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# A Note on the Reduction of Extreme Risks by Means of Diversification

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"A new study by EDHEC shows 20% allocation to hedge funds can halve the probability of a big loss in a portfolio." (www.hedgefundsworld.com)

"A study by EDHEC shows that an allocation of 20% to hedge funds can reduce a fund's probability of extreme loss by 50%". (www.commodities-now.com)

"Using hedge funds can halve the probability of extreme loss in a portfolio, according to a new study from Edhec". (www.ipe.com)

A recent EDHEC study[1] on the use of hedge funds in asset-liability management has concluded that "allocating 20% to hedge funds can reduce a fund's probability of extreme loss by 50%". This conclusion has received quite some attention in the media (see the above quotes for example) and many hedge fund marketers have already eagerly incorporated it in their sales pitch. The question, however, is whether it is indeed such a remarkable finding as many people seem to believe. After all, diversification reduces volatility and lower volatility means less extreme risk. What therefore needs to be shown is that the obtained reduction in extreme risk exceeds what one would normally expect from allocating 20% to a new diversifier.

To shed some light on this issue, we studied the simple case of a portfolio containing 70% stocks and 30% bonds, to which a new arbitrary diversifier is added. Assuming normal distributions throughout, the details are as follows:

[1] See Martellini and Ziemann (2005). We would like to emphasize that this note is not meant to criticize the latter paper, but purely the way the paper's conclusions have been interpreted by the media, investors and the hedge fund industry.

Stock mean = 10%, volatility = 16.5%

Bond mean = 5%, volatility = 8.5%

Diversifier mean = 7.5%, volatility = 12%

Correlation (stocks, bonds) = 0.2

Given a return distribution, the x% VaR is the return value below which x% of the probability mass is found, i.e. the probability of a return lower than the x% VaR equals exactly x%. Since we are dealing with normal distributions, if we set x low enough, the x% VaR is a good measure of extreme risk. Under the above assumptions, we therefore first calculated the 1% VaR of a portfolio composed of 70% stocks and 30% bonds. Subsequently, we added the diversifier to the portfolio and calculated the resulting drop in the probability of a return lower than the initial 1% VaR as derived from the 70/30 portfolio without diversifier. The result can be found in Figure 1, which shows the percentage reduction in the probability of an extremely low return as a function of the size of the diversifier allocation and the correlation between the existing portfolio and the diversifier return.

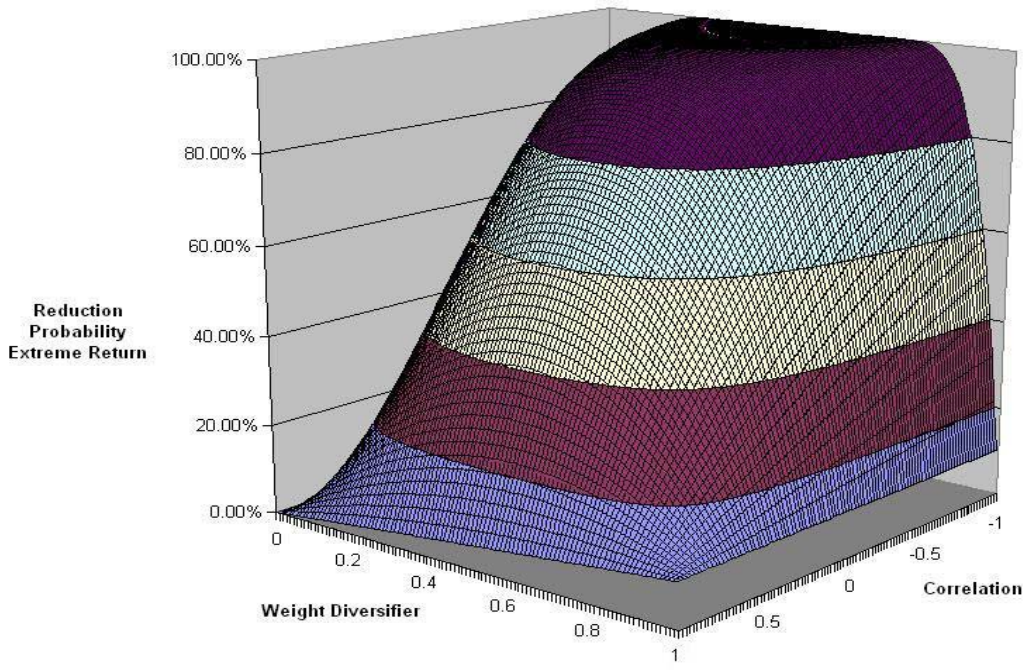


**Figure 1**: Reduction extreme risk as function diversifier weight and correlation between existing portfolio and diversifier return.

Figure 1 shows clearly that even for relatively high correlation coefficients, it only takes a relatively modest allocation to the diversifier to obtain a very substantial reduction in the probability of an extremely low return. The graph also shows that a given reduction in extreme risk can be obtained in many different ways. This becomes especially clear if we look at a contour plot of the above 3D-graph, which is shown in Figure 2.

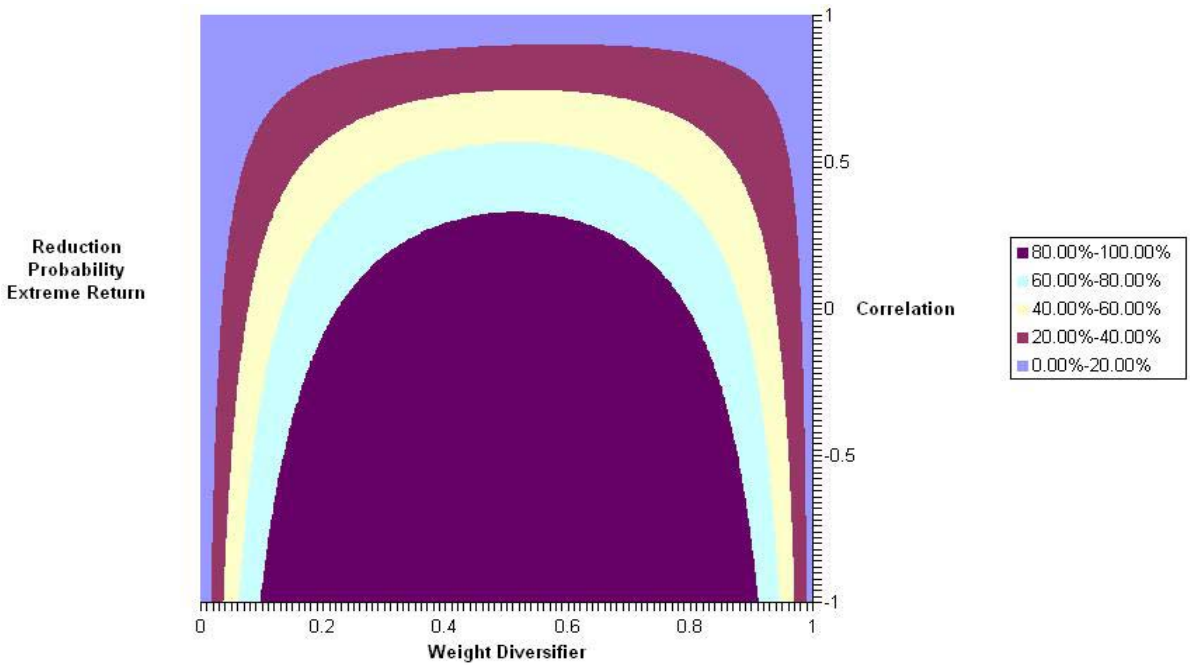


**Figure 2**: Contour plot reduction probability extreme risk (1% VaR) as function diversifier weight and correlation between existing portfolio and diversifier return.

From Figure 2 we see that there are many combinations of diversifier weight and correlation that will produce the same reduction in extreme risk. With a correlation between the 70/30 stock-bond portfolio and the diversifier return of 0.6 for example, we would have to allocate 40% to the diversifier to obtain a 50% reduction in extreme risk. When the correlation were only 0.42, however, a 20% allocation would suffice.

From the above it is clear that extreme risk is not too hard to diversify away as the tails of the distribution are the first place where the impact of diversification is felt. A substantial reduction of less extreme risks is harder to accomplish, however, as it means moving further into the distribution. Repeating the above procedure using for example the 5% VaR to define extreme risk, we would end up with the contour plot

shown in Figure 3. Comparing Figure 2 and 3, we notice that for many combinations of weight and correlation the percentage reduction in 5% VaR based risk is substantially less than for 1% VaR based risk.

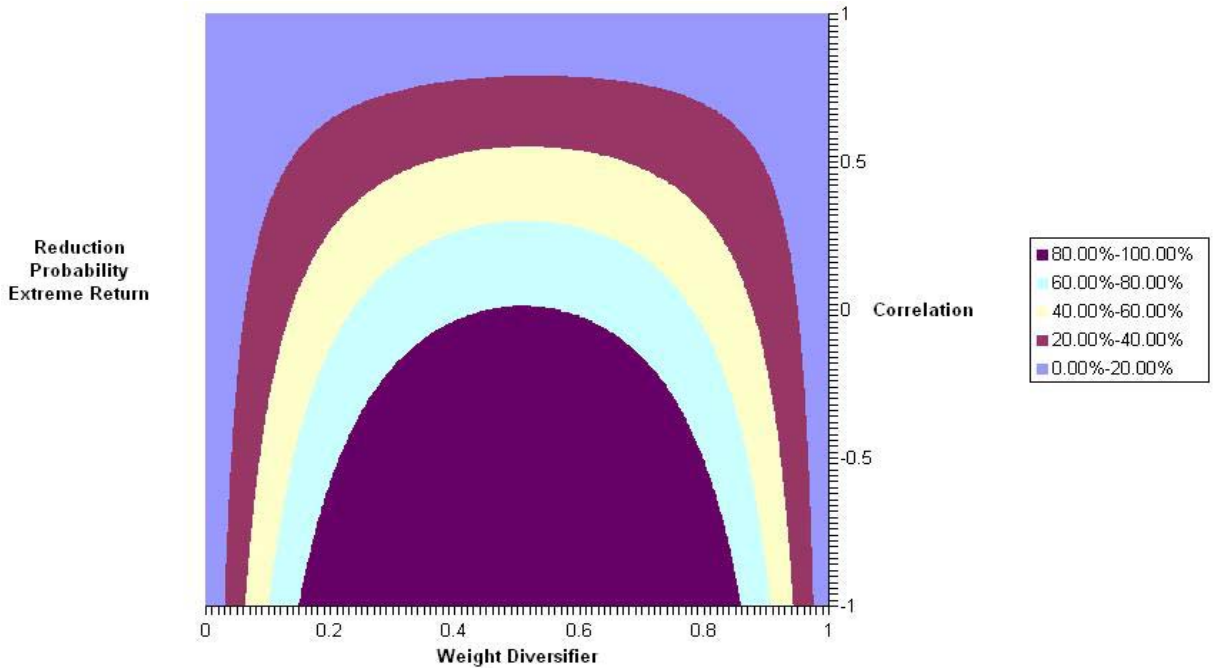


**Figure 3**: Contour plot reduction probability extreme risk (5% VaR) as function diversifier weight and correlation between existing portfolio and diversifier return.

## Conclusion

Even with fairly high correlation between the existing portfolio and the diversifier return, it typically takes only a relatively small allocation to substantially reduce the risk of an extremely low return. The reduction of extreme risks is not as hard as many people may believe.

## References

**Martellini, L. and V. Ziemann**, The Benefits of Hedge Funds in Asset Liability Management, Working Paper EDHEC Risk, 2005.