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Performance evaluation of hedge funds: comparison of different approaches using European data

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Abstract

The standard approach to the evaluation of funds assumes a normal return distribution and uses the variance as a measure of the funds risk. A few characteristics of hedge funds, such as the remuneration mechanism of the portfolio manager, make this assumption unacceptable and the traditional approach of Risk Adjusted Performance (RAP) must be revised before applying it to hedge funds. Some authors define a number of different RAP measures that attempt to overcome the problem related to the lack of normality: new RAPs are characterized by a more detailed return distribution analysis that does not consider only the first two moments of the distribution. A higher computational complexity may only be reasonable if selections founded on new RAPs permit to identify better investment opportunities than those selected with standard RAPs.

This work analyses different approaches proposed with a view to calculating the RAP for hedge funds and evaluates advantages and limits of each proposed measure. An application of these measures to the European hedge funds market is proposed in order to demonstrate the usefulness of new approaches. An empirical analysis studies differences in funds classification based on different measures and demonstrates that the standard RAP approach is unable to identify the best performing hedge funds.

1. Introduction

"Hedge fund" is a term used to define heterogeneous types of financial instruments characterized by the fact that the fund manager is subject to less limitations in selecting investments.[1] Hedge funds may be defined as an investment partnership that could take long and short positions[2] and is not subject to the information disclosure rules that are established for other investment funds.[3]

A distinctive characteristic of hedge funds is the active strategy adopted by the fund manager who tries to obtain the best result from all investment opportunities using instruments that are not available to other funds managers.[4]

The first hedge fund was instituted by Alfred Jones in 1949.[5] The development of the financial instrument was not stopped by the failure of some big hedge funds[6] and, in the Nineties, the instrument began to be negotiated all over the world.[7] Starting from the Nineties, different types of hedge funds characterized by different managers' styles were developed and today's investors can select among a variety of different solutions.[8] The universe of hedge funds is characterized by a

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[1] Pia P. (2002), *Hedge funds: fondi di copertura o fondi speculativi?*, Giappichelli editore, Torino, pp. 15-30

[2] Maugain O. (2001), *The evaluation of hedge funds*, working paper

[3] Liang B. (2003), "Hedge fund returns: auditing and accuracy", *Journal of Portfolio Management*, vol. 29, pp. 111-122

[4] Agarwal V. and Naik N.Y. (2004), "Risk and portfolio decisions involving hedge funds", *Review of Financial Studies*, vol. 17, pp. 63-98

[5] Lazzari V. (2000), "Economia e finanza degli hedge funds", *Banche, Imprese e Società*, vol. 3, pp. 383-413

[6] Jorion P. (1999), "Risk management lessons from Long Term Capital Management", *European Financial Management*, vol. 6, pp. 277-300

[7] Ineichen, A. (2000), *In search of Alpha: Investing in Hedge Funds*, Global Equity Research working paper

[8] Capocci D., Corhay A. and Hubner G. (2003), *Hedge funds performance and persistence in bull and bear markets*, working paper

significant heterogeneity in styles adopted by managers[9] that can influence the performance of the funds: empirical evidences demonstrate that mean returns of funds managed by managers that adopt different styles are not correlated.[10]
The diffusion of hedge funds can be explained analysing the correlation of these new assets with other assets available: the performance of these types of funds is not strictly related to the stock[11] and the bond market dynamics[12] and the choice to include this asset in a well-diversified portfolio allow reducing the overall portfolio risk. [13]
The lack of correlation between hedge funds and other financial instruments can be explained by taking into account the greater complexity of performance evaluation models proposed for these financial instruments. [14] Models proposed in literature demonstrate that hedge funds dynamics cannot be explained using only a single benchmark and it is necessary to decompose the performance into a group of heterogeneous factors.[15]
Differences in determinants of hedge funds performance point to the need to use evaluation measures specifically studied for this type of instrument. In fact, standard approaches used to analyze investment funds may be misleading and a reformulation of these methodologies is necessary to consider characteristics that make hedge funds different.[16]
This paper proposes a critical analysis of the Risk Adjusted Performance (RAP) approaches. The aim of the work is to present new approaches proposed to study these instruments and to verify if the new measures being proposed are more useful than standard approaches to select hedge funds. The study points to differences in hedge funds classifications realised with different RAPs and endeavours to identify the best one to select the best-performing funds in the time period being analysed or in particular market phases. The analysis of the European market demonstrates the incapability of standard approaches to evaluate hedge funds.
The next section analyses classical and new RAPs, explaining standard measures, their limits in evaluating hedge funds and new measures proposed to examine these particular instruments. The last section endeavours to verify if new measures overcome the limits of the standard approach using a sample of European hedge funds.

2. Literature Review

The performance evaluation allows to select assets that best fit investor's preferences and to modify the portfolio in response to new opportunities available on the market.[17]
The fund selection must consider possible gains related to the investment and the risk exposure necessary to achieve these results. [18] The RAP approach represents a solution to summarize the risk-performance profile of the instrument in a unique number that is easy to understand for all investors.

[9] Mc Fall Lamm R. Jr. (2003), "Asymmetric returns and optimal hedge fund portfolio", *Journal of Alternative Investment*, vol. 6, pp. 9-21
[10] Anjivel S.I., Boudreu B.E., Perskin M.W. and Urias M.S. (2000) *Why hedge funds make sense*, Quantitative Strategies Research Memorandum, Morgan Stanley
[11] Kouwenberg R. (2002), "Do hedge funds add value to a passive portfolio? Correcting for non normal returns and disappearing funds", *Journal of Asset Management*, vol. 3-4, pp. 361-382
[12] Ennis Krupp & Associates (2003), *A critical look at the case for Hedge Funds: lessons from the bubble*, Ennis Knupp & Associates research paper
[13] Bacmann J.F. and Gawron G. (2004), *Fat tail risk in portfolios of hedge funds and traditionally investments*, RMF research paper
[14] Nanes E. (2002), *Hedge funds: What are they? Why the attraction?*, CIC research paper
[15] Capocci D. (2001), "An analysis of hedge funds performance", *Journal of Empirical Finance*, vol. 11, pp. 55-89
[16] Getmansky M., Lo A.W. and Makarov I. (2004), "An econometric model of serial correlation and illiquidity in the hedge fund returns", *Journal of Financial Economics*, vol. 74, pp. 529-609
[17] Fuller R.J. e Farrel J.L. Jr. (1993), *Analisi degli investimenti finanziari*, McGraw Hill, Milano, pp. 67-90
[18] Sharpe W.F. (1966), "Mutual fund performance", *Journal of Business*, vol. 39, pp. 119-138

The choice among investment opportunities is based on past performance achieved by instruments and results obtained with these approaches could only be considered rational if results are time persistent.
Empirical analyses demonstrate that selections founded on RAP approaches are better than simpler funds selections founded on past gains.[19] However, results obtained with these approaches could be correct only if the analysis is released using a large database: in fact, long time series allow to evaluate an historical trend in the performance of funds managers and to discriminate between good and lucky managers.[20]

2.1. Risk Adjusted Performance approach to fund valuation

The RAP approach allows summarizing the risk and the return profile of an investment in a score that could be used to compare different funds.[21] Generically a RAP is defined as:

$$RAP = f(gains) - f(risk)$$

Normally, a higher measure value identifies better solutions for a typical investor that is supposed to be risk-averter.
The first type of utility-based RAP measures allows selecting the optimal fund for the investor analysing its utility function. The general formulation is:

$$RAP = U(gains) - U(risk)$$

Best funds are those that give the possibility to achieve the higher utility level for the investor but the results obtained with this approach are highly influenced by hypothesis assumed to define the shape of the utility function. In fact, the type of utility function is defined arbitrary by the evaluator and results of funds selection are highly influenced by this choice.[22]
The second one – the scale-independent RAP - can be formulated in different ways and in literature there are different approaches that can be particular useful to evaluate some types of funds or to consider a particular aspect of some funds. The main difference among these measures can be identified in the type of return and risk measures utilized:

- The Sharpe ratio[23] and Modigliani's RAP[24] use the same risk and return measure. These RAPs compare the fund performance with the risk-free rate of return and analyze the opportunity cost of investing in the funds market. The risk measure utilized is the standard deviation of gains.
- The Information Ratio compares the performance of funds with a benchmark that is characterized by a similar risk exposure and uses as a measure of risk the standard deviation of these tracking errors. [25]

[19] Blake C.R., Elton E.J. and Gruber M.J. (1996), "The persistence of risk adjusted mutual fund performance", *Journal of Business*, vol. 69, pp. 133-157
[20] Abernathy J.D. and Weisman A.B. (2000), *The danger of historical hedge fund data*, working paper
[21] Colombini F., Mancini A. and Mannucci S. (2003), *La performance dei fondi comuni di investimento*, Edibank, Milano, pp. 81-149
[22] Carluccio E.M. (1999), *Strategie, benchmarking e performance nell'asset management*, Bancaria Editrice, Milano, pp. 119-170
[23] Sharpe W.F. (1994), "The Sharpe ratio", *The Journal of Portfolio Management*, vol. 21, pp. 49-58
[24] Modigliani F. e Modigliani L. (1997), "Risk-adjusted performance", *The Journal of Portfolio Management*, vol. 2, pp 45-54
[25] Goodwin T. (1998), "The Information ratio", *Financial Analyst Journal*, vol. 54, pp. 34-43

- The Treynor Index analyzes the same return profile considered by the Information ratio but uses another measure of risk, the *Beta*.[26] The fund selection based on this measure is useful to evaluate the impact of the inclusion of a particular fund in a well-diversified portfolio.[27]
- The Sortino Index analyzes only the negative performance of a fund in the evaluation period as a measure of the risk related to the investment. This RAP is calculated as the ratio of the mean excess return over the risk free-rate on the standard deviation of losses recorded in the evaluation period. [28]
- Jensen's Alfa measures the excess return of the fund on the theoretical return calculated for an asset with similar risk. [29]

All these RAPs are based on the assumption of a normal return distribution. This assumption is useful to define a theoretical model because it permits to describe the distribution using only the first two moments. The simplification assumed in those formulas do not make standard RAP approaches appropriate for instruments characterized by a non-normal distribution because results obtained for these funds tend to underestimate or overestimate the performance. [30]
Other hypotheses beside this approach are as follows:

- investors' choices are realised using a mean-variance approach; [31]
- market risk is the only source of risk for the investment analysed. [32]

2.2. Limits of standard Risk Adjusted Performance on Hedge funds

The analysis of the performance of hedge funds demonstrates that these instruments achieve different results in comparison with other funds traded on the same market.[33] The analysis of the impact of the characteristics of the funds and the qualities of the managers on the fund performance highlights that hedge funds have distinctive characteristics.[34] The different results achieved can be explained analysing different constraints that the fund manager is submitted to. In fact, in the hedge fund scenario:

- there is the possibility of using leverage;[35]
- there are no restrictions to invest in a particular type of assets;[36]
- the manager can make a long term planning for investments without considering the possibility of withdrawals of investments that are limited by the fund regulations;[37]
- fees corresponded to the manager are partially fixed but substantially related to absolute performance; [38]

[26] Treynor J. (1965), "How to rate Management of investment funds", *Harward Business Review*, vol. 44, pp. 131-136
[27] Essayyad M. and Srivastava S.C. (1994), "Investing a new methodology for ranking international mutual funds", *Journal of Economics and Finance*, vol. 18, pp. 241-260
[28] Sortino F.A. e Forsey H.J. (1996), "On the use and measure of downside risk", *The Journal of Portfolio Management*, vol. 22, pp.35-42
[29] Jensen M.C. (1968), "The performance of mutual funds in the period 1945-1964", *Journal of Finance*, vol. 23, pp. 28-30
[30] Chen K. and Passow A. (2003), *Quantitative selection of long-short hedge funds*, FAME working paper
[31] Hubner G. (2000), *Horizon risk and asset pricing*, GEMME working paper
[32] Klemkosky R.C. (1973), "The bias in composite performance measurement", *Journal of Financial and Quantitative Analysis*, vol. 8, pp. 505-514
[33] Ackermann C., McEnally R and Ravenscrat D. (1999), "The performance of hedge funds: risk, returns and incentives" *Journal of Finance*, vol. 53, pp. 833-874
[34] Boyson N.M. (2003), *Why do experienced hedge fund managers have lower returns*, EDHEC working paper
[35] Fung W. and Hsieh D.A. (1999), "A primer on hedge funds", *Journal of Empirical Finance*, vol. 6, pp. 309-331
[36] Bing L. (1998), *On the performance of hedge funds*, working paper
[37] Tsatsaronis K. (2000), "Hedge funds", *BIS Quarterly Review*, vol. 61, pp. 61-71

- fees computation is released considering past performance and frequently higher fees are paid to managers that achieve higher results than those realized in the past; [39]
- are potentially more financial skilled because the instrument is reserved to wealthy individuals; [40]
- it requires a manager's participation in the investment.[41]

These differences make a hedge fund a unique instrument and, probably, the lack of normality of its return distribution could be considered a consequence of these characteristics.[42] The typical return distribution for this instrument is negatively skewed and leptokurtic [43] and, frequently, the performance differs significantly form the expected value.[44]
Factor model regressions of hedge funds performance highlight that these instruments are more complex than other mutual funds[45] and it is not reasonable to assume that the only risk factor related to this investment can be identified in the market risk.[46]
The non-normality makes the standard RAP approach useless for selecting hedge funds and highlights the need to see to a reformulation of measures proposed for the performance evaluation.[47]

2.3. New Risk Adjusted Performance being proposed

New RAPs proposed to evaluate hedge funds are particular measures that don't assume the normality hypothesis for return distribution.
First contributions tempt to modify classical measures to evaluate hedge funds considering the autocorrelation of hedge funds returns[48] or substituting the standard deviation with a risk measure founded on VAR.[49]
The new RAPs being proposed are not only a reappraisal of the standard approach, as they also analyze different aspects that can be evaluated only using different information that is not considered in the standard approach. These RAPs could be, as the standard RAP approach, utility-based or scale-independent.
The new utility-based RAPs are:

- The Q-ratio analyses the impact of the inclusion of hedge funds in a well-diversified portfolio and verifies the possible impact of this new instrument on the investor's utility function considering the possible correlation on portfolio assets.[50]
- The AIRAP is a measure that considers the impact of particular characteristics of hedge funds and their impact on the investor utility function. It considers the fund leverage, investors' preferences and the non-normality of the return distribution.[51]

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[38] Brown S.H., Goetzmann W.N and Ibbotson. R.G. (1998), "Offshore hedge funds: survival & performance 1989-1995", *Journal of Business*, vol. 72, pp. 91-117
[39] Boido C. e Riente E. (2004), "Hedge fund: dal mito alla realtà", *Banche e Banchieri*, vol. 5, pp. 406-420
[40] Das N., Kish R.J. Muething D.L. e Taylor L.W. (2002), *An overview of hedge fund industry*, working paper
[41] Kouwenberg R and Ziemba W. (2003), *Incentives and risk taking in hedge funds*, working paper
[42] Moix P. and Schmidhuber C. (2001), "Fat tail risk: the case for hedge funds (part I)", *AIMA Newsletter*, vol. 9
[43] Favre-Bulle A. e Pache S. (2003), *The omega measure: hedge fund portfolio optimization*, EDHEC working paper
[44] Favre L. and Ranaldo A. (2003), *How to price hedge fund: from two- to four- moment CAPM*, EDHEC working paper
[45] Fung W. and Hsieh D.H. (2002), "Asset-based style factors for hedge funds", *Financial Analyst Journal*, vol. 58, pp. 16-27
[46] Schneeweis T. and Spurgin R. (1996), *Multi-factor models in managed futures, hedge funds and mutual fund return estimation*, working paper
[47] Rovera C. (2005), *Rischio e rendimento degli hedge funds*, Giappichelli Editore, Torino, pp. 3-120
[48] Gehin W. (2004), *A survey of the literature on hedge fund performance*, EDHEC working paper
[49] Gregoriou G. N. and Gueyie J. P. (2003),"Risk Adjusted Performance of Funds of Hedge Funds Using a Modified Sharpe Ratio", *Journal of Wealth Management*, vol. 6, pp. 77-83
[50] Gulko L. (2003), "Performance Metrics for Hedge Funds", *Journal of Alternative Investments*, vol. 5, pp. 88-95

These new approaches consider all moments of the returns' distribution but results obtained are extremely sensitive to the choice of the utility function.
A more objective approach is founded on new scale-independent RAPs:

- The Stutzer index is a measure that considers also the skewness and the kurtosis of the return distribution and penalizes distributions characterized by negative skewness and high kurtosis.[52]
- The Omega function considers all higher moments of return distributions and provides full characterisation of the risk reward characteristics of the distribution. It is calculated as a ratio of total gains to total losses related to the investment in a hedge fund for the time period being analysed.[53]
- The Sharpe Omega uses the same approach as the Sharpe ratio but the risk measure is estimated analysing the Omega function. [54]
- The Kappa represents a modified Sortino Ratio that uses as a measure of the fund gains the excess return of the fund with respect to the minimum return that is acceptable for the investor. The RAP is calculated as the ratio of this difference to the lower partial moment of the return distribution. [55]
- The D-Ratio does not consider the moments of the returns distribution and classifies funds on the basis of the frequency of losses and gains. Hedge funds rankings area realised taking into account the ratio of positive and negative performances achieved in time period analyzed.[56]
- The ROAS and the ROPS use the same approach proposed by Sharpe for the performance measure, the mean excess return of the hedge funds performance on the risk-free rate, but use a different risk measure: the first one uses the absolute shortfall and the second one uses the probability of losses.[57]
- The Hurst Ratio is a measure of the persistence of the time series that can be useful to evaluate the validity of a performance evaluation based on historical data. The Hurst ratio is useful to distinguish the good portfolio manager from among other portfolio managers that are only lucky. [58]
- The Calmar Ratio and the Sterling Ratio are computed considering another risk measure, the potential maximum loss related to a specific investment.[59] The Calmar ratio is calculated as the ratio of mean return over the maximum drawdown and the Sterling ratio is the same measure evaluated using a smoothed maximum drawdown.[60]

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[51] Sharma M. (2004), "A.I.R.A.P.- Alternative RAPMs for alternative investments", *Journal of Investment Management*, vol. 2, pp. 34-65
[52] Bacmann J.F. and Scholz S. (2003), "Alternative Performance Measures for Hedge Funds", *AIMA Journal*, vol. 1, pp. 1-9
[53] Keating C. and Shadwick W.F. (2002), "A universal performance measure", *Journal of Performance Measurement*, vol. 6, n°3
[54] Kazemi H., Schneweis T. and Gupta R. (2003), *Omega as a performance measure*, EHDEC working paper
[55] Kaplan P.D. e Knowels J.A. (2004), *Kappa: a generalized downside risk-adjusted performance measure*, *Journal of Performance Measurement*, vol. 8, n°3
[56] Koh F., Lee D. e Kok Fai P. (2002), *Investing in hedge funds: risk, return and pitfalls*, working paper
[57] Koh F., Lee D. e Kok Fai P. (2002), *Investing in hedge funds: risk, return and pitfalls*, working paper
[58] Amenc N., El Bied S. and Martellini L. (2002), *Evidence of Predictability in Hedge Fund Returns and Multi-Style Multi-Class Tactical Style Allocation Decisions*, working paper
[59] Braga M.D. (2001), "Problematiche di performance measurement nell'hedge fund industry", *Lettera Newfin*, vol. 14, n° 2
[60] Pedersen C.S. e Rudholm-Alfvin T. (2003), "Selecting a risk-adjusted shareholder performance measure", *Journal of Asset Management*, vol. 4, pp. 152-172

These approaches are more complex than the standard RAP used to evaluate other funds and the information needed to select the best fund available is more detailed. New measures are not easy to calculate and one needs to evaluate if the sophistication of the approach guarantees a return that justifies a more detailed analysis.

3. Research design

The study considers the performance achieved by hedge funds and evaluates their risk-performance profile using classical and new RAPs. The purpose of the analysis is to evaluate benefits related to new approaches and to verify if these new measures are indeed a useful instrument to select hedge funds.
In the analysis, utility-based RAPs are excluded from the empirical analysis because no generic utility function is available and results obtained with these measures are highly influenced by the type of function selected. The aim of the work is to verify the superiority of new RAPs to evaluate this type of funds and the unavailability of a standard utility function make these measures useless to define a ranking of different RAPs.
The approach proposed in this study considers the classification based on each scale-independent RAP and tries to identify the RAP that defines a better and more stationary classification of hedge funds. In order to verify the superiority of new measures, the selection capability of these new measures is analysed and the results obtained with different RAP criteria are compared. The study of the results that are obtained is finalized by a more detailed analysis of RAP performance that permits to verify the usefulness of different measures in different market phases (bull and bear market) and the persistence of rankings defined with each RAP.

3.1. Data

The characteristics of the instrument make it impossible to perform an analysis on all the available hedge funds: managers are entitled to limit the availability of data about the funds being managed and, therefore, all databases must be considered only partially reprehensive. [61] (Table 1)

Table 1.

Top data vendors for Hedge Funds on the basis of funds' coverage

Database	N° Hedge Funds considered	Web site
Van Hedge Funds Advisors International	> 6000	www.vanhedge.com
Tass/Tremont	> 3000	www.hedgeindex.com
Hennessee Group	> 3000	www.hennesseegroup.com
Hedgefund.net	> 3700	www.hedgefund.net
Zurich Capital Markets	> 1500	www.marhedge.com
Hedge Fund Research	> 1300	www.hfr.com
Investor Force	< 1000	www.altvest.com

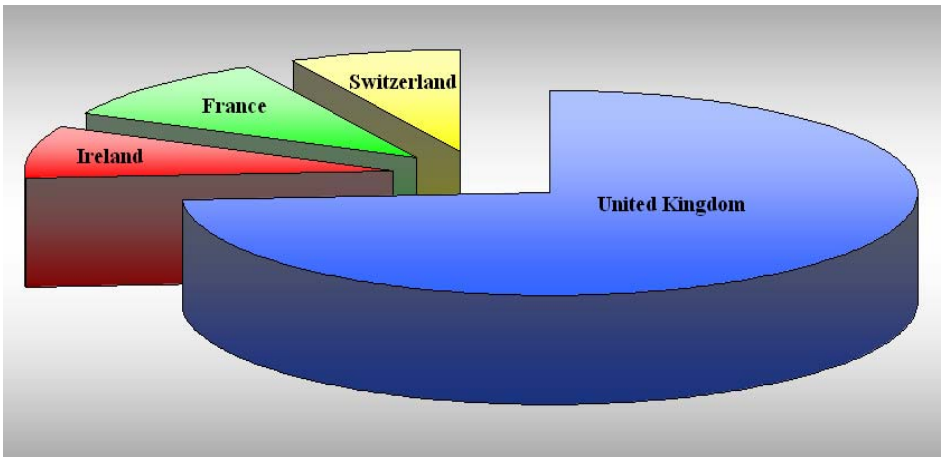
Source: Author's elaboration on data vendors' information

[61] Posthuma N. and Van der Sluis P.J. (2003), *A reality check on hedge fund returns*, working paper

A hedge fund is reported in no more than one or two databases offered by data vendors and, therefore, one needs to select the database that offers the highest coverage for the market being analysed.[62]
The analysis being proposed does not consider the American market, the biggest world market, although it analyses major European markets where hedge funds are traded. The choice of selecting European hedge funds allows the definition of a more comprehensive database of all the instruments traded because, even if the market is on the increase, the number of funds offered today on the market is lower than the number of those being offered in the United States.[63] The sample includes 556 hedge funds traded in at least one of the following countries: England, France, Ireland and Switzerland. (Figure 1)

Figure 1.

Sample Description



Data are collected using the two major data sources for the hedge fund market, Hedge Index Tass/Tremont and Hedgefund.net.[64] These databases are selected from among other data collectors because they offer a more comprehensive data set on the European market. The sample includes daily historical quotations of major funds traded in the four markets for the 1993-2003 period and considers all the funds, regardless of the year when they were set up. The sample is not affected by survivorship bias because none of the selected funds expires before the end of the time horizon being considered.[65]

3.2. Comparison among Risk Adjusted Performance classifications of hedge funds

The analysis of the usefulness of new RAPs is carried out considering differential capabilities of standard RAPs and new RAPs to identify the best performing hedge funds. The first aspect being analysed is the capability of the different RAPs to select funds that, in the future, will achieve the

[62] Kat H.M. (2003), "10 things that investors should know about hedge funds", *Institutional Investor*, pp. 72-81
[63] Amin G.S. and Kat H.M. (2003), "Hedge funds performance 1990-2000: do the money machine really add value?", *Journal of Financial and Quantitative Analysis*, vol. 38, pp. 251-274
[64] For a more detailed analysis of hedge funds' data collectors see Brooks C. and Kat H.M. (2001), "The statistical properties of hedge fund index returns and their implications for investors" , *Journal of Alternative Investments*, vol. 5, pp. 26-44
[65] For a more detailed analysis of the relevance of survivorship bias in the hedge fund market see Koh F., Koh W.T.H and Teoh M. (2003), *Asian hedge funds: return persistence, style and fund characteristics*, working paper

best performance. In order to evaluate the selection capability, results achieved one year later by the funds recognized as the best using a particular RAP are compared with the performance of other funds.

The analysis presented above studies the mean return and the maximum/minimum results obtained for each year for the two subgroups of hedge funds created using a 50% threshold: the subgroup High is composed by the hedge funds that in the previous year had a RAP value higher than the mean value and the subgroup Low is the residual group. (Tables 2 and 3)

Table 2.

Standard RAP measures as instruments to predict future performance of hedge funds

Old RAP measure	Level	Statistic	R_{94}	R_{95}	R_{96}	R_{97}	R_{98}	R_{99}	R_{00}	R_{01}	R_{02}	R_{03}
Sharpe $_{t-1}$	High	Mean	-0.53	1.32	1.75	1.75	-0.02	2.44	0.95	0.66	0.57	1.05
		Max	3.71	4.29	4.34	11.71	10.49	32.54	12.71	13.31	5.05	9.03
		Min	-0.47	-0.47	0.13	-1.19	-12.74	-0.45	-5.10	-1.46	-4.09	-2.52
	Low	Mean	0.29	1.08	1.34	1.50	-1.72	3.17	1.47	0.51	0.10	0.83
		Max	0.61	2.79	4.46	3.72	3.30	17.32	7.11	5.42	3.06	7.23
		Min	-0.03	-0.48	0.13	0.65	-7.52	-1.66	-0.75	-6.67	-4.27	-1.86
Rap $_{t-1}$	High	Mean	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09	0.04
		Min	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03	0.00
	Low	Mean	0.01	0.01	0.01	0.00	0.03	0.01	0.00	0.00	0.01	0.01
		Max	0.03	0.04	0.02	0.03	0.17	0.02	0.05	0.02	0.07	0.03
		Min	0.00	0.00	0.01	-0.06	-0.02	-0.01	-0.07	-0.04	-0.02	0.00
Information Ratio $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.05	0.05	0.09
		Min	-0.04	0.00	0.01	0.00	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
	Low	Mean	0.00	0.01	0.01	0.01	0.00	0.04	0.01	0.00	0.00	0.01
		Max	0.00	0.03	0.04	0.06	0.03	0.17	0.05	0.13	0.02	0.07
		Min	0.00	0.00	0.00	-0.01	-0.08	-0.02	-0.01	-0.07	-0.04	-0.02
Sortino $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
	Low	Mean	0.00	0.01	0.01	0.01	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.01	0.03	0.04	0.02	0.03	0.17	0.02	0.05	0.02	0.07
		Min	0.00	0.00	0.00	0.01	-0.06	-0.02	-0.01	-0.07	-0.04	-0.02
Treynor $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
	Low	Mean	0.00	0.01	0.02	0.02	-0.01	0.04	0.01	0.00	0.00	0.01
		Max	0.00	0.03	0.02	0.02	0.01	0.17	0.02	0.02	0.02	0.07
		Min	0.00	0.00	0.00	0.02	-0.06	-0.02	0.00	-0.07	-0.04	-0.02
Jensen $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.07	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	0.00	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
	Low	Mean	0.00	0.01	0.02	0.01	-0.01	0.03	0.01	0.00	0.00	0.01
		Max	0.01	0.03	0.04	0.03	0.06	0.11	0.13	0.05	0.02	0.07
		Min	0.00	0.00	0.00	-0.01	-0.11	-0.02	-0.02	-0.07	-0.04	-0.02

Table 3.

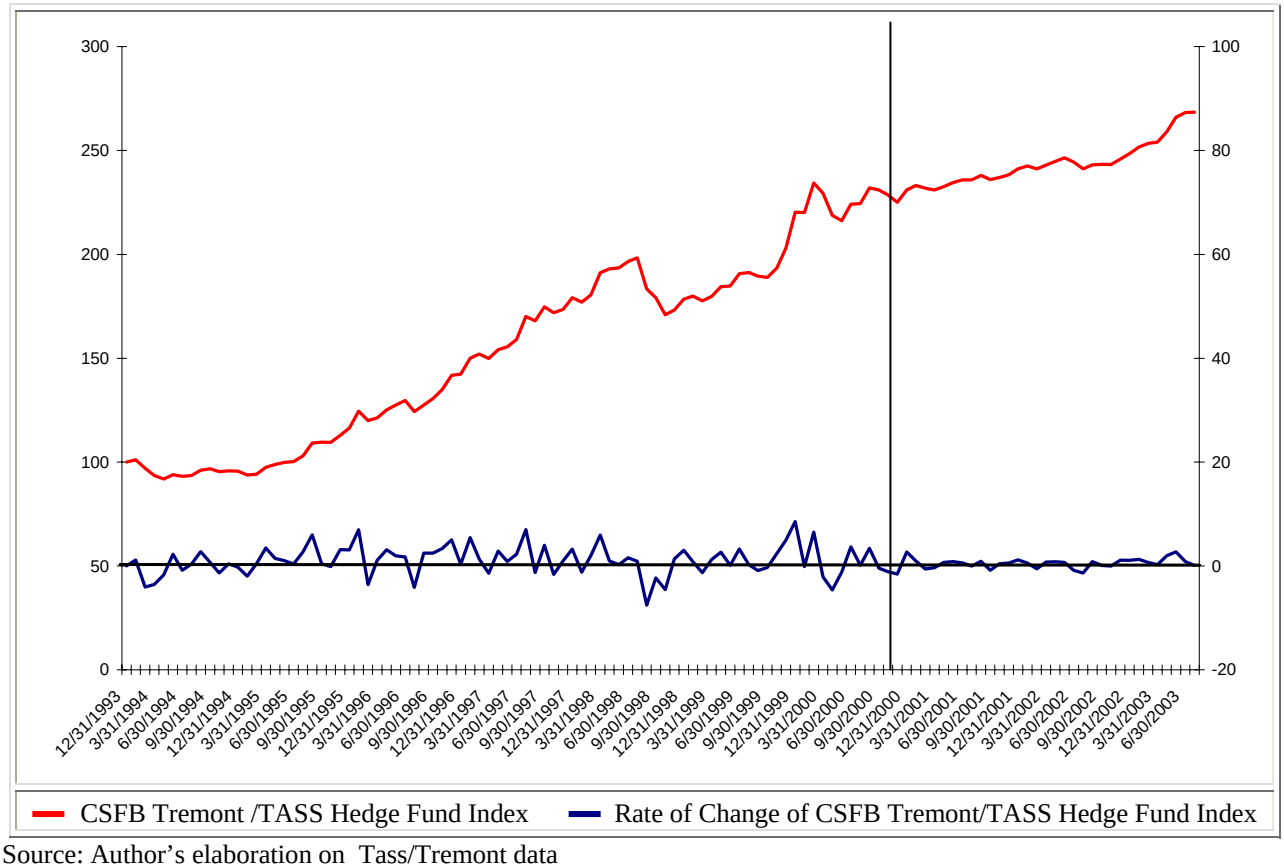
New RAP measures as instruments to predict future performance of hedge funds

New RAP measure	Level	Statistic	R_{94}	R_{95}	R_{96}	R_{97}	R_{98}	R_{99}	R_{00}	R_{01}	R_{02}	R_{03}
Stutzer $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.00	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	-0.02	-0.05	-0.07	-0.04	-0.03
	Low	Mean	0.00	0.00	0.00	0.02	0.01	0.01	0.01	0.01	0.00	0.02
		Max	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.03
		Min	0.00	-0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.00	0.01
Omega $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.00	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	-0.02	-0.05	-0.07	-0.04	-0.03
	Low	Mean	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.01	0.00	0.01
		Max	0.01	0.01	0.02	0.01	0.01	0.03	0.02	0.02	0.01	0.05
		Min	0.01	0.01	0.01	0.01	-0.01	0.00	0.00	0.00	-0.01	0.00
Sharpe Omega $_{t-1}$	High	Mean	0.00	0.01	0.02	0.02	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.00	0.04	0.04	0.12	0.10	0.33	0.04	0.05	0.02	0.07
		Min	-0.01	0.00	0.00	0.00	-0.09	-0.02	-0.03	-0.07	-0.04	-0.02
	Low	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.02	0.04	0.06	0.06	0.07	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
Kappa $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.00	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.05	0.13	0.03	0.07
		Min	-0.04	0.00	0.00	-0.01	-0.09	-0.02	-0.03	-0.07	-0.04	-0.02
	Low	Mean	0.00	0.00	0.01	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.01	0.00	0.04	0.06	0.06	0.07	0.13	0.05	0.05	0.09
		Min	0.00	-0.01	0.00	0.00	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
D-Ratio $_{t-1}$	High	Mean	-0.50	1.17	1.68	1.74	-0.18	2.74	1.01	0.63	0.43	0.96
		Max	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.00	0.01
		Min	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
	Low	Mean	-0.04	0.00	0.00	-0.01	-0.13	-0.02	-0.05	-0.07	-0.04	-0.03
		Max	0.00	0.00	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.03
		Min	0.00	0.00	0.02	0.00	0.00	0.03	0.01	0.01	0.01	0.05
Roas $_{t-1}$	High	Mean	0.00	0.01	0.02	0.02	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.00	0.04	0.04	0.12	0.10	0.33	0.04	0.05	0.03	0.07
		Min	-0.01	0.00	0.00	0.00	-0.09	-0.02	-0.03	-0.07	-0.04	-0.02
	Low	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.02	0.04	0.06	0.06	0.07	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
Rops $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.01	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
	Low	Mean	0.00	0.01	0.01	0.01	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.01	0.03	0.04	0.02	0.03	0.17	0.02	0.05	0.02	0.07
		Min	0.00	0.00	0.00	0.01	-0.06	-0.02	-0.01	-0.07	-0.04	-0.02
Hurst $_{t-1}$	High	Mean	-0.01	0.01	0.02	0.02	0.00	0.03	0.01	0.01	0.00	0.01
		Max	0.04	0.04	0.04	0.12	0.10	0.33	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	-0.02	-0.05	-0.07	-0.04	-0.03
	Low	Mean	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	-0.01	0.03
		Max	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.05
		Min	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	-0.01	0.01
Kalmar $_{t-1}$	High	Mean	0.00	0.01	0.02	0.02	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.01	0.04	0.04	0.12	0.10	0.33	0.05	0.05	0.03	0.07
		Min	-0.01	0.00	0.00	0.00	-0.09	-0.02	-0.03	-0.07	-0.04	-0.02
	Low	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.00	0.01
		Max	0.04	0.02	0.04	0.06	0.06	0.07	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03
Sterling $_{t-1}$	High	Mean	0.00	0.01	0.02	0.02	0.00	0.03	0.01	0.00	0.00	0.01
		Max	0.01	0.04	0.04	0.12	0.10	0.33	0.04	0.05	0.03	0.07
		Min	-0.01	0.00	0.00	0.00	-0.09	-0.02	-0.03	-0.07	-0.04	-0.02
	Low	Mean	-0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.01	0.00	0.01
		Max	0.04	0.02	0.04	0.06	0.06	0.07	0.13	0.13	0.05	0.09
		Min	-0.04	0.00	0.00	-0.01	-0.13	0.00	-0.05	-0.01	-0.04	-0.03

There is clear evidence of the dominance of the new approaches being proposed to select hedge funds: in fact, new RAPs define subgroups that, as the standard approach, are useful to separate good performers from the bad ones, but the mean difference return is significantly higher if the two groups are identified using new measures.
Another interesting aspect is the capability of the new approaches to evaluate the future performance of funds in different market phases. An analysis of this aspect could identify periods when an investment strategy founded on a more detailed analysis of the hedge funds dynamics leads to the best gains.
In order to analyze this aspect, one needs to identify phases of the hedge fund market considering a hedge fund index directly: in fact, the hedge industry is not alike those of other financial assets[66] and the lack of correlation could cause a misalignment between the hedge funds market dynamics and the performance of other assets.[67] In fact, managers of hedge funds adopt strategies that are independent of market phases and they can assume opposite positions with respect to market dynamics.[68]
In order to define the bull and bear periods for the hedge market, one needs to analyze the historical trend of a sectoral index, the CSFB Tremont Hedge Fund Index. [69] (Figure 2)

Figure 2.

Hedge fund market performance in the evaluation period



Source: Author's elaboration on Tass/Tremont data

[66] Sidani R. and Soueissy M. (2003), *The risk underlying hedge fund strategies*, working paper
[67] Amec N., Martellini L. and Vaissié M. (2002), *Benefits and risks of alternative investment strategies*, EDHEC working paper
[68] Boido C. (2001), "Organizzazione e politiche di offerta degli hedge fund", *Analisi Finanziaria*, vol. 1, pp. 4-17
[69] Hedgefund.net don't offer a global aggregate index that could be used to analyze the market trend

Major trends are identified using a simple technical analysis approach that classifies the bull and the bear market on the basis of index variations recorded in the time horizon being analyzed. A simple approach founded on the rate of change allows the identification of two major trends: a bullish trend from 1993 to 2000 and a bear trend for the period 2001-2003.[70] It is possible to verify the validity of different RAP measures to select investment opportunities in different scenarios and to evaluate the relative utility of these approaches in different scenarios.
The usefulness of the different approaches is tested by considering the mean difference of returns achieved by the best and worst classified funds and the mean percentage of success of each RAP to identify the best opportunities available. (Table 4)

Table 4.

Rap Analysis in bull and bear market

Rap measure	% Success in Bull market	Differential gains in Bull market	% Success in Bear market	Differential gains in Bear market
Sharpe	57.14%	-0.33	100.00%	0.08
RAP	42.86%	-0.26	100.00%	0.13
Information Ratio	71.43%	-0.42	100.00%	0.28
Sortino	57.14%	1.19	100.00%	0.55
Treynor	100%	1.33	100.00%	0.84
Jensen	42.86%	-1.33	100.00%	0.84
Stutzer	57.14%	-0.10	66.67%	0.27
Omega	71.43%	-0.12	100.00%	0.29
Sharpe Omega	85.71%	0.01	0.00%	-0.36
Kappa	57.14%	-0.18	0.00%	-0.35
D-Ratio	42.86%	-0.23	66.67%	0.30
Roas	85.71%	0.64	0.00%	-0.28
Rops	57.14%	0.10	100.00%	-0.21
Hurst	57.14%	-0.70	33.33%	0.27
Kalmar	85.71%	0.43	0.00%	-0.15
Sterling	100.00%	0.82	0.00%	-0.61

Results demonstrate that new RAPs are particularly useful in volatile markets, the bull markets, where a more detailed analysis of past performances is necessary to select the best performing hedge funds. In bear markets, standard approaches are sufficient to identify best investment opportunities and a more detailed analysis realized using new RAPs could not be justified in the light of the differential gains related to these new measures.
Results achieved by hedge funds often are not time-persistent and a fund classification based on its historical performance could be less useful if it varies frequently in the period analyzed. [71]
Therefore, the validity of a RAP measure cannot be analyzed without considering the temporal persistence of classifications based on the measure. A RAP could be preferred to another one if the fund classification obtained using this measure is stable in time and if the percentage of upgrades/downgrades of the funds included in a group is as small as possible. Hence, the analysis of the new measures being proposed is completed with the persistence study of the classification realized with each RAP in the time horizon considered. (Table 5)

[70] The bull market phase is identified as the period when the rate of change is double than the mean value registered on the overall time horizon
[71] Boyson N.M. (2003), *Do hedge funds exhibit performance persistence? A new approach*, EDHEC working paper

Table 5.

Percentage of upgrade/downgrades in the subgroups using different RAP classifications

Rap measure	Portfolio	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Sharpe	Best	10.59%	21.18%	63.20%	73.72%	48.28%	42.16%	68.45%	52.85%	61.84%	61.85%
	Worst	31.58%	63.16%	30.00%	33.33%	13.40%	46.81%	32.35%	34.95%	48.29%	57.74%
RAP	Best	10.92%	21.84%	65.63%	73.78%	50.69%	42.57%	68.69%	53.97%	63.99%	62.16%
	Worst	30.00%	60.00%	0.00%	0.00%	2.15%	37.93%	14.63%	26.04%	46.28%	50.71%
Information Ratio	Best	12.77%	25.53%	32.35%	30.99%	24.07%	36.59%	45.14%	52.27%	63.82%	65.00%
	Worst	17.54%	35.09%	62.12%	54.00%	57.33%	27.50%	33.70%	28.49%	47.30%	42.55%
Sortino	Best	17.19%	34.38%	71.21%	77.11%	59.15%	49.16%	71.47%	62.42%	75.16%	73.79%
	Worst	37.50%	75.00%	0.00%	20.00%	5.48%	34.62%	20.31%	31.52%	37.27%	37.50%
Treynor	Best	46.25%	92.50%	100.00%	97.76%	60.12%	94.05%	83.07%	83.71%	79.96%	93.27%
	Worst	9.09%	18.18%	0.00%	0.00%	66.67%	2.90%	9.09%	25.93%	62.50%	7.30%
Jensen	Best	14.10%	28.21%	77.78%	67.65%	50.82%	66.23%	74.40%	63.08%	65.53%	51.04%
	Worst	31.25%	62.50%	37.50%	50.00%	53.06%	27.91%	29.33%	54.65%	68.26%	59.84%
Stutzer	Best	33.33%	66.67%	73.02%	74.52%	66.67%	68.84%	73.02%	69.67%	82.54%	93.45%
	Worst	20.00%	40.00%	12.50%	35.71%	41.67%	27.27%	51.52%	38.89%	44.74%	31.43%
Omega	Best	34.13%	68.27%	77.44%	78.11%	71.30%	71.88%	78.39%	74.53%	86.16%	96.53%
	Worst	0.00%	0.00%	0.00%	50.00%	28.57%	58.33%	92.31%	100.00%	92.86%	87.50%
Sharpe Omega	Best	34.13%	68.27%	77.44%	78.11%	71.30%	71.88%	78.39%	74.53%	86.16%	96.53%
	Worst	0.00%	0.00%	0.00%	50.00%	28.57%	58.33%	92.31%	100.00%	92.86%	87.50%
Kappa	Best	10.67%	21.35%	65.12%	74.69%	50.69%	41.72%	68.60%	53.97%	63.90%	62.06%
	Worst	30.00%	60.00%	0.00%	11.11%	4.30%	34.29%	21.69%	26.63%	46.09%	50.69%
D-Ratio	Best	15.22%	30.43%	8.33%	8.51%	12.50%	19.20%	16.87%	26.26%	46.37%	46.29%
	Worst	6.03%	12.07%	56.12%	74.19%	67.06%	36.00%	60.41%	64.80%	52.73%	49.88%
Roas	Best	8.33%	16.67%	16.67%	25.00%	18.52%	10.91%	16.56%	22.12%	32.08%	46.90%
	Worst	11.29%	22.58%	63.27%	80.67%	73.53%	42.79%	66.93%	66.67%	61.86%	65.94%
Rops	Best	10.71%	21.43%	15.38%	24.53%	18.38%	17.16%	19.38%	22.12%	31.69%	35.10%
	Worst	11.29%	22.58%	62.11%	77.97%	72.28%	40.84%	58.96%	65.73%	61.56%	61.23%
Hurst	Best	34.13%	68.27%	77.44%	78.11%	71.30%	71.88%	78.39%	74.53%	86.16%	96.53%
	Worst	0.00%	0.00%	0.00%	50.00%	28.57%	58.33%	92.31%	100.00%	92.86%	87.50%
Kalmar	Best	26.52%	53.03%	37.11%	57.35%	43.48%	30.39%	26.44%	27.33%	47.15%	51.25%
	Worst	0.00%	0.00%	18.92%	45.71%	23.23%	37.19%	33.33%	62.75%	52.56%	62.02%
Sterling	Best	15.22%	30.43%	0.00%	2.27%	11.84%	11.71%	13.46%	24.66%	45.86%	53.33%
	Worst	6.03%	12.07%	54.46%	74.80%	69.41%	35.05%	64.71%	67.06%	53.82%	53.20%

Persistence does not seem to be a characteristic that allows the identification of the more useful RAP. In fact, the mean percentage of revisions in group components is the same for classifications based on standard and new measures and the mean value is not low. Analyzing new RAPs and old measures separately, it becomes possible to verify that:

- new measures have the capability of identifying two groups, best and worst funds, that vary with the same frequency;
- old measures identify subgroups of worst funds that vary less in the time horizon being analyzed;
- the failure of new measures is more evident in the bear market where the fund selection proves frequently erratic.

The unpredictability that characterized all group members could be explained considering the hedge funds characteristics that make historical data less useful for predicting future performance when they are more distant in time.[72]
Besides, the higher variability that characterizes this instrument makes it impossible to select a group of funds that can be over-performing for a long period of time[73] and one needs to monitor the market continually in order to understand when a particular hedge fund becomes an investment opportunity.

4. Conclusions

New approaches proposed to evaluate hedge funds could be useful to define an investment strategy and, new measures granted especially significant gains in volatile markets where a more detailed analysis of the performance of hedge funds makes it possible to select the potentially best one. The new RAP approaches being proposed do not eliminate problems related to the non-persistence of RAP-based classifications that must be considered a direct consequence of the characteristics of hedge funds.
Results obtained are statistically significant for the European market, but there is no clear evidence of the validity of these conclusions for different markets. Prior to defining the results that have been obtained as a rule, one needs to replicate these approaches on other financial markets.
The sample considers only a pool of successful funds that have survived for the entire time period being analyzed and the construction of a numerous sample of funds not affected by survivorship bias for different markets may prove unfeasible.[74] An empirical analysis demonstrates that this phenomenon tends to overestimate the performance and/or to underestimate the risk exposure related to the hedge funds market.[75] For these markets, the choice to include or not to include funds that expire before the end of the period being analyzed can affect rankings realized with RAP measures and the interpretation of results must consider the impact of this choice.[76]
The analysis proposed in this work endeavors to verify the validity of new RAP approaches and evaluates the usefulness of these measures for an investor who has to select one of the funds available. The next step of the research could be identified in the study of different dynamics of hedge funds that adopting different styles: this analysis could be useful to estimate advantages related to the diversification among different hedge funds. In fact, a portfolio approach could make it necessary to re-analyze the RAP approach used to select hedge funds and to define a new measure that also considers possible correlations among different hedge funds included in the portfolio.

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