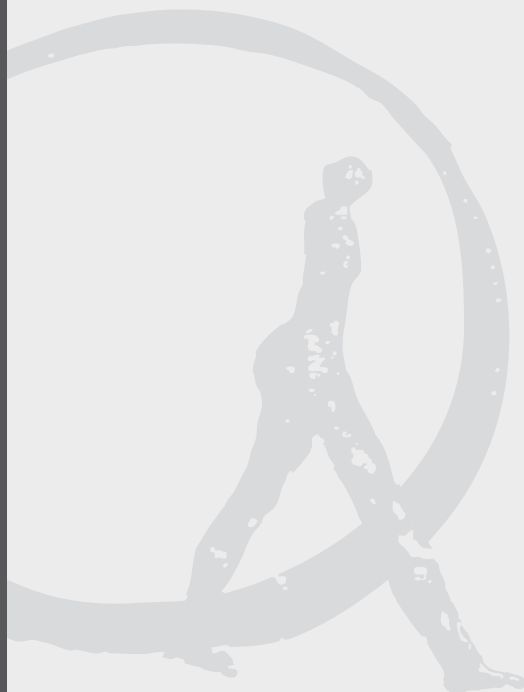


# Revisiting the Limits of Hedge Fund Indices: A Comparative Approach

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## Abstract

Hedge fund indices have been criticised for a lack of representativity and for their biases, to the point that serious doubts about the usefulness of hedge fund indices have been raised by investors and regulators. This paper examines whether the problems that are outlined for hedge fund indices also exist for other indices that seem to be widely accepted. The drawbacks of hedge fund indices pointed out in the literature do indeed exist. However, in this paper, we point out that there are possible solutions to these problems. In addition, we argue that most of the problems are not specific to hedge fund indices, but also exist with well accepted instruments such as stock market indices.

EDHEC is one of the top five business schools in France. Its reputation is built on the high quality of its faculty (104 professors and researchers from France and abroad) and the 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 focused 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 programmes in the areas of asset allocation and risk management in both the traditional and alternative investment universes.

Hedge fund indices have seen widespread growth over the past few years, reflecting both the general growth of the hedge fund industry and the fast growth of indices with respect 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.

The different indices available are constructed from different data, according to diverse selection criteria and methods of construction, so much so that indices competing in the same strategy will have different returns (see Brooks and Kat 2002 or Amenc, Martellini, and Vaiisié 2004). Because of this heterogeneity, investors can hardly rely on this information to obtain a "true and fair" view of hedge fund performance. One of the reasons for this lack of homogeneity in hedge fund index return data is that none of these existing indices is fully representative. In other words, this is a sampling problem: a number of funds that should be part of an index are not included in the index. Because of the lack of regulation on hedge fund performance disclosure, existing databases cover only a relatively small fraction of the hedge fund population. It is likely that only slightly more than half of existing hedge funds choose to self-report their performance to one of the major hedge fund databases.

In addition, hedge fund indices are built from databases of individual fund returns, and therefore inherit their shortcomings in terms of scope and quality of data, which vary significantly among various data vendors. In what follows, we briefly review the biases hedge fund indices are known to suffer from. First, a fund's participation in a database is voluntary, which poses a real problem in terms of the reliability of the data published ("self-reporting bias"). A fund can in fact decide, for one reason or another, to register in one or more databases. Since the funds that have refused to report to one or another of the databases are, by definition, unobservable, it is not possible to evaluate the impact of this bias. In addition, since some refuse to display their performance because of poor results and others because they have already reached their critical size, it is difficult to know even whether this bias has a positive or negative impact on the performances announced. The lack of transparency also poses a problem in terms of the reliability of data and exposes investors, in particular, to a risk of a change in the manager's management style (for more on this "style drift", see Lhabitant 2001). Thirdly, depending on the date at which the database began, the quality of past information will vary (notably for funds that ceased their activity before the database began). This affects the performance of the index to a greater or lesser degree, depending on the number of funds that stop communicating their results each year (referred to as the attrition rate) and the average performance differential observed between those funds and the remaining funds. This is known as a "survivorship bias". Since the HFR and CISDM<sup>1</sup> databases began in 1994, it is likely that they will dispose of more accurate information than the CSFB database (which begins only in 2000) over the period 1994/2000, and that they will not be affected in the same way by survivorship bias. Brown, Goetzmann, and Ibbotson (1999) valued the average impact of this bias at 2.6%, compared to 3% for Fung and Hsieh (2000) and 2.43% for Liang (2001). By comparison, it should be noted that for mutual funds Malkiel (1995) estimated this bias to be 0.5%. The various databases are again affected in different ways by this bias. For example, the TASS database has a higher survivorship bias than the HFR database because it has a higher attrition rate, which in turn is due to different criteria for adding and removing funds. Also, the funds have selection criteria that can be very diverse, and the data provided will not be representative of the same management universe. This is referred to as "selection bias". For instance, HFR excludes managed futures from its databases while TASS and CISDM take them into account. Finally, most funds are present in one but not the other: of the 1,162 HFR funds and the 1,627 TASS funds, only 465 are common to both databases. 59% of the funds that are still in activity and 68% of the funds that no longer report to HFR are not part of the TASS database (see Liang 2000). Of the 465 funds in common between the HFR and TASS databases, only 154 (or 33.1%) have been included in both databases at the same time. However, when a fund is added to a database, all or part of its historical data is recorded *ex post* in the database. Since the databases are the sole means of communication for most funds, it is reasonable to believe that the funds will decide to publish their results only when they are at their highest levels, in order to attract as many investors as possible. It is therefore probable that the average performances displayed by the funds during their incubation period will be better than those of funds that have belonged to the database under consideration for a longer period. In this case we talk about "instant history bias" or "backfill bias". Fung and Hsieh (2001) valued the impact of this bias at 1.4% per year. A recent study by Posthuma and Van der Sluis (2003), however, has shown that the actual average survivorship bias in the TASS database is perceptibly higher (i.e., 4.35%). In this

1 - The CISDM database used to be called MAR.

respect, it is worth noting that the instant history bias may be as high as 6.34% for Long/Short Equity funds. If the funds are not recorded at the same date in two different databases, it is probable that the two databases will not be exposed to instant history bias in the same way. That only 47% of the performances recorded are strictly identical heightens this risk.

These problems of representativity and of database biases have led to serious doubts about the usefulness of hedge fund indices. Fung and Hsieh (2004) state that "existing hedge fund indices, while helpful in providing investors with an idea on the current progress of the industry on average, offer little clues to . . . questions [of asset allocation and performance measurement]". Likewise, regulators have questioned the appropriateness of hedge fund indices as assets eligible for retail investment products, based on the problems outlined above (see the Committee of European Securities Regulators 2006). In addition, because of the many problems of existing hedge fund indices, many investors have taken a critical stance on hedge fund indices.

This paper examines whether the problems that are outlined for hedge fund indices also exist for other indices that seem to be widely accepted. Our conclusion is that the drawbacks of hedge fund indices pointed out in the literature do indeed exist. However, in this document, we point out that there are possible solutions to these problems. In addition, we argue that most of the problems are not specific to hedge fund indices, but also exist with well accepted instruments such as stock market indices. Therefore, rejecting hedge fund indices seems to be inconsistent with the treatment of indices for other asset classes which face the same types of problems. For all these reasons, it would be regrettable if investors and regulators reject all hedge fund indices<sup>2</sup> without distinguishing between those that do provide quality indices and those that—for marketing reasons alone—use the term "index" without fulfilling the quality requirements.

It should also be noted that there are various types of hedge fund indices and that they can be classified along two lines. The first distinction is between non-investable and investable indices. There actually seems to be some confusion between investable and non-investable indices among investors, as many problems underlined in the literature (notably the data biases) apply mainly to non-investable indices and are less severe for investable indices. It is surprising that many investors insist on the problems of database biases with non-investable indices, as outlined in the literature, when the only type of index that is actually relevant for investment decisions is the investable type. The second distinction is between strategy indices for a given hedge fund style or strategy and global hedge fund indices that aggregate funds across all investment styles. The objective of constructing representative indices is far more feasible for strategy indices that may be representative of a given style than it is for global indices, which cannot claim to be truly representative of the entire hedge fund universe.

It is important to note that the numerous drawbacks of hedge fund indices are not necessarily specific to hedge funds, but may be found in other indices as well. This paper assesses some of the problems that have been pointed out with hedge fund indices by looking at the case of stock market indices. The objective is to see whether there are similar problems with stock market indices or whether—on the contrary—the problems really are limited to the area of hedge funds. We will first outline possible solutions to constructing quality hedge fund indices, and then address each problem in turn.

## 1. Innovative Solutions

While hedge fund indices based on large databases come with a large number of biases linked to the construction of the database itself, it should also be stressed that such indices are—by definition—not investable. As a response to this problem, numerous investable hedge fund indices have been created. Our suggestion would be to prefer investable indices, since these indices avoid a number of database problems associated with non-investable indices. However, in addition to the low number of funds used by investable indices, providers of investable hedge fund indices often employ the questionable practice of selecting the index constituents based on good performance over the past, which leads to indices that are not at all representative of the entire hedge fund universe for a given strategy. Therefore, it must be ascertained that these investable indices are also representative.

2 - In Europe, hedge fund indices have been confronted with low acceptance both in the industry and from regulators. A survey of market participants (EDHEC 2005) finds that investors largely prefer funds of hedge funds over indices when implementing hedge fund allocations (see pp. 82, 83). The Committee of European Securities regulators (2006) has taken a critical standpoint on hedge fund indices at the beginning of a consultation process, trying to establish whether hedge fund indices should be eligible as underlying securities for index derivatives that may be used by retail investment funds.

Although it may not be straightforward to design hedge fund indices that guarantee both representativity and investability, recent research shows that it can be done.

In particular, Goltz, Martellini, and Vaissié (2007) examine 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.

Factor-replicating portfolios, a well-known method borrowed from empirical research in finance, are used to construct representative indices based on a limited number of funds, provided that the 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. The use of this method would allow investors to reap the benefits of investing in hedge funds, without being subject to selection biases and the implicit allocation choices of investment vehicles that are not fully representative.

Starting with a database of hedge fund returns, Goltz, Martellini, and Vaissié (2007) 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 should be noted that the PCA is done on a universe of funds taken from a large database, with funds that are either open or closed to new investments. Therefore, the result of the PCA is a factor that represents the entire universe for a given strategy, and biases linked to an exclusion of funds that are not actually investable do not occur.

Specifically, it is better to conduct PCAs 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 using the same trading strategy but different leverage will have different return variances.

The method may be used to describe each variable as a linear function of a reduced number of factors. To that end, it is necessary to select a number of factors  $I$  such that the first  $I$  factors capture a large fraction of asset return variance, while the remainder can be regarded as statistical noise. By taking  $I=1$  in the equation, this method can be used to generate "the best one-dimensional" summary of a set of individual funds.

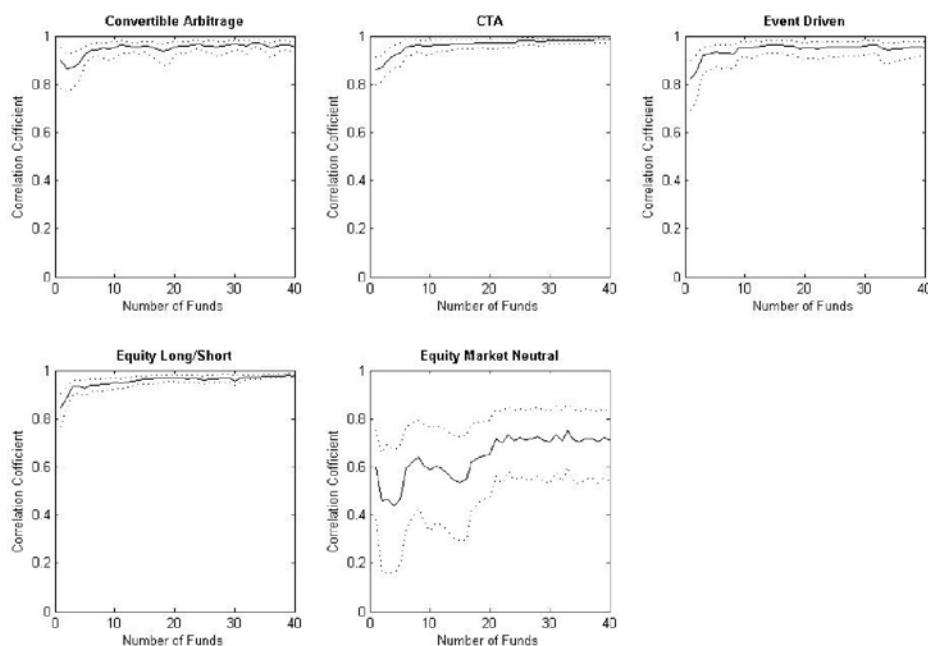
Once the common factor has been extracted, the aim is to replicate this common factor, which represents the entire universe, through a portfolio of a few funds that must be open to new investments. Goltz, Martellini, and Vaissié (2007) suggest using the following two-phase method to build factor-replicating portfolios (FRPs):

- Selection phase: for each strategy, a portfolio is formed using the ten hedge funds in the corresponding category that are the most closely correlated to the first principal component in the first three-year calibration period.
- Optimisation phase: the portfolio weights are chosen so that the portfolio returns have maximal correlation to the corresponding principal component.

This two-phase procedure is repeated every year, and the performance of FRPs is examined for a three-year out-of-sample period.

In order to judge the representativity 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-phase procedure, selecting between 1 and 40 funds in each strategy. The correlation coefficients with the first principal components for FRPs with a different number of funds are shown in the figure below. The 5% and 95% confidence bounds for the out-of-sample correlation coefficient are also indicated.

**Figure 1: 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)**



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 ten funds does not significantly increase the correlation. The only case where correlation drops considerably when selecting fewer than ten funds is the Equity Market Neutral FRP.

## 2. Problem of representativity

Concerns that existing hedge fund indices are not representative of the universe should be put into perspective. In fact, a lack of representativity is not necessarily specific to hedge funds. It has often been noted that the mechanism of capitalisation-weighting that is applied in stock market indices actually leads to portfolios that are not representative of the entire market (see, among others, Strongin, Petsch, and Sharenow 2000, who find that the effective number of stocks in cap-weighted indices is low compared to the number of constituents). In addition, some widely accepted indices contain only a small number of stocks in the first place (see also section 2.8. below). In order to directly assess the representativity of stock market indices, we use the criterion introduced above—that is, the correlation of index returns with the first principal component. The first principal component must be constructed using a large number of stocks, and the index returns may then be compared to this factor, which is representative of the entire stock market.

To construct the first principal component of stock returns, we obtained monthly returns for the stocks traded on the NYSE, as well as for the Eurostoxx 600 components. We then assessed the correlation coefficient of the S&P 500 and the Eurostoxx 50 index returns, with the first principal component (PC1). The results shown in Table 1 below indicate that the correlation achieved is actually fairly low when compared to the correlation coefficients for investable hedge fund indices with the corresponding first principal component referred to above.

**Table 1: Stock Market Indices – Correlation with PC1**

	S&P 500 Index	Eurostoxx 50 index
Correlation with PC1 of NYSE components	0.749	-
Correlation with PC1 of Stoxx 600 components	-	0.945

The data used are monthly returns data for the period 01/2003 to 12/2006 for components of the NYSE and for components of the DJ Eurostoxx 600, as well as the monthly returns for the S&P 500 and the Eurostoxx 50 index for the same period.

It should also be noted that the correlation is particularly weak in the case of the S&P 500, where we construct the PC1 from stocks traded on the NYSE. For the case of the Eurostoxx 50 index, we do not have such an exhaustive set of stock returns data and must limit ourselves to the 600 Stoxx components to construct the PC1. It is obvious that, in this case, the correlation with the PC1 will be higher. Overall, however, we may conclude from table 1 that even the widely accepted stock market indices provide but a limited representation of the universe of traded stocks.

### 3. Problem of return heterogeneity from one provider to another

To further assess the representativity of hedge fund indices with respect to that of stock market indices, we compared the heterogeneity of hedge fund style indices to that of equity style indices (Amenc and Goltz 2006). The table below reproduces the results.

**Table 2: Heterogeneity of Equity Style and Hedge Fund Strategy Indices.**

	Equity Style Indices		Hedge Fund Strategy Indices		Event Driven	Equity Market Neutral	Long/Short Equity
	Growth	Value	Convertible Arbitrage	CTA			
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 significant. 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.

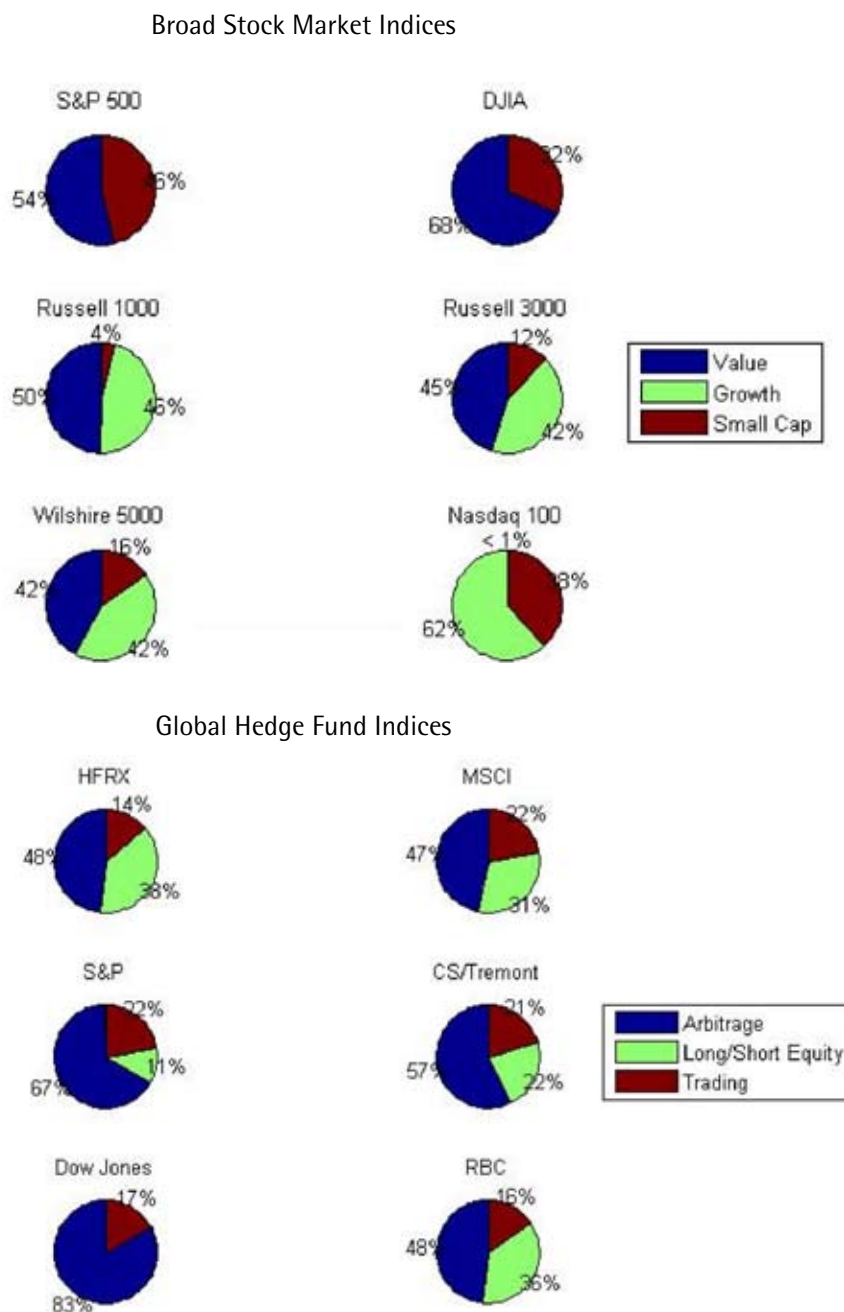
From this evidence, we conclude that the problem of representativity is not limited to hedge fund indices. Rather, even equity style indices which seem to be well established as underlyings for indexing products show a low degree of representativity.

### 4. Problem of style composition heterogeneity from one provider to another

At this point, it is appropriate to point out the difference between two types of hedge fund indices. The first type consists of strategy indices that aim to be representative of a given hedge fund style or strategy. The second type is made up of global indices that, more often than not, are not in fact representative of the entire hedge fund universe. In fact, these global indices use either an asset-weighted or an equal-weighted aggregation of all strategy indices, which leads to biases that depend on the weighting mechanism chosen.

Global hedge fund indices' considerable differences in terms of strategic allocation are often pointed out as a major problem. The figure below shows the strategic allocation to investment styles of global hedge fund indices (Lhabitant 2007) and of US stock market indices. The style exposures are calculated using Sharpe's return-based style analysis for the Dow Jones IA, S&P 500, Russell 1000, Russell 3000, Wilshire 5000, and Nasdaq 100 indices. The style exposures are with respect to the returns of MSCI style indices for the US—that is, MSCI Growth, Value and Small Cap indices—and they were calculated using monthly data over the period from January 2004 to December 2006.

Figure 2: Strategic style allocation of broad stock market indices and global hedge fund indices.



It is clear that the heterogeneous style composition that is often presented as a serious problem for hedge fund indices is also present in stock market indices. In fact, it can be stated that the style composition of stock market indices is no less heterogeneous than that of hedge fund indices; indeed, some stock market indices had a strong value tilt (the Dow Jones Industrial Average), others a strong growth tilt (the NASDAQ 100 index), and yet others were rather balanced (the Russell and Wilshire indices, for example).

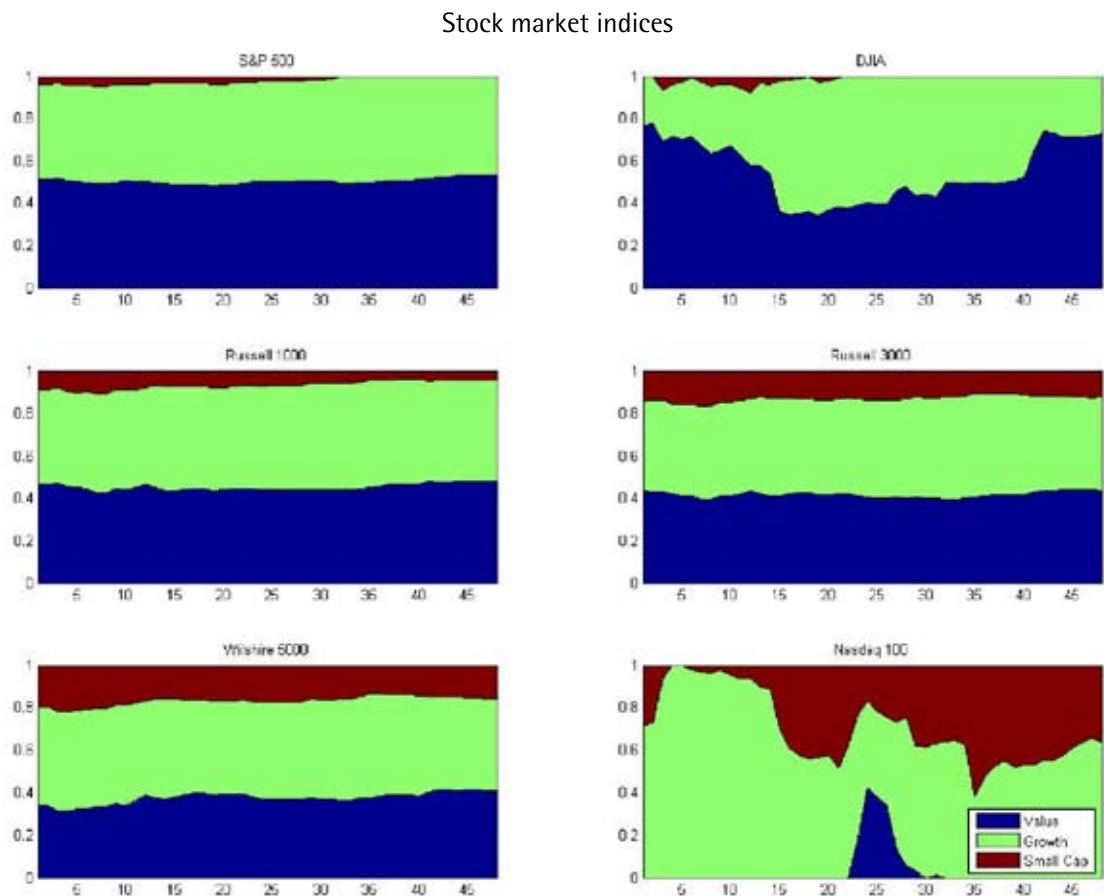
## 5. Problem of style stability

An additional problem concerning style composition is that investors typically seek stability in their exposures. Global hedge fund indices that mix the existing strategies expose investors to a given strategic allocation across styles. Although an allocation to different hedge fund strategies may not correspond to the optimal mix, given a specific investor's initial portfolio, the style composition has a tendency to vary over time. Therefore, investors are exposed to implicit allocation choices which they cannot control.

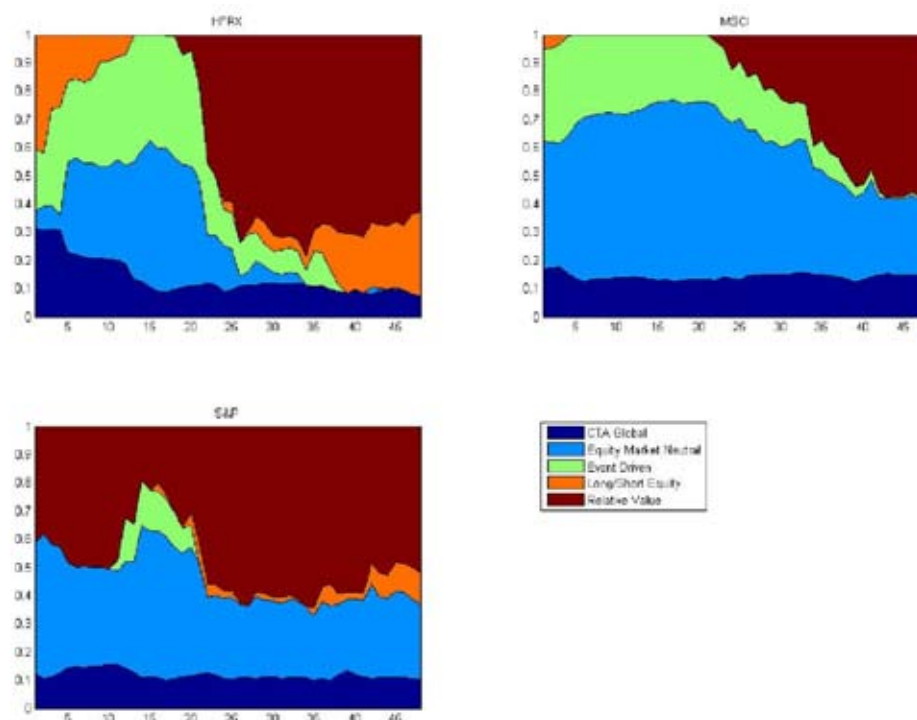
This is a serious problem from the investor's perspective, but investable style indices that track the performance of a given hedge fund strategy provide an alternative. These indices allow customised portfolios of hedge fund strategies that best suit an investor's needs to be built. In addition, the problem of style shifts also exists with broad stock market indices. In fact, while the investor may think that he holds a somewhat 'neutral' allocation, the actual style allocation may vary over time. In order to assess the magnitude of this problem, we take the stability of style exposures of global hedge fund indices and compare it to that of stock market indices

To this end, we perform a returns-based style analysis with monthly data, where we roll the data window in order to obtain the time-varying exposures. The time period is from January 2000 to December 2006. The initial calibration period is given by the first 36 months of the sample. Therefore, the time-varying exposures are observed *ex post* in each of the 48 months in the period from January 2003 to December 2006. We perform this analysis on both the US stock market indices used above and the global hedge fund indices with available data for the corresponding period, namely the global investable HFR, MSCI and S&P hedge fund indices. The results are shown in the figure below.

Figure 3: Dynamic style exposure of broad stock market indices and global hedge fund indices.



## Global hedge fund indices



The results show that there is considerable variation in style weights in both stock market indices and hedge fund indices. While some of the stock market indices have rather stable exposures to different styles, major indices like the Dow Jones Industrials and the NASDAQ 100 experience drastic variations. For example, the value exposure of the Dow Jones Industrials takes on values from 40% to 80%. Likewise, the growth exposure of the NASDAQ is between 40% and 100%. The style variations of global hedge fund indices are even more pronounced than those of the equity indices. There are also considerable differences among the HFRX, MSCI, and S&P indices, with the latter being more stable over time.

While the style instability of global hedge fund indices is a serious problem for investors, it should be noted that the same type of problem is very pronounced for equity indices as well. In addition, the existence of style shifts is an argument in favour of investable style indices—not an argument against hedge fund indices in general.

### 6. Component weighting method

The definition of a weighting scheme is often cited as a problem for hedge fund indices. Differences in the weights that are attributed to components can lead to significant differences in index performance. Of course, choosing a weighting mechanism in index construction for an index based on any asset class is always problematic. However, while there are standards for other asset classes—in particular, capitalisation weighting, which is the standard in equity index construction—hedge fund index providers must deal with a scarcity of information on assets under management and find it difficult to use capitalisation weighting.

Even in the case of equity indices, however, there are different weighting schemes. 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 is vulnerable to the argument (see, among others, Haugen and Baker 1991, Amenc, Goltz, and Le Sourd 2006, or Hsu 2006) that its mechanics lead to trend-following strategies that result in an inefficient risk-return trade-off. In reply to this criticism, equity indices with different weighting schemes have been devised: there are "fundamental-weighted" (Arnott, Hsu, and Moore 2005), "diversity-weighted" (Fernholz, Garvy, and Hannon 1998), or equal-weighted indices.

Such different weighting methods lead to considerable differences in the performance of equity indices (see Arnott, Hsu, and Moore 2005), just as with hedge fund indices. While it is somewhat understandable that discussion of these issues is less pronounced in the equity universe, where market capitalisation weighting is the *de facto* standard, the significant impact of the weighting method on the performance of indices concerns any asset class and is not specific to hedge funds.

## 7. Selection bias (component selection)

As mentioned in the introduction, the literature takes great care in spelling out the sources of selection bias of hedge fund indices. Indeed, the majority of hedge fund index providers apply selection principles to the funds in their databases in order to construct their indices. And the problem is exacerbated for investable hedge fund indices.

In principle, providers of investable indices face two problems. First, these providers have to exclude funds that are closed to new investment or have low liquidity or low investment capacity. Second, providers of investable indices have been tempted by *ex post* selection of outperforming funds, a practice that naturally leads to good *pro forma* track records but, once the results are observed out of sample, it encounters the same problems of robustness as in-sample optimisation.

The first problem may be specific to hedge fund indices, but applying selection criteria to index components is also a common practice with stock market indices. Rinaldo and Häberle (2006) show that a considerable share of index-related investment management, usually considered 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 dynamically. Likewise, criteria that require interpretation lead to discretionary decisions on index inclusion. S&P, for example, assesses the "financial viability", "adequate liquidity", and "reasonable price" of constituent companies (see the "S&P U.S. Indices Methodology", March 2006, <<http://www.standardandpoors.com>>). The Dow Jones Titans indices are subject to discretionary adjustments of components by an index committee and the Dow Jones Industrial Average even has its components selected at the discretion of the editors of the *Wall Street Journal* (see Rinaldo and Häberle 2006, table 1). For inclusion in the Dow Jones Industrial Average there are no pre-determined criteria--apart from the requirement that components be US-based.

In addition, some of the "fundamental-weighted" indices mentioned in section 2.5 actually conduct stock selection in addition to changing the weighting schemes. Among the US stock market indices that select components on fundamental criteria are the Intellidex indices published by the American Stock Exchange (see <<http://www.amex.com>>) and the Wisdom Tree indices (see <<http://www.wisdomtree.com/>>).

In addition, a large number of indices that are provided directly by stock exchanges, which are supposed to be accurate reflections of the exchanges, do not 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 unique to hedge funds.

## 8. Problem of component transparency

Replication of hedge fund indices may be a difficult task, given the opaqueness of the component list. But not even for stock market indices is full transparency automatic. For example, the full composition of MSCI Equity indices is not available free of charge to investors. Also, some of the listed property index providers do not freely disclose components and component weights to the public. In general, this problem crops up with indices that are built from proprietary databases. As the examples above show, the absence of total transparency is not a problem for hedge funds alone.

In addition, the absence of detailed information on the components does not necessarily mean that investors are left without information that is relevant for risk-management purposes. In fact, it has been argued that information on risk-factor exposure is more relevant than detailed information on components. Transparency, of course, is not an objective *per se*; it is simply a means. Indeed, it is no use seeking absolute transparency. What investors really need is enough information to assess the risk and return profile of an investment opportunity with a reasonable degree of certainty. A survey of investors and fund managers (Amenc, Malaise, and Vaissie 2005) shows that investors and managers agree on the relevance of returns-based performance indicators such as risk exposure and risk-adjusted performance, indicators that provide significant quantitative information for quality reports for end-investors without disclosing single positions, since the major indicators are calculated on the basis of past returns. For hedge fund indices, detailed reporting of performance and risk measures based on past returns may constitute a viable alternative to detailed information on index components.

### 9. Problem of diversification I: number of components

A problem that is often mentioned when discussing sufficient diversification of hedge fund indices is small number of components in the investable indices in particular. To analyse once again whether this problem is unique to hedge fund indices, we compare the number of index components of some investable hedge fund indices to that of a selection of equity indices.

**Table 3: Number of index components: Investable hedge fund indices vs. stock market indices**

Investable Hedge Fund Index	No of funds in the index	Stock Market Index	No of stocks in the index
Dow Jones	40	Dow Jones IA	30
FTSE	40	CAC40	40
CSFB/Tremont	60	Eurostoxx 50	50
MSCI	120	FTSE	100

This table shows a list of available hedge fund indices that are investable, as well as the number of components in each index. The information is taken from Goltz, Martellini, and Vaissie (2007, table 3). The HFRX index is not listed as the number of components is not disclosed. The table also shows some selected stock market indices along with the number of components

The table shows that the number of components in investable hedge fund indices is actually in the range of the number in the major stock market indices. Of course, the stock market indices included in table 3 are the narrower indices, and quite often, there are broader indices for each geographic region. However, as shown in Amenc, Goltz, and Le Sourd (2006), the narrow indices are actually the leaders in Europe in terms of market share. Therefore, most investors in traditional index funds, exchange-traded funds, or stock index futures are actually exposed to narrow indices that may not fully represent the entire stock market.

### 10. Problem of diversification II: properties of components and optimal allocation

Sufficient diversification, of course, does not depend merely on the absolute number of components, but also on the properties of these components, as well as on how these components are combined in a portfolio. Learned and Lhabitant (2002) show that there is a risk of "diversification overkill"; in fact, by increasing the number of hedge funds in a portfolio, the correlation with the general stock market increases. This "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 five to ten hedge funds are enough to reap the benefits of diversification without falling into the trap of "over-diversification".

However, the properties of the funds used must be taken into account. The table below, taken from Amenc and Goltz (2006), shows that hedge funds show less co-movement than the components of a broad stock market index. Hence, even with a small number of funds, significant diversification is possible.

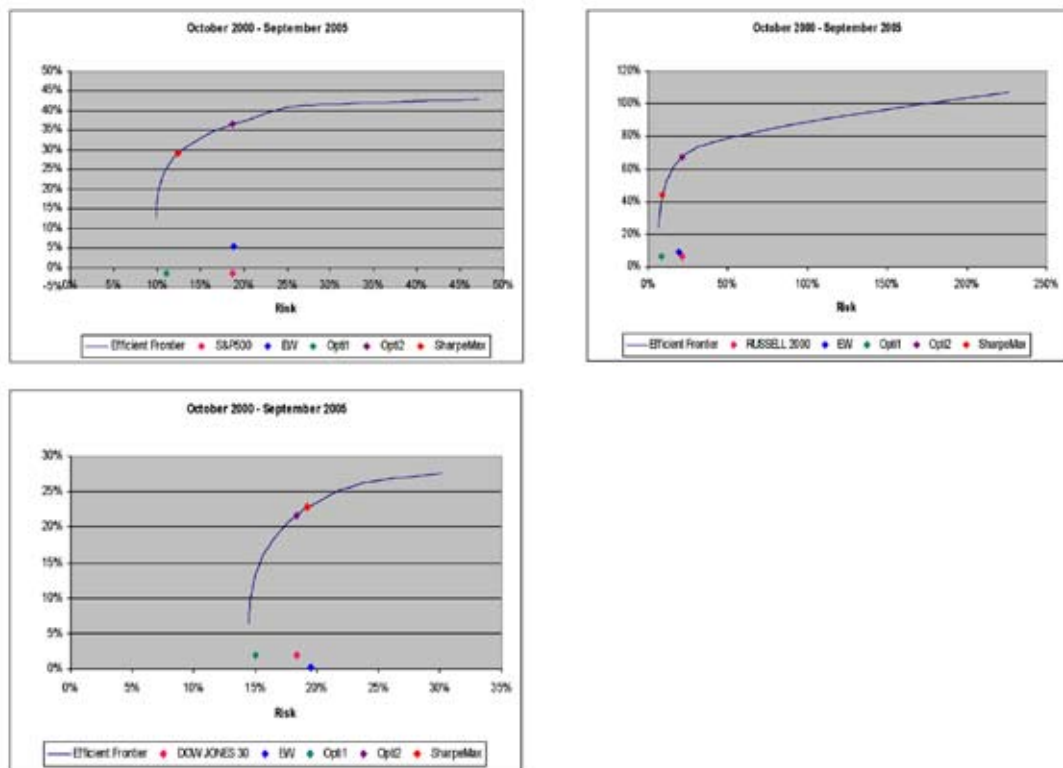
**Table 4: Co-movement between index components: hedge funds vs. stocks**

	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.

Although table 4 shows that the diversification potential among index components seems to be more pronounced for hedge funds than for stock market indices, the ultimate goal of an investor is to hold an efficient portfolio. Existing market capitalisation-weighted indices typically fail to provide the investor with such a portfolio, as shown recently in Goltz, Amenc, and Le Sourd (2006). The figure below, taken from their 2006 work, shows the relative efficiency of stock market indices by comparing their situation on the mean-variance plane with the actual efficient frontier for portfolios containing the index components. Goltz, Amenc, and Le Sourd also indicate the equally weighted portfolio and the index in the mean-variance plane. By visually comparing the index with the mean variance efficient frontier, an idea of the efficiency of the index can be had. The conclusion on the efficiency of the index will therefore depend on how close the index lies to the mean variance frontier. To compare the market index to portfolios obtained through an allocation to the different index components, they also plot another three portfolios in the mean variance plane. These are i) the portfolio with minimum risk given that it has the same return as the index and ii) the portfolio with the maximum return given that it has the same risk as the index and iii) the portfolio with the maximum Sharpe ratio. Comparing the distance with these three portfolios allows an assessment of the gain an investor can obtain in terms of the risk/return trade-off by deviating from the index using the same stocks.

**Figure 4: Optimisation of S&P 500, Russell 2000 and Dow Jones 30 for the period of October 2000 to September 2005**



Of the three indices shown here—the S&P 500, Russell 2000, and Dow Jones 30—the index farthest from the mean variance frontier is the S&P 500. It is clear then that the broad market indices are dominated in terms of efficiency not only by an optimal portfolio but also by a naïve portfolio that consists of equally weighted component stocks. It is possible to construct a portfolio made up of the market index constituents with the same

return as the index but with a lower risk (Opti 1), or with the same risk as the index but a higher return (Opti 2). In fact, the inefficiency of broad market indices is closely linked to their construction methodology, which uses market capitalisation weights and thus leads to i) a trend-following strategy by increasing the weights of stocks that perform well and ii) high concentration in a few heavyweight stocks and thus insufficient diversification.

In conclusion, it is surprising that so much attention is focussed on the possibly insufficient diversification of hedge fund indices, when completely inefficient stock market indices are widely accepted as benchmarks and/or investment media.

## 11. Problem of defunct funds

We believe that the prominence given to database biases stems from confusion over the distinction between investable and non-investable indices. Database biases are certainly worth taking into account when considering information from non-investable hedge fund indices. These indices are based on large databases of hedge fund returns and their reported performance is indeed subject to the biases mentioned above. However, these indices do not give birth to actual investment products tracking them, as it is not feasible to invest in the large number of funds that the index contains (operational limits of the index provider or funds closed to new investment). These indices are used instead to represent the broad hedge fund universe or to benchmark hedge fund performance. Therefore, the only indices that could potentially be used in the context of actual investment decisions are investable hedge fund indices. These indices typically rely on a small number of funds to allow investability. The actual track record of these investable indices corresponds to the true returns that have been generated for investors by holding the index and, in that sense, they are free of any biases. For example, a fund will be accounted for upon entering the index, with no possibility of "backfilling". Likewise, defunct funds are necessarily excluded from investable hedge fund indices as soon as the fund goes defunct. Excluding 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.

The 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 the 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 aim—to represent the investable (and observable) part of the hedge fund universe rather than the (unobserved) entire hedge fund universe. In short, the omission of assets is a generic problem with any index: one may as well blame stock market indices for not including stocks that have been delisted or stocks that are to be listed in the future!

The following table illustrates how stock market indices deal with removal issues.

**Table 5: Removal criteria for popular stock market indices (Source: Credit Suisse Tremont 2006)**

Index	Stoxx 50	S&P 500
Removal Criteria	<p>Bankrupt companies have the option to be removed immediately from the index if their illiquidity is due to (1) not being traded for ten consecutive days, (2) being suspended from trading, or (3) ongoing bankruptcy proceedings. Changes are announced immediately, implemented two days later, and become effective the trading day after implementation</p>	<p>The S&amp;P 500 Committee will review companies on the S&amp;P 500 that liquidate, as shares decrease. Liquidity concerns can be used as a reason to eliminate poor performing companies.</p>

It is clear that even leading stock market indices reserve the right to exclude "poor performing" or defunct companies. While it is of great interest to require high standards from index providers in dealing with these data issues, why hedge fund indices should be treated any differently from other indices with respect to requirements spelled out by the regulator is a mystery.

## Conclusions

While we agree that hedge fund indices have numerous problems, we point out in this paper that

- 1) there are solutions that allow truly representative investable hedge fund indices to be constructed and most importantly
- 2) these problems are not specific to hedge funds.

Therefore, it is perhaps surprising that many investors and regulators reject the usefulness of hedge fund indices. This document shows that indices for other asset classes, stock market indices in particular, encounter the same problems encountered by hedge fund indices. It is unclear on what basis hedge fund indices should be subject to discrimination.

We have also pointed out that a distinction should be made between investable and non-investable and between strategy indices and global hedge fund indices. In particular, we have pointed out that numerous problems identified in the literature are in fact related to non-investable indices. Investable indices avoid certain database problems and can be made representative, as long as an appropriate construction methodology is used. It is of course obvious that such aggregates as global hedge fund indices cannot claim to be truly representative of the entire hedge fund universe, but representativity can be achieved for a given hedge fund strategy. Therefore, we argue that investable hedge fund strategy indices are a useful tool in asset allocation and performance analysis.

Suffering from a lack of official recognition, hedge fund indices do not currently enjoy the status of a major benchmark 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 on short-term treasury bills or money market instruments. This choice is the worst of all choices, as it assumes that hedge funds are completely free of systematic risk exposures. It leads to performance measures that lack any pertinence and it leads investors into the error of omitting to balance returns against the associated risk exposure. Establishing hedge fund indices as truly recognised benchmarks would therefore be an important step towards informing investors on the level of risk in hedge fund products.

Rather than denying official recognition for any hedge fund index, a more promising approach would accept hedge fund indices in principle and require a number of quality criteria, including:

- Transparency of the method
- A method 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

Ensuring the respect of certain quality criteria for hedge fund indices is surely more convincing than rejecting hedge fund indices on the basis of their shortcomings or accepting all hedge fund indices without considering the specific quality of each index. The widespread adoption of high-quality hedge fund indices for investment and risk analysis would mean great progress towards investor awareness of the risks in hedge fund products.

## References

- Amenc, N., P. Malaise and M. Vaissié, (2005), EDHEC Funds of Hedge Funds Reporting Survey, EDHEC Publication.
- 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.
- Amenc, N., L. Martellini, and M. Vaissié, (2004), "Indexing Hedge Fund Indices", in *Intelligent Hedge Fund Investing*, ed. Barry Schachter, Risk Books.
- Arnott, R.D., J. Hsu, and P. Moore, (2005), "Fundamental Indexation", *Financial Analysts Journal* 60(2), 83-99.
- Brooks, C. and H. Kat, (2002), "The statistical properties of hedge fund index returns and their implications for investors", *Journal of Alternative Investments*, 5 (2).
- Brown, S.J., W. Goetzmann, and R. Ibbotson, (1999), "Offshore Hedge Funds: Survival & Performance" 1989-95, *Journal of Business*, Vol. 72, N°1 (January), p.91-118.
- Committee of European Securities Regulators, (2006), CESR's Issues Paper: "Can hedge fund indices be classified as financial indices for the purpose of UCITS?", Ref: CESR/06-530, October 2006
- Credit Suisse Tremont, (2006), Response to CESR's Issues Paper, working paper
- EDHEC, (2005), EDHEC European Alternative Diversification Practices Survey, EDHEC Risk & Asset Management Research Centre.
- Fernholz, R., R. Garvy, and J. Hannon, (1998), "Diversity-Weighted Indexing", *Journal of Portfolio Management*, 24(2), 74-82.
- Fung, W., and D. A. Hsieh, (2000), "Performance characteristics of hedge funds and CTA funds: natural versus spurious biases", *Journal of Financial and Quantitative Analysis*, 35 (3), 291-307.
- Fung, W., and D. A. Hsieh, (2001), "The risk in hedge fund strategies: theory and evidence from trend followers", *Review of Financial Studies*, 14 (2), 313-341.
- Fung, W., and D. A. Hsieh, (2004), "Hedge Fund Benchmarks: A Risk-Based Approach", *Financial Analysts Journal*, Vol. 60 Issue 5, pp. 65-80.
- Goltz, F., L. Martellini, and M. Vaissié, (2007), "Hedge Fund Indices: Reconciling Investability and Representativity", *European Financial Management*.
- 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., (2001), "Assessing Market Risk for Hedge Funds and Hedge Funds Portfolios", *Journal of Risk Finance*, Spring 2001, p.1-17.
- Lhabitant, F.S, and M. Learned, (2002), "Hedge Fund Diversification: How Much is Enough?", *The Journal of Alternative Investments*, winter, vol. 5 (3).
- Lhabitant, F.S., (2004), "Evaluating Hedge Fund Investments: The Role of Pure Style Indices", in *Intelligent Hedge Fund Investing, Successfully Avoiding Pitfalls through Better Risk Evaluation*, B. Schachter (ed), Risk Books.
- Lhabitant, F.S, (2007), "Hedge Fund Indices for Retail Investors: UCITS Eligible or not Eligible?", *Derivatives Use, Trading and Regulation*, 12, 275-289.

- Liang, B., (2000), "Hedge Funds: The Living and the Dead", *Journal of Financial and Quantitative Analysis* Vol. 35, p.309-326,
- Liang, B., (2001), "Hedge fund performance: 1990-1999", *Financial Analysts Journal*, January/February, 11-18.
- Malkiel, B., (1995), "Returns from Investing in Equity Mutual Funds 1971 to 1991", *Journal of Finance*, Vol. 50, N°2 (June), p.549-572.
- Posthuma, N. and Van der Sluis, P. J., (2003), "A Reality Check on Hedge Fund Returns", unpublished manuscript.
- Rinaldo, A., and R. Häberle, (2006), "Wolf in Sheep's Clothing: the Active Investment Strategies behind Index Performance", working paper, UBS AG
- Strongin, S., M. Petsch, and G. Sharenow, (2000), "Beating Benchmarks", *Journal of Portfolio Management*, 26(4)