Downside Risk Metrics applied to Hedge Funds: An overview and some extensions

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Hedge Funds are considered as one of the portfolio management sectors which shows a fastest growing for the past few years. These funds have been in existence for several decades but they do not have become popular until the 1990's. It is said that Hedge Funds are capable of making huge profits but sometimes we get some news announcing that a certain Hedge Fund suffered spectacular losses, not very often as someone might say. Due to their (at least apparent) high and unpredictable fluctuations, it is necessary to keep the risks we take when we trade with Hedge Funds under rigorous control. An optimal Hedge Fund management requires a high precision risk evaluation and an adequate risk metrics.

The Capital Asset Pricing Model (CAPM) is the classic method for quantifying the risk of a certain portfolio. Basically, the so-called Ratio Sharpe evaluates the quality of a certain asset by normalizing the asset growth expectation with the volatility, which measures the amplitude of the return fluctuations. Thus, based on the fact that the asset growth expectation must be high and volatility low, a "good" certain Hedge Fund holds a high Ratio Sharpe. And the better the Hedge Fund the more attractive and advisable is to invest in this fund. It is said that Hedge Fund managers begin to trade with an specific Hedge Fund only when this fund gets an annual Ratio Sharpe approximately greater or equal than 1. They assert that only up to this point the fund can provide benefits after removing trading costs.

However, it has been observed that CAPM theory is not able to capture all the aspects involved in the behavior of the markets and, more specifically, the Hedge Fund universe. Some of these aspects are the high fluctuations or the asymmetry (also called skewness) of many assets that compound our portfolio or fund. Indeed, Hedge Funds are characterized by their big sensitivity to the market crashes and by trading with products, such as derivatives or even the stock shares, showing a pronounced skewness in their price distribution. For

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instance, a very well-known CTA Hedge Fund had a poor Ratio Sharpe (0.19) but, despite this mediocre mark, their earnings during the 2000 raised beyond the 40%. Conversely, after 31 months of trading, the famous fund of LTCM had a very appealing ratio (4.35) and nothing seemed to forecast and announce its posterior debacle. These two examples are not very exceptional cases, and they make us reexamine the validity of the CAPM theory. Everything seems to indicate that the CAPM method is not complete enough for evaluating the risks involved in the Hedge Fund management.

Recently, there have appeared new risk indicators aiming to evaluate the quality of a certain asset. Within the CAPM framework, the risk is directly related to the volatility but now these new measures connects risk with volatility in a more subtle manner with the so-called Downside risk. In this way, the mean-variance framework that was typically useful in the CAPM theory appears now incomplete for analyzing the risk involved in portfolio management. We will have a look on some of these indicators. We will show the way they consider risk and the way they evaluate it. Without being able to choose between them, each new indicator we here describe tries to solve in some way the limitations of the CAPM theory. Thus, the present work wants to apply some of these indicators to several Hedge Fund style indices, make few considerations on them and give a rapid method to compute them not only in order to refine the CAPM theory but also in order to provide alternative and complementary risk metrics for the Hedge Funds.

As we have said, Downside risk analysis has been gaining wide acceptance in recent years. One important benefit of Downside risk lies in distinguishing between *good* and *bad* returns: Good returns are greater than the goal, and bad returns are less than the goal. Downside risk measures incorporates an investor's goal explicitly and defines risk as not achieving the goal. In this way, the further below the goal, the greater the risk. And, in the opposite side, returns over the goal does not imply any risk. Within this approach, a portfolio's riskiness may be perceived differently by investors with different goals. According to our target return, we will have a particular risk indicator value. This is perhaps more realistic than the CAPM theory approach where all investors have the same Ratio Sharpe. Now every investor has its own expectations for the same financial product. We have used the monthly CFSB/Tremont Hedge Fund style indices data from the beginning of 1994 until the end of 2002 for calculating the Downside risk indicators we here present.

First and the simplest correction to the Ratio Sharpe proposed by the CAPM theory is the so-called *Adjusted Ratio Sharpe*. This approach wants to keep in our mind the way we quantify risk with the Ratio Sharpe but correct its value taking into account the Excess Downside Deviation. The Excess Downside Deviation is an statistic quantity that computes the deviation of the return below our target return. This method is useful since it maintains the Ratio

Sharpe concept and keeps the risk measure in the same range where investor used to manage the classic Ratio Sharpe. However, the main disadvantage is it still needs to be assumed that the asset returns are Gaussian and, as we have said, this not a very realistic hypothesis.

Afterwards, we present different measures that do not need to specify a return distribution. Their computed values depends only on the historical time series data. First indicators we show within this criteria are the ones proposed by Sortino. We show the *Sortino Ratio* (SoR) and the *Upside Potential Ratio* (UPR). They look like the Ratio Sharpe but the statistical parameters involved are different. These indicators are based on a new parameter called lambda that is, in some sense, equivalent to the Ratio Sharpe and they provide a risk measure in terms of this lambda. The Sortino Ratio is simpler than the Upside Potential Ratio and it is unable to discern between upside and downside growth expectations. However, the theoretical SoR curve assuming returns to be Gaussian gives a much better prediction of the SoR values computed from Hedge Fund data than the corresponding UPR case. The shortcoming of these two measures is that they are new and investors are not used to deal with them but the comparison of these ratios of an specific fund with their theoretical Gaussian curves will always help to understand and read these new risk indicators.

Another possible choice is the *Gain-Loss ratio* (G-L). This approach has a well-grounded pricing theory behind. This measure has nothing in common with the rest of measures. This takes the ratio between upside and Downside return expectations. Pricing theory behind considers statistical arbitrage opportunities in the event of this quotient is different than 1. We will compare the G-L ratio derived for several Hedge Fund indices to the Gaussian curve and we observe a similar behavior. This measure has the same shortcoming of the two Sortino measures and, again, this can be solved by comparing the ratios we obtain from data to the theoretical Gain-Loss ratio curve where we assume that returns are Gaussian.

The present investigation can be also understood solely as a first shot on the Downside risk metrics world since there are many interesting things to study under this perspective. First possibility is to study these risk indicators when returns obey another return distribution much more realistic (see for instance: Schmidhuber and Moix (2001a, 2001b)). We thus show that the generalised Laplace function provides a better description than the Gaussian distribution to the frequency distribution of the Hedge Fund return changes. We also introduces another aspect: Why should we take a constant target return? We there briefly report some new risk measures when target return is another asset, a time-varying benchmark. Obviously, the risk measures reported above can be extended to these much more sophisticated frameworks. The only problem we may have is in the way we theoretically calculate these risk measures. We

should also need to introduce the distribution of prices for the benchmark. Another possibility is to go further and study the effect of these analysis in the Multi-factor market modelling. There are many models in the literature that have proposed this approach (see for instance: Markowitz (1959) and Low (2001)). Finally, it also interesting to look at the possibilities of the Downside Risk of capturing in a compact measure the non-Gaussinity of other assets such as the stock shares or indices.

References

[1] Bernardo, A., and O. Ledoit, 2000, Gain, loss, and asset pricing, *Journal of Political Economy* **108**, 144-172.

[2] Cochrane, J., 1999a, New facts in finance, *Economic perspectives* Federal Reserve Bank of Chicago **XXIII** Third Quarter, 36-58.

[3] Cochrane, J., 1999b, Portfolio advice for a multifactor world, *Economic perspectives*, Federal Reserve Bank of Chicago, **XXIII** Third Quarter, 59-78.

[4] Cochrane, J., 2001, *Asset pricing* (Princeton University Press, Princeton).

[5] Johnson, D., N. Macleod and C. Thomas, 2002, A framework for the interpretation of excess downside deviation, *AIMA Newsletter* September, 14-16.

[6] Keating, C., Shadwick, W. F., 2002a, A universal performance measure, *Finance Development Centre*, working paper.

[7] Keating, C., Shadwick, W. F., 2002b, An introduction to Omega, *AIMA Newsletter* April.

[8] Lhabitant, F.-S., 2002, *Hedge Funds* (Wiley, Chichester, UK).

[9] Low, 2001, Semidimensional risks in the cross section of stock returns, Yale University and National University of Singapore, working paper.

[10] Markowitz, 1959, *Portfolio Selection: Efficient Diversification of Investments* (John Wiley, New York) and reprinted by (Blackwell, Oxford) in 1991.

[11] Schmidhuber, C., and P-Y Moix, 2001a, Fat tail risk: The case of Hedge Funds (Part I), *AIMA Newsletter* September.

[12] Schmidhuber, C., and P-Y Moix, 2001b, Fat tail risk: The case of Hedge Funds (Part II), *AIMA Newsletter* December.

[13] Sortino, F., and H. Forsey, 1996, On the use and misuse of downside risk, *Journal of Portfolio Management* Winter, 35-42.

[14] Sortino, F., R. van der Meer, and A. Plantinga, 1999, The Dutch triangle, *Journal of Portfolio Management* Fall, 35-42.