Lower partial moments and maximum drawdown measures in hedge fund risk – return profile analysis

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Summary

The study concentrates on alternative risk measures. The author depicts the research showing that maximum drawdown and lower partial moments measures lead to similar hedge fund strategies rankings as the traditional Sharpe ratio. The advantage of the paper is that the research takes into consideration the period of 2008 – 2009 when the American mortgage crisis appeared and the majority of hedge funds realized substantial losses together with the dramatic decrease of their assets under management. The paper shows that the Sharpe ratio, although largely criticized because of being based on the standard deviation, is neither a better nor a worse measure of hedge fund effectiveness than the examined alternative measures. All the ratios show similar results.

Key words: hedge funds, alternative risk measures, efficiency, risk return ratios

JEL classification code: G2, C2

Introduction

The paper shows hedge fund rankings made both with traditional effectiveness measures and alternative ones using lower partial moments and maximum drawdown. Its aim is to show if there are any differences between hedge funds efficiency when different measures are applied. The effectiveness is understood as the relation between rate of return and risk. The author used data from the Hedge Fund Research and the analyzed period is from January 2005 to April 2011. The results show that the traditional risk measure – the Sharpe Ratio leads to similar conclusions on hedge fund effectiveness as mentioned alternative risk measures. The strong side of the paper is that the research takes into consideration the period of 2008 – 2009 when the American mortgage crisis appeared and the majority of hedge funds realized substantial losses together with the dramatic decrease of their assets under management.

It is often stressed that the Sharpe Ratio is not an adequate effectiveness measure for hedge fund rates of return because it is based on the standard deviation which requires the assumption of standard normal distribution of rates of returned which is not fulfilled in practice. Therefore, some proposals of new effectiveness or risk measures appear and they are called „alternative" measures. Kazemi et al.[1] suggest that the Sharpe Ratio should be adjusted to the real distribution in order to give up the normal distribution of rates of return. Brooks and Kat[2] show that hedge fund rates of return are attractive from the point of view of risk and rate of return, however if one incorporates higher central moments and autocorrelation into the analysis, it is obvious that the Sharpe Ratio overestimates hedge fund portfolio results. The necessity for looking for new risk measures is also emphasized by Sharma.[3] It should also be stressed that the literature is full of contradictory conclusions as far as hedge funds risk and rates of return are concerned. They depend on the data base used for the research, examination period and measures applied in the analysis.[4] It means that any results achieved on hedge funds should be interpreted with care. The main problem which arises when hedge fund markets are

[1] H. Kazemi, T. Schneeweis, B. Gupta, Omega as a Performance measure, research paper, Center for International Securities and Derivatives Markets, University of Massachusetts, Amherst, July 2003, www.cisdm.org.; at: http://www.edge-fund.com/KaSG03.pdf, 3.11.2015.

[2] C. Brooks, H.M. Kat, The Statistical Properties of Hedge Fund Index Returns and Their Implications for Investors, The Journal of Alternative Investments, Vol. 5, No. 2, 2002, p. 26 – 44.

[3] M. Sharma, A>I>R>A>P> - alternative RAPMs for alternative investments, Journal of Investment Management, Vol. 2, No. 4, p. 106 – 129.

[4] See for instance: B. Liang, On the Performance of Hedge Funds, Financial Analysts Journal, summer 1999, p. 72 – 85; T. Schneeweis, G. Martin, H. Kazemi, V. Karavas, The Impact of Leverage on Hedge Fund Risk and Return, The Journal of Alternative Investments, Vol. 7, No. 4, 2005, p. 10 – 21; S. Titman, The leverage of hedge funds, Finance Research Letters, Vol. 7, 2010, p. 2 – 7.

researched is that data bases are incomplete and not homogenous. On the 22 July 2013 the Directive was introduced in the European Union which made hedge funds registry compulsory as well as it obliged them to report their results for data bases. However, the market needs at least 5-7 years to complete data bases and to make them representative for the scientific research. Besides, afterwards hedge fund managers decided to move their hedge funds outside Europe and United States and started to register them in Asia.[5] Such events show that hedge fund markets are flexible and they adjust to regulations very quickly. This process is called the regulatory arbitrage and is one of the characteristic features of hedge funds. The problem of hedge fund regulations should be addressed globally, not only in the USA and EU.

Theoretical aspects of traditional effectiveness measures

Standard methods of investment efficiency valuation include: Sharpe ratio, Jensen ratio and Treynor ratio. The Sharpe ratio can be defined as:[6]

$$\text{Sharpe Ratio} = \frac{r_i^d - r_f}{\sigma(r_i)} \qquad (1)$$

where:

Sharpe Ratio – the investment result on the portfolio of i assets

r_i^d – the average value of the rate of return on the portfolio of i assets

$\sigma(r_i)$ – the standard deviation on rates of return on the portfolio of i assets

r_f – risk – free interest rate

It should be stressed here that the Sharpe ratio is a relative efficiency measure of the investment and is used to compare a few or more hedge funds (or other types of investments, for the first time it was used by Sharpe to compare investment funds) and not to assess the investment efficiency of the single hedge fund. The same rule applies to Sortino or Treynor

[5]Compare f.ex. Hedge Fund Research Global Hedge Fund Industry Report – Fourth Quarter 2013 and Hedge Fund Research Global Hedge Fund Industry Report - First Quarter 2014, https://www.hedgefundresearch.com/, the Q1 2015 Preqin Quarterly Update, Hedge Funds, https://www.preqin.com/docs/quarterly/hf/Preqin-Quarterly-Hedge-Fund-Update-Q1-2015.pdf .

[6] W.F. Sharpe, The Sharpe ratio, Journal of Portfolio Management, Vol. 21, No. 1, p. 49 – 58.

ratios. Besides, the Sharpe ratio is most often revealed by hedge funds on their internet pages[7]. It is also applied often in the literature devoted to hedge funds.[8]

At the same time the literature gives many proofs that those who apply the Sharpe ratio do not take into consideration that it is only a "more or less" efficiency measure which is liable to substantial calculation errors.[9]

The next one, Jensen ratio can be presented in the following way:[10]

$$JR = \left(r_i^d - r_f\right) - (r_{ip}^d - r_f)\times \beta_i \qquad (2)$$

where:

β_i – the sensitivity of hedge fund rates of return changes compared with the market. The market stands for some benchmark portfolio, for instance an index

r_{ip}^d– the average rate of return on the market portfolio

The drawback of the Jensen ratio is the possibility of making rates of return artificially higher when managers use the financial leverage.

The Treynor ratio is usually depicted as:

$$\text{Treynor Ratio} = \frac{r_i^d - r_f}{\beta_i} \qquad (3)$$

Both Treynor and Jensen ratio are adequate only if just a part of the investor's capital is invested in hedge funds.

Alternative risk measures

The subject of this paper is not to present alternative risk measures in details but to pay attention to the existence of other methods of hedge fund efficiency valuation than the traditionally used Sharpe ratio. Alternative efficiency measures can be divided into the following groups:

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[7] Compare for example internet pages of Credit Suisse First Boston Group.

[8] Compare for example: N. Chan, M. Getmansky, S. Haas, A. Lo, Do Hedge Funds Increase Systemic Risk?, Economic Review, 91(4), p. 49 – 80 and G.N. Gregoriou, R. Pascalau (ed.), Derivatives Pricing, Hedge Funds and Term Structure Models, Palgrave, Macmillan, Hampshire 2011, p. 10 – 11.

[9] A.W. Lo, The Statistics of Sharpe Ratios, Financial Analysts Journal, July – August 2002, p. 36 – 50.

[10] W. Breuer, M. Guertler, F. Schuhmacher, Portfopiomanagement I – Theoretische Grundlagen und praktische Anwendungen, Gabler, Wiesbaden 2004 and M. Eling, F. Schuhmacher, Does the choice of performance measure influence the evaluation of hedge funds?, Journal of Banking and Finance, Vol. 31, 2007, p. 7.

1. Maximum drawdown measures such as Calmar, Sterling or Burke ratio.[11]
2. Measures based on the value at risk such as: excess return on the value at risk (VaR), conditional Sharpe ratio or modified Sharpe ratio. [12]
3. Measures based on lower partial moments, that is Omega, Sortino and Kappa ratio.[13]
4. Measures made with the example of the Sharpe ratio but taking into consideration the skewness and kurtosis of rates of return.[14]
5. Measures based on higher partial moments which value the upside potential of the profit and are thus called upside potential ratios.[15]
6. Data Envelopment Analysis, often abbreviated to DEA which is a non-parametrical approach based on linear programming in order to value the inputs and results.[16]

The paper is focused on two groups mentioned above, that it maximum drawdown and lower partial moments measures.

The idea of maximum drawdown measures

The Calmar ratio is defined as follows:[17]

$$CR = \frac{r_i^d - r_f}{-MD_i} \tag{4}$$

where:

r_f - risk – free interest rate

r_i^d – the average value of the rate of return on i assets

[11] T.W. Young, Calmar Ratio: a smoother tool, Futures, vol. 20, nr 1, 1991, p. 40; G. Burke, A sharper Sharpe ratio, Futures, vol. 23, nr 3, 1994 p. 56; L.N. Kestner, Getting a handle on true performance, Futures, vol. 25, nr 1, 1996, p. 44 – 46.
[12] M. Eling, F. Schuhmacher, Does the choice of performance measure influence the evaluation of hedge funds?, Journal of Banking and Finance, Nr 31, 2007, p. 2635 – 2637.
[13] W.V. Harlow, Asset Allocation in a Downside-Risk Framework, Financial Analysts Journal, September – October 1991, p. 28 – 40 and P.D. Kaplan, J.A. Knowles, Kappa: A Generalized Downside Risk – Adjusted Performance Measure, Morningstar Associates and York Hedge Fund Strategies, January 2004, p. 1 – 17.
[14] K. Dowd, Beyond Value at Risk. The New Science of Risk Management, John Wiley & Sons, New York 1998 and G.N. Gregoriou, G. Huebner, N. Papageorgiou, F. Rouah (ed.), Hedge Funds. Insights in Performance Measurement, Risk Analysis, and Portfolio Management, John Wiley & Sons, Inc., Hoboken 2005, p. 549 – 550.
[15] F.A. Sortino, R. van der Meer, A. Plantiga, The Dutch triangle, Journal of Portfolio Management, Vol. 26, 1999, p. 50 – 58.
[16] M. Eling, Performance Measurement of Hedge Funds Using Data Envelopment Analysis, Working Papers on Risk Management and Insurance No. 25, University of St. Gallen, November 2006, p. 2 – 29.
[17] T.W. Young, Calmar ratio: A smoother tool. Futures, Vol. 20, Nr 1, 1991, p. 40. See also: M. Eling, F. Schuhmacher, Does the choice …, op.cit., p. 6.

MD_i – the lowest rate of return on i assets in the assumed period.

The above formula shows that the Calmar ratio takes the lowest asset rate of return in the assumed time period into consideration. Its advantage is that it provides for the worst scenario in the past. Simultaneously, its disadvantage is high sensitivity to generating random rates of return caused by events of low probability. Introducing the minus sign in the denominator makes the maximum efficiency appear together with the ratio increase. It means that the optimum efficiency is achieved when:

$CR \rightarrow max$

In order to decrease the mentioned Calmar ratio sensitivity , one can use the Starling ratio which takes average level of N maximum negative rates of return into account.

The Sterling ratio is often presented as:[18]

$$SR = \frac{r_i^d - r_f}{\frac{1}{N}\sum_{j=1}^{N}(-MD_{ij})} \qquad (5)$$

In this case the maximum efficiency is also achieved together with the increase of the Sterling ratio. Thus, the optimal investment efficiency is assured when:

$SR \rightarrow max$

As for the Burke ratio, the excess rate of return is related to the square root of the sum of N powered lowest rates of return generated in the assumed period of time.

The mathematical formula for the Burke ratio is:[19]

$$BR = \frac{r_i^d - r_f}{\sqrt[2]{\sum_{j=1}^{N} MD_{ij}^2}} \qquad (6)$$

The optimal investment efficiency is achieved for the same condition as for the previous ratios:

$BR \rightarrow max$

[18] L.N. Kestner, Getting a handle on true performance, Futures, Vol. 25, Nr 1, 1996, p. 44 – 46 and M. Eling, F. Schuhmacher, Does the choice …, op.cit., p. 6.
[19] G. Burke, A sharper Sharpe ratio, Futures, Vol. 23, No. 3, 1994, p. 56 and M. Eling, F. Schuhmacher, Does the choice …, op.cit.,p. 6.

Definitions of lower partial moments measures

Risk measures based on the left tail of the distribution treat risk only in a negative context. Contrary to those which understood risk as both positive and negative fluctuations, these ones consider just rates of return downwards movements from the assumed benchmark. The literature calls them lower partial moments. The lower partial moment of order n for the empirical distribution of rates of return is defined as:[20]

$$LPM_n = \sum_{R_i=-\infty}^{\tau} p_i(\tau - R_i)^n \qquad (7)$$

where:

R_i – rate of return on assets

p_i- probability of appearance of the rate of return R_i

n – order of the partial moment (f.ex. n = 0, n = 1, n = 2)

τ – minimal rate of return accepted by an investor[21]

For the continuous distribution with the probability density function dF(R), the analogical equation looks in the following way:[22]

$$LPM_n \int_{-\infty}^{\tau} (\tau - R_i)^n \, dF(R) \qquad (8)$$

In the need of calculation the lower partial moment for the sample, the adequate formula is:[23]

$$LPM_n = \frac{1}{N} \sum_{n=1}^{N} \max(\tau - R_i; 0)^n \qquad (9)$$

[20] W.V. Harlow, Asset Allocation in a Downside-Risk Framework, Financial Analysts Journal, September – October, 1991, s. 30.

[21]It is the risk free interest rate that is used as the minimal rate. However those two should not be treated as substitutes, because for investors who want to engage in risky investments, it can be also a higher rate. Nevertheless, if one looks from the point of view of a hedge fund client, the use of the risk-free interest rate seems adequate. In this case it was reflected by the interest rate of 10-year American treasury bonds at the end of the examined period, that is at the end of April 2011 (3,32%). The literature does not present the unified attitude towards the risk free interest rate, if it should be assumed at the level from the end of the research period, its beginning or if it should be changed in the meantime. Please see for instance: A. Bernardo, O. Ledoit, Gain, loss and asset pricing, Journal of Political Economy 2000, Vol. 108, No. 1, p. 144–172. Data source: http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2011, 05.09.2015.

[22] W.V. Harlow, Asset Allocation in a Downside-Risk Framework, Financial Analysts Journal, September – October, 1991, p. 40.

[23] Compare for instance: P.D. Kaplan, J. A. Knowles, Kappa: A Generalized Downside Risk – Adjusted Performance Measure, Morningstar Associates and York Hedge Fund Strategies, January 2004, p. 2.

where:

N – numer of observations

Omega is defined as:[24]

Omega = $\frac{\int_{\tau}^{\infty}[1-F(R)]dR}{\int_{-\infty}^{\tau}F(R)dR}$ (10)

And for the sample:

Omega = $\frac{R_{av}-\tau}{LPM_1}$ + 1 (11)

where:

R_{av} – average rate of return from the examined period

Sortino is presented by the following formula:[25]

Sortino = $\frac{R_{av}-\tau}{\sqrt{\int_{-\infty}^{\tau}(\tau-R)^2dF(R)}}$

where:

R_{av} – expected rate of return from the analyzed period defined as:

$$\int_{-\infty}^{\infty}RdF(R)$$

Another version of this formula is:

Sortino = $\frac{R_{av}-\tau}{\sqrt{LPM_2}}$ (12)

The generalized formula of these two above mentioned measures is Kappa. For a sample it is defined as:[26]

Kappa = $\frac{R_{av}-\tau}{\sqrt[n]{LPM_n}}$ (13)

[24] P.D. Kaplan, J. A. Knowles, Kappa: A Generalized Downside Risk – Adjusted Performance Measure, Morningstar Associates and York Hedge Fund Strategies, January 2004,p. 2.
[25] Ibidem, p. 3.
[26] Compare f.ex. P.D. Kaplan, J. A. Knowles, Kappa: A Generalized Downside Risk – Adjusted Performance Measure, Morningstar Associates and York Hedge Fund Strategies, January 2004, p. 3.

The traditional portfolio theory assumed that investors are risk averse. Thus, it looks for the highest expected value possible for the same risk level..[27] Statman and Shefrin show a different opinion and conclude that investors are mainly interested in the potential of generating the excess rate of return when their capital is well hedged against potential losses. [28] Sortino, Meer and Plantinga showed the concept of maximizing the expected value of rate of return by an investor which should be higher than the minimal accepted by him rate of return instead of the traditional theory based on aiming at maximizing the average of the distribution.[29] The proposed by the mentioned authors way of investment effectiveness valuation takes into consideration both lower and higher partial moments:

$$\text{Upside potential ratio} = \frac{\int_{\tau}^{\infty}(R-\tau)dF(R)}{\sqrt{\int_{-\infty}^{\tau}(\tau-R)^2 dF(R)}} \qquad (14)$$

Which can be written more clearly as:

$$\text{Upside potential ratio} = \frac{HPM_1}{\sqrt{LPM_2}} \qquad (15)$$

where:

HPM_1 – upper partial moment of the first order

The results of author's examinations

Maximum drawdown measures

Data presented in table 1 and 2 show that rankings made with the Sharpe ratio and maximum drawdown measures such as Calmar, 5-period and 10-period Sterling, as well as 5-period and 10-period Burke ratio, are pretty similar. This conclusion puts in question arguments presented by opponents of the standard deviation and using it as a measure of risk. Table 3 shows that Spearman rank correlation ratios between the Sharpe ratio and alternative effectiveness measures are very high and achieve values from 0,62 (for a 10-period Burke ratio)

[27] H. Markowitz, Portfolio selection, Journal of Finance, No. 7 (1), March 1952, p. 77 – 91.
[28] M. Statman, H. Shefrin, Behavioral Portfolio Theory, Leavey School of Business, Santa Clara University 1998; F.A. Sortino, R. van der Meer, A. Plantiga, The Dutch triangle, Journal of Portfolio Management, Vol. 26, 1999, p. 50 – 58.
[29] F.A. Sortino, R. van der Meer, A. Plantiga, The Dutch triangle, Journal of Portfolio Management, Vol. 26, 1999, p. 50 – 58.

to 0,99 (for a 5-period Sterling ratio). It proves that no matter what the risk and return measure is, hedge fund efficiency results do not change a lot.

Table 1. Sharpe, Calmar, Sterling and Burke Ratios for different hedge fund strategies

Ratio/Strategy	Sharpe Ratio	Calmar Ratio	5-period Sterling Ratio	10-period Sterling Ratio	5-period Burke Ratio	10-period Burke Ratio
Merger Arbitrage	0,216981	0,118154	0,160875	0,197196	0,048743	0,044314
Macro	0,210884	0,079409	0,113	0,144711	0,070163	0,014666
Relative Value	0,178571	0,043611	0,073121	0,12106	0,028059	0,025669
Emerging Markets	0,168449	0,037354	0,077426	0,104578	0,031483	0,05794
Event Driven	0,140097	0,035405	0,062917	0,089586	0,025432	0,018433
Equity Hedge	0,08209	0,02326	0,036801	0,051259	0,015315	0,018085
Multistrategy	0,074766	0,015481	0,032089	0,049949	0,011435	0,006601
Fixed Income Convertible Arbitrage	0,074286	0,014991	0,029618	0,046604	0,011603	0,040767
Equity Market Neutral	-0,04938	-0,01393	-0,01653	-0,02493	-0,00713	-0,0074
Short Bias	-0,14124	-0,04957	-0,068	-0,0835	-0,02986	-0,02288

Source: author's own calculations.

Table 2. Ranking of strategies applied by hedge funds from the point of view of Sharpe, Sterling, Calmar and Burke ratios.

Ratio/Number	Sharpe Ratio	Calmar Ratio	5-period Sterling Ratio	10-period Sterling Ratio	5-period Burke Ratio	10-period Burke Ratio
1	Merger Arbitrage	Macro	Macro	Macro	Macro	Emerging Markets
2	Macro	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage
3	Relative Value	Emerging Markets	Relative Value	Relative Value	Emerging Markets	Fixed Income Convertible Arbitrage
4	Emerging Markets	Relative Value	Emerging Markets	Emerging Markets	Relative Value	Relative Value
5	Event Driven	Event Driven	Event Driven	Event Driven	Event Driven	Event Driven
6	Equity Hedge	Equity Hedge	Equity Hedge	Fixed Income Convertible Arbitrage	Equity Hedge	Equity Hedge
7	Multistrategy	Multistrategy	Multistrategy	Multistrategy	Fixed Income Convertible Arbitrage	Macro
8	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Equity Hedge	Multistrategy	Multistrategy
9	Equity Market Neutral	Equity Market Neutral	Equity Market Neutral	Equity Market Neutral	Equity Market Neutral	Equity Market Neutral
10	Short Bias	Short Bias	Short Bias	Short Bias	Short Bias	Short Bias

Source: author's own calculations.

Table 3. Spearman rank correlation ratios for different maximum drawdown measures.

	Sharpe	**Calmar**	**Sterling dla N = 5**	**Sterling dla N = 10**	**Burke dla N = 5**	**Burke dla N = 10**
Sharpe	1	0,98	0,99	0,94	0,96	0,62
Calmar	0,98	1	0,99	0,94	0,99	0,61
Sterling dla N = 5	0,99	0,99	1	0,95	0,98	0,56
Sterling dla N = 10	0,94	0,94	0,95	1	0,96	0,64
Burke dla N = 5	0,96	0,99	0,98	0,96	1	0,94
Burke dla N = 10	0,62	0,61	0,56	0,64	0,94	1

Source: author's own calculations.

Lower partial moment measures

Data presented in table 4 and 5 show that rankings made with the Sharpe Ratio and lower partial moment measures such as Omega, Sortino and Kappa Ratio, are pretty similar. This conclusion puts in question arguments presented by opponents of the standard deviation and using it as a measure of risk. Table 6 shows that Spearman rank correlation ratios between the Sharpe Ratio and alternative effectiveness measures are very high and achieve values from 0,97 (for Omega, Kappa for n = 4 and Kappa for n = 5 Ratio) to 0,99 (for Sortino and Kappa for n = 3 Ratio). It proves that no matter what the risk and return measure is, hedge fund efficiency results do not change a lot.

Table 4. Lower partial moment measures for different hedge fund strategies.

Ratios/Strategies	Sharpe Ratio	Omega Ratio	Sortino Ratio	Kappa Ratio for n = 3	Kappa Ratio for n = 4	Kappa Ratio for n = 5
Merger Arbitrage	0,000745	1,004807	0,001673	0,001007	0,000754	0,000598
Equity Market Neutral	-0,00136	0,990727	-0,00146	-0,0007	-0,00049	-0,00037
Short Bias	0,000569	1,003994	0,001595	0,000972	0,000717	0,00056
Emerging Markets	0,001657	1,059481	0,026723	0,018245	0,014424	0,011734
Equity Hedge	0,001109	1,022607	0,008745	0,005393	0,004062	0,003232
Event Driven	-0,00119	0,990455	-0,00128	-0,00061	-0,00042	-0,00032
Macro	0,002335	1,035507	0,016764	0,011822	0,009573	0,007937
Relative Value	-0,00102	0,994287	-0,00117	-0,0006	-0,00043	-0,00033
Fixed Income Convertible Arbitrage	0,000834	1,005478	0,002131	0,001307	0,000971	0,000761
Multistrategy	-0,00031	0,997328	-0,00044	-0,00022	-0,00015	-0,00012

Source: author's own calculations.

Table 5. Ranking of hedge fund strategies from the point of view of Sharpe, Omega, Sortino and Kappa ratios.

Ratios/ Number	**Sharpe Ratio**	**Omega Ratio**	**Sortino Ratio**	**Kappa Ratio for n = 3**	**Kappa Ratio for n = 4**	**Kappa Ratio for n = 5**
1	Macro	Emerging Markets	Emerging Markets	Emerging Markets	Emerging Markets	Emerging Markets
2	Emerging Markets	Macro	Macro	Macro	Macro	Macro
3	Equity Hedge	Equity Hedge	Equity Hedge	Equity Hedge	Equity Hedge	Equity Hedge
4	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage	Fixed Income Convertible Arbitrage
5	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage	Merger Arbitrage
6	Short bias	Short bias	Short bias	Short bias	Short bias	Short bias
7	Multistrategy	Multistrategy	Multistrategy	Multistrategy	Multistrategy	Multistrategy
8	Relative Value	Relative Value	Relative Value	Relative Value	Equity Market Neutral	Equity Market Neutral
9	Event Driven	Event Driven	Equity Market Neutral	Equity Market Neutral	Relative Value	Relative Value
10	Equity Market Neutral	Equity Market Neutral	Event Driven	Event Driven	Event Driven	Event Driven

Source: author's own calculations.

Table 6. Spearman rank correlation ratios for different lower partial moment measures.

	Sharpe Ratio	**Omega Ratio**	**Sortino Ratio**	**Kappa Ratio for n = 3**	**Kappa Ratio for n = 4**	**Kappa Ratio for n = 5**
Sharpe Ratio	1	0,97	0,99	0,99	0,97	0,97
Omega Ratio	0,97	1	0,99	0,99	0,99	0,97
Sortino Ratio	0,99	0,99	1	1	0,99	0,99
Kappa Ratio for n = 3	0,99	0,99	1	1	0,99	0,99
Kappa Ratio for n = 4	0,97	0,99	0,99	0,99	1	1
Kappa Ratio for n = 5	0,97	0,97	0,99	0,99	1	1

Source: author's own calculations.

Final conclusions and discussion

The results presented in tables 1 – 3 let conclude that traditional effectiveness measure such as the Sharpe Ratio leads to the similar conclusions as alternative measures. Thus, it is not obvious if alternative measures are really worth applying. They are more complex than traditional ones and this is why the human factor risk is higher for them than for the Sharpe Ratio. The human factor risk is one of the two parts of the model risk. The other part is the risk that the applied model will show other results the real ones. If some model is much more accurate, it is worth generating the human factor risk. In this case, the accuracy seems to be the same as for the traditional effectiveness measure. Thus, if further research confirm the same results, it will put in question the alternative measures created so far and create the need for looking for new ones which will let achieve more adequate results.

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