point of contact for a hedge fund and the traditional source of financing for leverage and short selling. Trades executed with 'executing brokers' are 'given up' after execution and passed electronically to the prime broker, who will be in charge of ensuring that post trade (matching, settlement and payments) is handled in a single location. The benefits of such a model are numerous and range from a high level of transparency of the funds (supposedly held with one prime broker)

to the scaling down of back-office operations to one firm and the possibility of benefiting from prime brokerage technology (trading, risk management, reporting) and financial services (cross-product margining, leverage, stock borrowing and lending).

While the concept of prime brokerage has been a real success story both for clients (one-stop services with considerable technology made available at no capital cost) and providers (better assessment of credit risk involved in hedge fund financing and leveraging of services traditionally delivered within product silos allowing for unlimited cross selling), the reality is that a significant number of hedge funds have decided that there is no 'prime' in prime brokerage and that ensuring a long-term relationship with several brokers would allow them to keep better control over their sources of financing and execution services.

Advanced managed account platforms provide the full range of middle and back-office services, alongside independent valuation and risk monitoring with contractual arrangements favouring stringent control of the hedge fund manager's operations. No investor can be expected to gain full insight into the holdings of a hedge fund, but managed account platforms typically provide a host of information at the aggregate level, such as portfolio risk exposures. These are actually derived from the current holdings of the fund rather than from ex-post statistical analysis, which is the only tool for investors in the absence of insights into the fund holdings. The managed account platform provider plays the role of information aggregation from the portfolio holdings of the funds. Given the managed account setup, the holdings are fully transparent to the provider. Risk reports can then be compiled for investors, showing the current exposure of the fund.

This enables investors to have access to relevant information. For example, they are informed about the effective style mix of the fund. In the same vein, analysis of exposure to risk factors such as stock market, bond market and currency risk is provided to inform investors about sources of risk. It should be noted that there is an important risk of data overkill when it comes to reporting. Therefore, the aggregated information received from the platform provider has to be seen as a most useful source of transparency, perhaps even more useful than the provision of full transparency to all investors.

As a consequence, managed account platforms can be regarded as a tool to enhance the transparency of the strategy employed by a manager. Therefore, funds available on such platforms provide a natural alternative for index construction when compared to non-transparent hedge funds. The limit of such platforms is, of course, their limited number of available funds. However, given that it is possible to achieve high representativeness even with a low number of funds (see section three above), this limitation may be overcome.

To conclude this section on the problem of transparency, we would like to emphasise that again in relation to this criterion, the CESR should not adopt more demanding positions on hedge funds than on other asset classes. It seems odd to demand that hedge fund index providers publish the complete fund-by-fund composition of their indices, when the same demand is not made of indices from other asset classes. MSCI, for example, does not publish the composition of its stock indices and requests very large sums of money from managers or investors wishing to access that information.

5. Diversification Problem

5.1. Relevance of the question

The CESR argues that an index should be sufficiently diversified. Diversification can be understood in two ways.

First, diversification may mean that an index should not be too highly concentrated. This requirement can usually be achieved by respecting a minimum number of funds in the index, meaning that the risk that is specific to individual funds can then be diversified away. In other words, in order to fully represent a given hedge fund strategy, rather than the specificities of a given set of funds, a minimum number of funds is required. Second, diversification may be understood as a good allocation scheme that makes it possible to achieve a superior risk/return trade-off. Achieving a good risk/return trade-off is typically the objective of asset allocation funds, consultants or the management team of pension funds, and the aim is to construct a portfolio of multiple asset classes or styles. A superior risk/return trade-off, however, is not what is offered by an index, which tries to achieve representativeness for a given asset class or style. Therefore, diversification understood in this sense is linked to the construction of a good benchmark rather than a good index.

While a benchmark should obviously be well diversified in order to allow the investor to obtain an attractive long-term risk and return profile, an index does not have to be diversified per se. If the index covers a given strategy segment, sector or industry, it is obviously not well diversified in a broad sense. In the example of an industry index for the health sector, the index obviously does not constitute a well-diversified benchmark, since it omits other sectors and other asset classes. However, the index is supposed to be representative of the health sector, which means that it should represent the risk and return properties of the entire sector, rather than just some specific companies. Therefore, the requirement of a somewhat reasonable number of individual companies being included in the index stems from the criterion of representativeness and not that of diversification.

In spite of doubts over the relevance of this question, the following section will analyse if hedge fund indices indeed differ from other indices with respect to diversification. We will consider in turn diversification for i.) global hedge fund indices that mix funds following a wide range of styles and ii.) hedge fund strategy indices that seek to reflect the commonalities of funds in a specific category.

5.2. Benchmarking the diversification properties of hedge fund indices

The question of the diversification of hedge fund indices can be addressed by looking at the co-movements between the indices' components. Again, we choose to contrast the behaviour of hedge fund indices with that of equity style indices.

5.2.1. Diversification of global hedge fund indices

- Diversification between components

We first compare the co-movements between the index components. A global hedge fund index that aggregates a wide variety of hedge fund strategies is expected to offer high diversification, simply because the hedge fund universe is not heterogeneous. Hedge fund managers follow a multitude of strategies, investing in different instruments and following different investment styles. Therefore, correlation between such managers should be low and diversification within a global hedge fund index should be very pronounced. Note

that this is different from the fact that such a global hedge fund index offers good diversification benefits with respect to traditional asset classes, since the returns behaviour is different from the latter. In order to assess this question, we calculate the mean correlation of all hedge funds in the CISDM (Center for International Securities and Derivatives Markets) database and compare this to the mean correlation coefficient between all stocks included in the Stoxx 600 index for European stocks.

equity investment styles. Consequently, within a global hedge fund index, diversification would be more pronounced than within a stock market index. To test this conjecture, we use data on the CISDM Equal Weighted index, an index that aggregates returns from funds in the CISDM database, irrespective of the strategy that the fund follows. We then calculate the correlation between the CISDM indices for the five major hedge fund strategies. We run a similar test for the correlation between the DJ Stoxx Style indices and the Stoxx 600 index.

Co-movement between Index Components: Hedge Funds vs Stocks

	CISDM Funds	Stoxx 600 Index Components
Average Correlation	0.17	0.25
Variance explained by PC1	0.24	0.29

The data used are monthly returns data for the period of 01/1999 to 12/2005 for the hedge funds from the CISDM database and for components of the Stoxx 600 index for European stocks.

The above table, in the first line, shows that the average correlation is significantly lower for hedge funds than for the stock index, as expected. The second line of the table indicates the percentage of variance explained by the first principal component as obtained by a standard factor analysis technique (principal component analysis); the higher this percentage the more pronounced the common factor in returns of the index component. Again, we can see that the hedge funds in the CISDM database show less co-movement, as indicated by the low explanatory power of the first principal component.

To provide some background information on the use of the percentage of variance explained by the first principal component, the concept of PCA (Principal Component Analysis) is formalised in Appendix B of this document.

- Diversification between styles

We would expect that the diversification potential between hedge fund strategies will be greater than the diversification potential between different

However, analysis of the unconditional correlation coefficient alone would be limited. It is a well-known empirical fact that the dependencies of financial assets are constant neither over time nor across states of the world. In other words, these correlations are both time- and state-dependent. In particular, dependencies tend to be higher in times of market downturns and it has been shown that correlations between equity markets in different countries increase significantly in negative environments. Therefore, diversification benefits assessed over the whole time period may not reflect the benefits investors get in times of market turmoil, i.e., when they are most valuable. In other words, the unconditional diversification benefits may not hold conditionally, as dependence that is conditional on down markets may be higher than unconditional dependence.

The table below therefore also assesses correlation in two different states of the broad index (CISDM Equal Weighted and Stoxx 600, respectively), namely negative or positive returns. The results are shown both for hedge fund and equity indices. The table shows correlations calculated using the returns during months with positive returns ('Up') and negative returns ('Down') for the global index.

markets and that diversification effects within a global hedge fund index are more robust across different states of the market than diversification effects within a stock index. In particular, it should be noted that most hedge fund strategies have a negative correlation with the global hedge fund index when the latter falls in value. On the contrary, equity style indices maintain a positive correlation in down market states.

Conditional Correlation between Style Categories: Hedge Funds vs Stocks

	CISDM Equal Weighted Index with CISDM Strategy Indices				
	Convertible Arbitrage	CTA	Event Driven	Equity Market Neutral	Long/Short Equity
Correlation in Down Markets	-0.12	-0.47	0.47	-0.13	0.79
Correlation in Up Markets	0.42	0.13	0.74	0.72	0.95

	DJ Stoxx Index with DJ Stoxx Style Indices		
	Growth	Value	Small Cap
Correlation in Down Markets	0.92	0.54	0.54
Correlation in Up Markets	0.90	0.90	0.82

The data used are monthly returns data for the period of 01/1999 to 12/2005 for the hedge fund indices from CISDM and for the Stoxx 600 index for European stocks. The value, growth and small cap indices are the large cap growth, large cap value and small cap indices for the DJ Stoxx TMI index.

From a comparison of the values for hedge funds (the upper part of the table) with the values for equity (the lower part of the table), two conclusions can be drawn.

First, the correlations of hedge fund strategies with the global hedge fund index are significantly lower on average than the correlations of equity style indices with the global equity index. Second, the down market correlations of hedge funds are actually lower than the up market correlations for all strategies. The inverse is true for the growth style index correlations. For value and small cap indices, the down market correlations are lower than the up market correlations, but down market correlations are still higher than for all hedge fund strategies, except Long/Short Equity. This allows us to conclude that the diversification potential within a global hedge fund index actually increases in down

5.2.2. Diversification of hedge fund strategy indices

A lot of emphasis in the preceding subsection was placed on the fact that the question of diversifying between styles is not at all the relevant one for index providers. Rather, indices should provide investors with a representation of the risks of a meaningful subcategory of the total asset universe. Such subcategories are represented by styles or sectors. The allocation between such categories relies heavily on the quality of the indices that are used. In particular, investors depend on a true representation of the given style without significant drifts, as such drifts would remove the control they have with regard to the overall allocation decision. However, as well as style drifts, indices for such subcategories also have to avoid giving exposure to idiosyncratic risk rather than to the systematic component that is linked to the style category.

Therefore, diversification in terms of a minimum number of assets (the first type mentioned above) could be regarded as an objective for index providers.

The parallel between hedge fund strategies and equity styles or industry sectors is straightforward. While the former present active strategies that are exposed to common risk factors, the latter constitute passive portfolios with common risks. Therefore, we again propose to compare hedge fund indices to their equity counterparts, this time looking at the indices for subcategories.

If hedge fund indices typically have a relatively low number of components, the same can be said of sector or style indices in the equity universe. Once a global equity index is subdivided into styles or sectors, the number of components available shrinks automatically. Rather than focusing on the absolute number of assets contained in the index, we assess the diversification potential offered by its components. In fact, very little diversification will be achieved if the components are highly dependent, even if a large number of components are available. We use the same methodology as above and look at the average correlation coefficient and the percentage of variance as explained by the first principal component extracted using a principal component analysis (again, see Appendix B for a demonstration of this concept).

We use a data set that is identical to the one we used for global indices. Again, we use the CISDM database of hedge funds, this time selecting only the funds that are defined as belonging to one of the five major hedge fund strategies used above. The funds in these strategies constitute 85% of total assets under management by single hedge funds contained in the CISDM database. For indices of equity subcategories, we again use Dow Jones Stoxx indices. Component information is available for the Dow Jones Stoxx TMI large cap, mid cap and small cap indices (we refer to these as style indices[2]), as well as for a range of Dow Jones Stoxx 600 sector indices.

The analysis is conducted over the same time period of seven years considered in the previous test. The table above shows that the diversification

Co-movement between Index Components: Hedge Fund Strategy Indices and Equity Style and Sector Indices

	Average correlation	Variance explained by PC1
Consumer Goods	0.19	0.22
Consumer Services	0.22	0.25
Health	0.15	0.19
Oil & Gas	0.25	0.30
Technology	0.47	0.49
Telecom	0.46	0.50
Utilities	0.20	0.25
Large Cap Index	0.26	0.29
Mid Cap Index	0.22	0.25
Small Cap Index	0.19	0.21
Convertible Arbitrage	0.42	0.47
CTA	0.21	0.32
Event Driven	0.37	0.43
Equity Market Neutral	0.05	0.21
Long/Short Equity	0.24	0.34

The data used are monthly returns data for the period of 01/1999 to 12/2005 for the hedge funds of the five major categories from the CISDM database and for components of the different subindices for European stocks published by Dow Jones Stoxx [the Stoxx TMI index (Large Cap, Mid Cap, Small Cap) and the Stoxx 600 sector indices (Consumer Goods, Consumer Services, Health, Oil & Gas, Technology, Telecom, Utilities)].

[2] *The component lists for growth and value indices are not available on Datastream™ Thomson Financial™.*

potential within hedge fund strategy indices is comparable to that available within equity style or sector categories. Most hedge fund strategies have an average correlation between funds that is around 0.20. This is comparable to the lowest values achieved by equity sector or style index components. Only Equity Market Neutral component funds have correlation that is close to one, suggesting very high diversification potential. On the other hand, CTA and Event Driven show a high degree of dependence between components and thus lower diversification potential. However, compared to some industry sectors such as the technology and telecom sectors, the co-movement between components is still lower. The results for the percentage of variance explained by the first principal component confirm these conclusions. The components of hedge fund strategy indices appear to offer at least as much diversification as securities that make up equity indices.

5.2.3. Concluding remarks on the diversification issue

A further argument can be made in favour of hedge fund indices. Given the absence of a plausible weighting criterion for hedge fund indices, most indices are actually equal weighted. This is in stark contrast with stock market indices, which are predominantly value-weighted. The disadvantages of value-weighting have often been cited in recent academic literature and have also been recognised by investors. In fact, even if a stock market index contains a large number of components, value-weighting will lead to a high concentration in a few securities. According to Bernstein (2003), the S&P 500 index cannot be considered a diversified portfolio because the ten largest companies in the index accounted for 25% of the market value, and the top 25 companies accounted for 40%. According to Strongin, Petsch and Sharenow (2000), because of the heavy weighting of the large capitalisation stocks, the S&P 500 index only has 86 stocks (with significant weights) and the Russell 1000 only has 118. Consequently, index performance is often dictated by the few biggest companies of the index and these indices do not provide investors with the kind of risk reduction benefits through diversification they think they are achieving. Equal-weighting, which is the standard for hedge fund indices, makes it possible to offer more diversified and less concentrated portfolios.

Given the results presented here, as well as the advantages of equal-weighting, there appears to be no reason to give more recognition to equity indices than to hedge fund indices.

6. Summary and Conclusion

6.1. How do hedge fund indices fare when testing the criteria outlined by the CESR?

The question addressed by the CESR is an extremely relevant one: rather than accept an index because it is labelled as such, it should be possible to test the quality of a given index according to identified quality criteria.

However, when the CESR commented on the quality of hedge fund indices, it underlined a few problems (such as survivorship bias) that are only relevant for non-investable hedge fund indices. These will certainly not be used as the underlyings for derivative instruments. Concerning investable indices, two of the general criteria outlined by the CESR are extremely useful in assessing their quality. These criteria are representativeness and transparency. While the representativeness of hedge fund indices remains a challenge, it should be noted that i) this problem also exists for other indices such as equity style indices and ii) there are methods that allow the construction of investable hedge fund indices that fulfil the representativeness requirement, despite a number of challenges that are specific to the hedge fund industry. The transparency problem is also a crucial one. We argue that in addition to the transparency of the index construction methodology, the transparency of the investment itself, i.e., the component funds included in a hedge fund index, should also be considered. Managed account platforms are a natural way to achieve high transparency.

Finally, in relation to diversification, we have shown that this criterion stems from confusion over terms, rather than from true relevance with respect to index quality. While a benchmark should obviously be well diversified in order to allow the investor to obtain an attractive long-term risk and return profile, an index does not have to be diversified per se. If the index covers a given strategy segment, sector, or industry, it is obviously not well diversified in a broad sense. In the example of an industry index for the health sector, the index obviously does not constitute a well-diversified benchmark, since it omits other sectors and asset classes. However, the index is supposed to be representative of the health sector, which means that it should represent the risk and return properties of the entire sector, rather than just some specific companies. Therefore, the requirement of a somewhat reasonable number of individual companies being included in the index stems from the representativeness and not the diversification criterion.

Our empirical tests show that hedge fund indices — both global indices and strategy indices — can at least keep up with equity indices when it comes to diversification. However, we would like to stress that obtaining representativeness is a task for index providers. This representativeness usually only makes sense when one considers distinct style or sector categories of an asset class. Diversification, on the other hand, is a task that is achieved by asset allocation. This is the task of investors or their consultants and requires the definition of a benchmark that has the optimal risk return characteristics over the long term. Therefore, the prime requirement for hedge fund indices should be representativeness rather than diversification.

6.2. Conclusion

The representativeness criterion is what is relevant when assessing the quality of hedge fund indices. In fact, the quintessence of an index is good representation of the risks of a given investment universe. In the case of performance measurement, when investors choose an index as a benchmark, they assume that it represents the risks of the given fund or portfolio.

Due to a lack of official recognition, hedge fund indices do not have the status of a major reference for most hedge fund or fund of hedge fund managers. Instead, most of these managers use the risk-free rate, as represented by the rate of returns of short-term treasury bills or monetary instruments, as a reference.

This practice constitutes the worst of all choices, given that it assumes that hedge funds are completely free of systematic risk exposures. Such a practice therefore results in performance measures that lack all relevance and lead investors into the error of omitting to balance returns with their associated risk exposure. Establishing hedge fund indices as truly recognised references therefore appears to be an important step towards properly informing investors about the level of risk in hedge fund products.

References

• Amenc, N. and F. Picard, 'Stock Picking: Myth or Reality?', EuroPerformance and EDHEC Risk & Asset Management Research Centre, working paper, 2006.

• Bernstein, P., 'Points of Inflection: Investment Management Tomorrow', *Financial Analysts Journal*, vol.59, n°4, July/August 2003.

• Brown, S.J., W. Goetzmann and R. Ibbotson, 'Offshore Hedge Funds: Survival & Performance 1989–95', *Journal of Business*, vol. 72, n°1, January 1999, pp. 91–118.

• Committee of European Securities Regulators, 'CESR's Advice to the European Commission on Clarification of Definitions concerning Eligible Assets for Investments of UCITS', Ref: CESR/06-005, January 2006.

• Fung, W. and D.A. Hsieh, 'Performance Characteristics of Hedge Funds and CTA Funds: Natural Versus Spurious Biases', *Journal of Financial and Quantitative Analysis*, 35 (3), 2000, pp. 291–307.

• Géhin, W. and M. Vaissié, 'Hedge Fund Indices: Investable, Non-Investable and Strategy Benchmarks', EDHEC Risk & Asset Management Research Centre, working paper, 2004.

• Goltz, F., L. Martellini and M. Vaissié, 'Hedge Fund Indices: Reconciling Investability and Representativity', *European Financial Management*, forthcoming, 2006.

• Strongin, S., M. Petsch and G. Sharenow, 'Beating Benchmarks', *Journal of Portfolio Management*, summer edition, 2000.

Appendix A:
Reconciling Investability and Representativeness

A.1. Methodology

Starting with a database of hedge fund returns, Goltz, Martellini and Vaissié (2006) extract the combination of individual funds that capture the largest possible fraction of the information contained in the data. Technically speaking, this amounts to using the first component of a Principal Component Analysis (PCA) of fund returns as a candidate for a pure style index.

It is better to conduct PCA on standardised returns (so that they all have mean zero and variance one), because this removes differences in variances caused by leverage differences. For example, two funds employing the exact same trading strategy but different leverage will have different return variances.

One may use the method to describe each variable as a linear function of a reduced number of factors. To that end, one needs to select a number of factors *l* such that the first *l* factors capture a large fraction of asset return variance, while the remaining part can be regarded as statistical noise. By taking *l* =1 in the equation, this method can be used to generate 'the best one-dimensional' summary of a set of individual funds.

Once the common factor has been extracted, Goltz, Martellini and Vaissié (2006) suggest using the following two-stage methodology for building factor-replicating portfolios (FRPs):

- Selection stage: for each strategy, we form a portfolio using 10 hedge funds from the corresponding category that are most correlated to the first principal component in the first three-year calibration period;

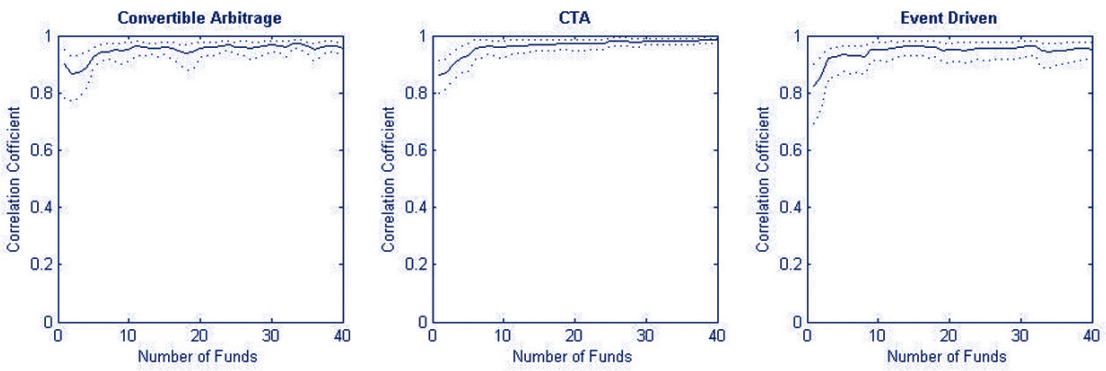
- Optimisation stage: the portfolio weights are chosen so that the portfolio returns have maximal correlation with the corresponding principal component.

This two-stage procedure is repeated every year, and the performance of FRPs is examined during an out-of-sample period stretching over 3 years.

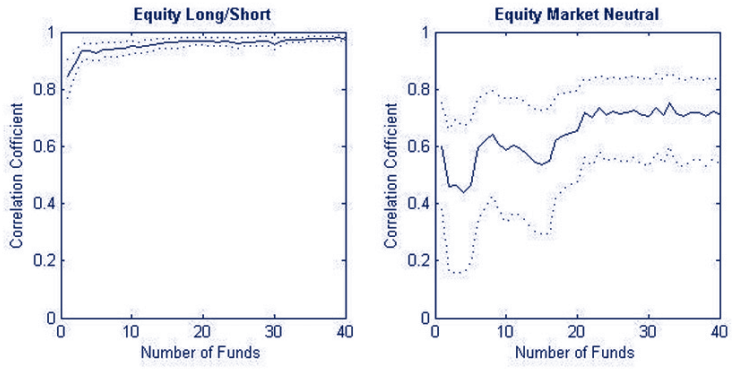
A.2. Results

In order to judge the representativeness obtained with their factor replicating portfolios (FRPs), the authors examine the correlation coefficient they obtain with respect to the first principal component (PC1). They implement their two-stage procedure, selecting between 1 and 40 funds in each strategy. The correlation coefficients between the first principal components and the FRPs with different numbers of funds are shown in the figure below. The 5% and 95% confidence bounds for the out-of-sample correlation coefficient are also indicated.

Correlation Coefficients and Confidence Bounds between FRPs and PC1 as a Function of the Number of Funds Included in the FRP – Source: Goltz, Martellini and Vaissié (2006)



Appendix A:
Reconciling Investability and Representativeness



As can be seen from the figure, the out-of-sample correlations with the first principal component are very robust with respect to the number of funds in the FRP. Even when only five to ten funds are used, correlations are very high. On the other hand, choosing more than 10 funds does not significantly increase the correlation. The only case where correlation drops significantly when selecting less than 10 funds is the Equity Market Neutral FRP.

Appendix B: Principal Component Analysis

The PCA of a time series involves studying the correlation matrix of successive shocks. Its purpose is to explain the behaviour of observed variables using a smaller set of unobserved implied variables. From a mathematical standpoint, it involves transforming a set of *K* correlated variables into a set of orthogonal variables, or implicit factors, which reproduces the original information present in the correlation structure. Each implicit factor is defined as a linear combination of original variables.

R is defined as the following matrix:

$$R = (R_{tk})_{\substack{1 \le t \le T \\ 1 \le k \le n}}$$

R actually contains standardised, as opposed to raw, returns. It is better to conduct PCA on standardised returns (so that they all have mean zero and variance one) because this removes differences in variances caused by leverage differences. For example, two funds employing the exact same trading strategy but different leverage will have different return variances.

We have *n* variables, i.e., returns for n different individual funds or assets, and *T* observations of these variables, where *T* is the number of months in our case.

$$R_{tk} = \sum_{i=1}^{n} \sqrt{\lambda_i}\, U_{ik}\, V_{ti} \qquad (1)$$

where:

$(U) = (U_{ik})_{1 \le i,k \le n}$ is the matrix of the n eigenvectors[3] of R'R;

$(V) = (V_{ti})_{\substack{1 \le t \le T \\ 1 \le i \le n}}$ is the matrix of the n eigenvectors RR'.

Note that these n eigenvectors are orthogonal. $\lambda\{i\}$ is the eigenvalue (ordered by degree of magnitude) corresponding to the eigenvector U_i. Denoting $S_{ik} = \sqrt{\lambda_i}\, U_{ik}$ the principal component sensitivity of the k^{th} variable to the i^{th} factor, and $V_{ti} = F_{ti}$ one can equivalently write equation *(1)* as follows:

$$R_{tk} = \sum_{i=1}^{n} s_{ik}\, F_{ti}$$

where the *n* factors F_i are a set of orthogonal variables. One may use the method to describe each variable as a linear function of a reduced number of factors. To that end, one needs to select a number of factors *I* such that the first *I* factors capture a large fraction of asset return variance, while the remaining part can be regarded as statistical noise:

$$R_{tk} = \sum_{i=1}^{I} \sqrt{\lambda_i}\, U_{ik}\, V_{ti} + \varepsilon_{tk} = \sum_{i=1}^{I} s_{ik}\, F_{ti} + \varepsilon_{tk} \qquad (2)$$

where some structure is imposed by assuming that the residuals ε_{tk} are uncorrelated to one another.

By taking *I=1* in equation *(2)*, this method can be used to generate 'the best one-dimensional' summary of a set of individual funds or securities.

The percentage of variance explained by the first *I* factors is then given by $\frac{\sum_{i=1}^{I} \lambda_i}{\sum_{i=1}^{N} \lambda_i}$, where again we consider that *I=1*.

[3] *An eigenvector is a vector that is scaled by a linear transformation, but not moved. The scaling factor is the eigenvalue.*

Notes

EDHEC RISK AND ASSET
MANAGEMENT RESEARCH CENTRE

393-400 promenade des Anglais
06202 Nice Cedex 3
Tel.: +33 (0)4 93 18 78 24
Fax: +33 (0)4 93 18 78 41
E-mail: research@edhec-risk.com
Web: www.edhec-risk.com

EDHEC
BUSINESS SCHOOL
Lille - Nice