

Bringing Investor Confidence Back to Alternative Investments:
How Enterprise Risk Management is the Answer

Yan Olszewski

* The views and opinions expressed in this paper are those of the author and do not represent those of his employer. All errors and omissions are those of the author.

During the first quarter of 2006, the alternative investments universe appeared to be making a turn in regards to performance and investor confidence. Returns were the highest they had been in a decade and there had not been a large hedge fund failure since Bayou¹. Investors were happy and so were the hedge fund managers, who would be expecting big bonuses at year-end. As May rolled in, the euphoria of high returns ended. What began as an excellent year, became lacklustre. To add insult to injury, the last half of 2006 has highlighted the lack of stringent risk management at numerous hedge funds and fund of funds². In August, the energy hedge fund MotherRock, informed investors that they were closing shop because of a bad bet on natural gas prices³. A month later, the hedge fund community, and the world, learned that Amaranth, a multi-strategy hedge fund, had more that 50% of its assets in a trade that also was betting on natural gas prices. The effect, “as of September 19, the Net Asset Value of the Multi-Strategy funds had declined approximately 65 per cent month-to-date and approximately 55 per cent year-to-date.”⁴ Both of these high profile hedge fund closings highlight a problem that has been plaguing hedge funds and their investors for years - the fact that there is a lack of solid risk management in this universe.

Almost monthly there is an article written stating how much institutional money is flowing into the hedge fund universe. One hears that a pension plan is invested in a single strategy manager while another pension plan invested in a fund of funds. Reading

¹ Hedge fund fraud that unravelled in 2005 where it was found that founder, Simon Isreal III, was reporting impressive returns but in reality, most of the money was siphoned off to support Simon Isreal’s extravagant lifestyle.

² A short list includes the obvious MotherRock, Amaranth and the fund of funds that invested in them Goldman Sachs, Morgan Stanley, Credit Suisse Group, Deutsche Bank, Ivy Asset Management, MAN, Collins Stewart, Abria, Union Bank Privee to name a few.

³ Leising and Burton (2006) for Bloomberg.com

⁴ Letter sent to investors by Nick Maounis, CEO of Amaranth Advisors LLC.

about all this institutional money flowing into the hedge fund universe, one would expect that the standards of risk control involving these investments would be a focus. But this is not the case – SDCERA and Caisse de Depot warn that the notion of advanced risk management at hedge funds is lacking⁵. Reasons for a lack of risk management are varied and will be different depending on which industry participant you ask. Some will tell you that the instruments hedge funds trade are complex, difficult to properly price and control while others will tell you that all hedge funds have well defined risk management procedures - losses are due to unexpected “x sigma moves.” Both sides have some merit but let’s be honest - there is a lack of risk management because it interferes with profit making. Somehow in the hedge fund universe, a disconnect has occurred between risk management and return management.

Recent hedge fund blow ups are indicative of a lack of synergy between risk and return. Many banks and insurance companies have been optimizing between risk and return for years, resulting in increased stakeholder benefits. What these institutions have been implementing and practicing is the concept of enterprise risk management. Enterprise risk management (ERM) is an approach that has thus far not been adapted in the alternative investments community. ERM is not a formula that is implemented or a way of measuring risk, like value at risk, but it is an ongoing process that flows through the whole organization and is “designed to identify events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the

⁵ San Diego County Employee Retirement Association pension fund (SDCERA) had \$175 million invested in Amaranth and Caisse de Depot et Placement de Quebec invested \$68.5 million with Amaranth

achievement of an entity's objectives.”⁶ Such a simple description, which if implemented properly and on an ongoing basis, would add value to the organization and ensure investors that their investments are properly protected.

Here, the concept of enterprise risk management will be examined in the context of multi-strategy hedge funds and fund of hedge funds. This paper seeks to demonstrate that risk at these organizations has to be considered holistically and not in “silos”. Arguments will be made as to why everyone in the organization, from junior analysts to the CEO, should have an understanding of the entity's risk and why the risk of the entity should be monitored and managed. A number of qualitative and quantitative tools will be suggested and their use will be demonstrated on such hedge funds as Amaranth. The result of implementing these tools will show that the risks in these funds were increasing months prior to their blow-ups. This finding will be used to demonstrate the need for qualitative filters at fund of fund investment committees to suggest redemption even though returns have not suffered. Having outlined the ERM concept for hedge funds and some tools that could be used to implement it, it will be shown how implementing ERM can lead to a less risky portfolio that should lead to greater investor confidence and a more stable business model.

Implementing ERM at a Multi-Strategy Hedge Fund or Fund of Funds

Implementing ERM is a difficult task as there is no standard toolkit of methods leading to overnight success. The process is ongoing and involves both qualitative and quantitative input. Ideally, this process should result in an understanding of various risk limits the

⁶ Enterprise Risk Management – Integrated Framework (Executive Summary), www.coso.org

organization faces and how it can maximize returns while staying within this limits. One starting point in the ERM process would be to implement the Delphi method among senior management, as did Hydro One of Ontario.⁷ Currently many multi-strategy hedge funds and fund of funds do not have an understanding of the risks in their organizations and what priority these risks take. Since there usually is not a hierarchy for various types of risk such as credit or market that a hedge fund faces, the risk management function approaches these risks on an “as needed basis” and not within a unified framework. This leads to the problem where certain risks are ignored until it is too late, as appears to be the case with Amaranth who ignored the financial risk that accompanies investment in the natural gas market. Through the Delphi Method, senior management, analysts and traders could anonymously vote to quickly identify and prioritize risks based on magnitude and probability and evaluate the quality of controls.⁸ Having such a list would provide the risk management function with a starting framework for putting together an ERM policy, which would highlight the risks an organization faces and how these can be managed to result in the highest return.

Another interesting tool that was implemented by Hydro One and could easily be transferred to the alternative investment universe, is the risk map. Each strategy, at a multi-strategy level, and each hedge fund, at a fund of funds level, would have their own map. This map would provide a visual identification of the common risks that a strategy or hedge fund could face. Examples of risks would be growth of a strategy or hedge fund, the risk of an administrator closing, the risk of the strategy no longer working, the

⁷ Aabo, T., J. R.S., Fraser & Simkins B.J. (2004).

⁸ Ibid

risk of false marking by the hedge fund manager, etc. The list of risks would depend on a consensus reached among the people involved with the strategy or hedge fund, possibly with the help of the Delphi Method. The magnitude and probability of these risks would be arrived through a qualitative and quantitative methodology. An example of such a risk map is demonstrated on Figure 1. Such a visual representation of risk would result in quick identification of problem areas and allow the risk management function to take action to prevent these areas from reaching out of control. Taking MotherRock as an example, from the manager's viewpoint, they would have risk maps for each strategy that would include such risks as position size and catastrophic event risk. Limits for these risks would be decided in advance and then changes to these risks would be easy to spot by examining how they change week to week on the risk map. For the risk map to be an effective risk management tool, the organization would have to have a set of risk limits with which it feels comfortable and is willing to take action if they are crossed. The concept of risk limits that resemble a "set of moving goal posts", simply would not work.

Once various risks are identified and limits for these risks agreed upon, the difficult task of measuring and monitoring these risks arises. There are currently numerous financial tools available that allow the risk management function to measure and monitor risk. In order to best utilize the various tools available, the limitations of each have to be understood and respected. The most common tool currently used in the alternative investments world is that of correlation. Correlation is very powerful since it can be used to describe many forms of risks and to identify changing risk profiles. In the ERM framework, an organization would decide on correlation limits to various market risk

factors, follow the progress of these correlations and have a policy to take action if there were deviation from these limits. In the fund of fund space, by specifying and maintaining correlation limits for underlying investments and the overall portfolio, the manager is sending a message to potential investors that the fund is serious about maintaining a certain profile and will act to remedy deviations if they occur. In order to fully utilize this risk measure, multi-strategy and fund of fund managers must realize that it can underestimate the true correlation, an investment may have to other investments in the portfolio and to market factors. Referring to Table 1, an emerging market hedge fund's correlations are shown to other hedge funds and various market factors. The normal correlation measure indicates an investment that has reasonable correlations to the overall portfolio and the market factors. The true risk of the manager only becomes evident when his behaviour is considered in the context of negative months of the other investments. As it is seen, the conditional downside correlation is much higher than the normal correlation. Here it is necessary to consider the correlation in normal, down and up markets to better understand the risks of this investment. Highlighting the benefits of various correlation measures and making sure the whole organization is familiar with them increases the probability that future investments will conform to established risk limits.

Another widely used risk measurement and management tool is the standard deviation of an investment or as it is known in the investment community, "volatility". Since Markowitz proposed portfolio theory in 1952, standard deviation has become a very important tool in the asset manager's toolkit. Implementing volatility limits at the

individual investment and portfolio levels is a very important step towards unifying the risk management function at hedge funds and fund of funds. Once the whole organization is familiar with these limits, every person involved in the investment process can contribute to the risk management function by choosing investments that conform to these limits. As with correlation, there are certain flaws with volatility that investment professionals using this tool should understand. One of the main faults of this measure is that it treats all observations equally in its calculation. To remedy this problem, one can supplement this measure with exponentially weighted moving average (EWMA) volatility. Not only does this additional volatility assign greater weight to current observations, it conforms to the risk platform of Riskmetrics. To demonstrate the need for consideration of EWMA volatility alongside regular volatility, one simply has to look at how this measure was able to detect a rise in risk in the monthly returns of Amaranth, one year before the fund suffered its unfortunate loss. Referring to Chart 1, it is evident that using the EWMA volatility results in a much quicker identification of increased risk in an investment. Looking at the two volatility measures for September 2005, it is clear that there is approximately a 30% increase in risk when one considers the EWMA compared to the standard volatility measure. If a fund of fund would have limits for the volatility of its investments, a 30% increase would definitely signal a change in profile. Correlation and volatility can only result in a more stringent risk management framework if they are used with limits and there is an effort made by the organization to enforce deviations from these limits. The ERM approach would be responsible for identifying limits for these measures and would have an individual in place who can take action when violations occur.

Other tools that can be used by multi-strategy hedge funds and fund of funds include factor analysis and style analysis. At a multi-strategy level, these tools may be used to complement the analysis of the underlying securities. With factor analysis, the risk manager is able to model the underlying securities on broader indexes allowing for better stress testing and scenario analysis. Factor analysis also enables the risk manager to identify general market conditions that can affect the entity and implement ways to manage the portfolio when these market conditions arise. This characteristic conforms to ERM where the risk management function is responsible for “identifying events that may affect the entity, and manage risk to be within its risk appetite.” Picking the factors for this analysis includes qualitative judgement, as to exposures, and quantitative tools (such as stepwise regression) to pick the final set of factors. For a fund of funds, style and factor analysis become the first line of defence to spot whether a hedge fund manager is deviating from their original trading style. Style analysis involves major hedge fund indexes, such as the Hedge Fund Research Indexes, and can be performed on a rolling basis to spot deviations in strategy. Factor analysis is used to arrive at a better understanding of which market factors drive hedge fund manager returns.

To demonstrate the value of style analysis, the returns of Amaranth were investigated using both twelve and twenty-four rolling months. Referring to Table 2 and 3, it is evident that after March 2006, the profile of Amaranth had completely changed. Examining the risks represented by each style, it was determined that the HFR Emerging Market: Eastern Europe style is the predominate driver of returns. Considering that the run up in Eastern Europe has been highly correlated with energy commodities and energy

indexes, increases in this style suggest that Amaranth may have been increasing its energy exposure – see Chart 2. This type of finding merits discussions with the manager to attribute the performance. If these results were unexpected, it is wise to consider sending in a redemption notice. This situation highlights the need of the investment committee at a fund of funds to have discussions with the risk management function to set strict guidelines on the exposures they are willing to take through their hedge fund investments. An example of such a guideline is a requirement that no hedge fund manager be more than 25% invested in a single strategy or investment. This guideline would also apply for multi-strategy hedge funds where no trader can have more than 25% of the firm's P/L. Implementing such a guideline is easier said than done but bare in mind, if such a guideline is implemented, it sends a signal to investors that the entity is serious about preserving capital and working diligently to increase investor wealth. At the end of the day, the question to ask is whether an entity should make decent profits for a long time or have one amazing year with a greater risk of go out of business.

Enterprise risk management is about setting limits and guidelines for investments and monitoring these investments for deviations. The above mentioned tools allow multi-strategy hedge funds and fund of funds to monitor and manage their various investments to meet these guidelines but in order to create a portfolio that is formed to represent the organization's views, one has to consider the concept of portfolio optimization. Markowitz first suggested portfolio optimization in 1952 and it quickly became evident that considering risk and return in the construction of portfolios is very important. Unfortunately, the concept of portfolio optimization is rarely implemented at fund of

funds and multi-strategy hedge funds. This can help explain the over concentration in certain investments and gives an indication to the origins of style drift. It is understood that investment professionals are reluctant to have a “machine” dictate how they should allocate their money among different investments. This is where the dislocation occurs behind the real use of an optimizer. It is not advocated that the results suggested by the optimizer be taken as written in stone, what is being advocated is that the optimizer be used to combine all the views of the organization into one spot to get a direction of how investments should be made in order to satisfy all the constraints and views that an organization has. Developments in portfolio optimization technology allow for both quantitative and qualitative constraints (guidelines) to be included in the optimization routine. The Black-Litterman approach to optimization allows the user to “modify” the expected returns of their investments with qualitative views. This type of capability is very useful in the alternative investment space where changes in market conditions affect expected payoffs, which rely on historical information. Also, portfolio optimization allows the user to input various constraints on the portfolio such as beta, size, correlation, risk and return expectations. By imposing such constraints, the multi-strategy hedge fund or fund of funds is signalling to investors that they monitor their investments closely and are willing to take corrective action if deviations are spotted. With portfolio optimization, rebalancing of the portfolio becomes easy and further demonstrates the robustness of the organization to maintaining a well balanced portfolio. To demonstrate the effectiveness and importance of portfolio optimization to the enterprise risk management process, a portfolio of various hedge funds was constructed and compared to the actual allocations that were given to the hedge funds. The strategies represented in

this portfolio vary from emerging market macro managers to sector specific long/short managers. The mandate of the portfolio is opportunistic which means it is allowed to invest in strategies that are expected to outperform in the near future. Unfortunately, it was constructed ad hoc without the use of any risk constraints or limits to sector exposures. This has resulted in underperformance of the Hedge Fund Research Strategic fund of fund index and significant underperformance of the Hedge Fund Research Weighted Index. Taking the same managers but incorporating various constraints, a portfolio optimization was performed. The constraints for the portfolio would be decided by the senior management of the firm and would be related to the different tools suggested above. In this case, the constraints include beta values to different market indexes of $-0.3 \leq \beta \leq 0.3$, maximum allocation to a manager of 8% and value at risk limit at the 99% of 2.5%. These constraints describe a fairly market neutral portfolio with a risk level that would be acceptable to many institutional investors. The optimization is performed by maximizing return given the VaR limit and the covariance matrix is calculated using the exponential weighted moving average procedure. Referring to Table 4, it is evident that the portfolio optimization results in a portfolio that is expected to produce the same monthly returns as the original allocation but with lower risk, lower beta exposures and fewer managers. The fewer investments with this portfolio allow for closer monitoring and due diligence which would allow for better operational risk management. Another important benefit of performing a portfolio optimization is that it allows the user to weed out the best investment out of correlated options. Table 5 displays the correlation matrix of the investments being considered. It is seen that many are correlated and that the optimizer picks the investments that best work with the other

hedge fund managers being considered. To expand the uses of portfolio optimization, one can perform the optimization incorporating the downside correlation matrix of the managers to add an extra level of risk control. The possibilities of incorporating the factor model results also exist and thus through portfolio optimization one is able to incorporate all the tools suggested for implementing enterprise risk management within a multi-strategy hedge fund or fund of funds.

Conclusion

The tools suggested in this paper have existed for many years. Numerous institutions implement them in the day-to-day management of their investment products. The enterprise risk management approach towards risk is “designed to identify events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of an entity’s objectives.”⁹ Multi-strategy hedge funds and fund of funds should make more of an effort to identify the risks that face their organizations and set limits for these risks. It was suggested that the Delphi Method and risk maps would help in the identification of and setting limits for these risks. Once the risks and limits are known, various tools such a correlation, volatility and factor analysis can be used to monitor and manage deviations from predefined limits. The above sounds pretty straightforward to implement but in reality it is not. It becomes difficult to enforce limits if an investment is doing well; greed blinds sensibility. In order for multi-strategy funds and fund of funds to become well respected (lower chances of blowing-up) they need to start behaving institutionally. With the ERM approach, these alternative investment vehicles, signal to potential investors that they follow certain limits and take

⁹ Enterprise Risk Management – Integrated Framework (Executive Summary), www.coso.org

action to remedy any deviations from these limits. This should ultimately lead to greater investor and public confidence in hedge funds and finish the institutionalization process of this asset class.

Bibliography

- Aabo, T., J. R.S., Fraser & Simkins B.J. (2004). The Rise and Transformation of the Chief Risk Officer: A Success Story of Enterprise Risk Management. *Journal of Applied Corporate Finance* **17(3)**: 8-17.
- Alexander, G.J. and Baptista, A.M. (2006). Risk Management with Stress Testing: Implications for Portfolio Selection and Asset Pricing.
- Amenc, H. and Martellini, L. (2002) Portfolio Optimization and Hedge Fund Style Allocations Descisions. USC FBE Working Paper No. 02-4.
http://ssrn.com/abstract_id=305006
- Fama, E. F. and French, K. R.(1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* **33 (1)**: 3–56.
- Fama, E. F. and French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance* **51 (1)**: 55–84.
- Fung, W. and Hsieh, D. (1998). Performance Attribution and Style Analysis: From Mutual Funds to Hedge Funds. Working Paper, Fuqua School of Business, Duke University
- Fung, W. and Hsieh, D. (1999). A Primer on Hedge Funds. *Journal of Empirical Finance* **6**: 309-331.
- Getmansky, M., Lo, A.W., and Mei, S.X. (2004). Sifting Through the Wreckage: Lessons form Recent Hedge Fund Failures. *Journal of Investment Management* **3(4)**.
- Lhabitant, F.S. (2004). *Hedge Funds: Quantitative Insights*. John Wiley & Sons, Inc., England.
- Liebenberg, A. and Hoyt, R. E. (2003). The Determinants of Enterprise Risk Management: Evidence from the Appointment of Chief Risk Officers . *Risk Management & Insurance Review* **6**: 37-52.
- Madhavan, A. and Yang, J. (2003). Practical Risk Analysis for Portfolio Manager and Traders.
- Markowitz, H. M. (1952). Portfolio Selection. *Journal of Finance* **7**: 77--91.
- Meulbroek, Lisa K., "Integrated Risk Management for the Firm: A Senior Manager's Guide" (February 20, 2002). Available at SSRN: <http://ssrn.com/abstract=301331>

Morton, D. P., Popova, E. and Popova I. (2005). Efficient Fund of Hedge Funds Construction Under Downside Risk Measures.

http://www.me.utexas.edu/~popova/mpp_manuscript.pdf .

Olszewski, Y. (2005). Building a Better Fund of Hedge Funds: A Fractal and Alpha-Stable Distribution Approach. <http://ssrn.com/abstract=776064>

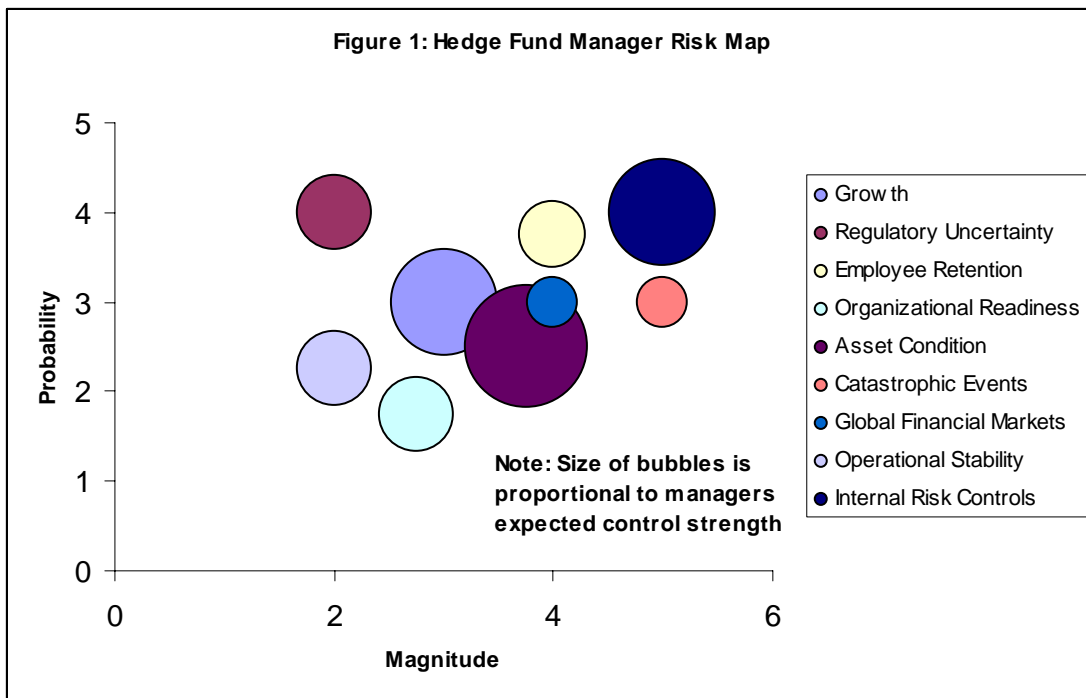
“Overview of Enterprise Risk Management.” Casualty Actuarial Society Enterprise Risk Management Committee, May 2003.

Panning, B. H. (2006). Managing the Invisible: Measuring Risk, Managing Capital, Maximizing Value. Available at SSRN: <http://ssrn.com/abstract=913682>

Schneeweis, T. and Spurgin, R. (1998). Multi-Factor Models in Managed Futures, Hedge Fund and Mutual Fund Return Estimation. *Journal of Alternative Investments*.

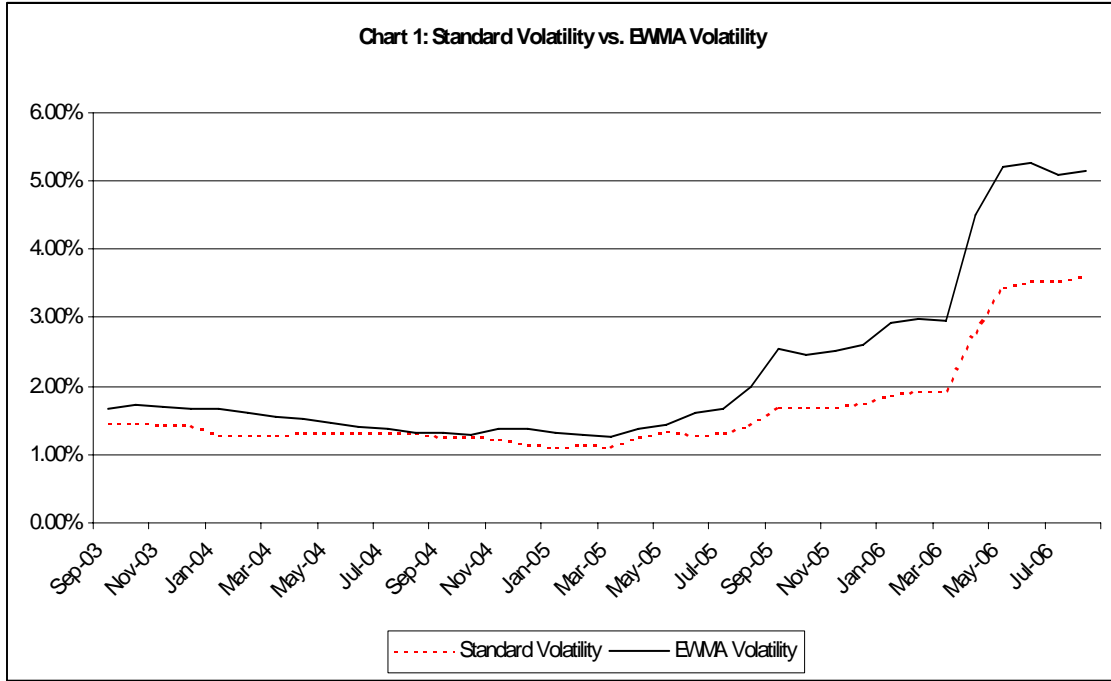
Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *Journal of Finance* **19**: 425-442.

Stulz, R. M. and Nocco, B. W. (2006). Enterprise Risk Management: Theory and Practice. Available at SSRN: <http://ssrn.com/abstract=921402>



How Enterprise Risk Management is the Answer – January 2007

Table 1: Emerging Market Manager Correlations				
	Normal Correl	Conditional Down	Conditional Up	
Hedge Fund 1	1.000	1.000	1.000	
Hedge Fund 2	- 0.027	- 0.350	0.127	
Hedge Fund 3	0.158	0.114	0.256	
Hedge Fund 4	- 0.108	0.271	- 0.140	
Hedge Fund 5	- 0.230	- 0.429	- 0.054	
Hedge Fund 6	0.182	- 0.044	0.267	
Hedge Fund 7	- 0.156	- 0.344	0.087	
Hedge Fund 8	0.003	1.000	0.030	
Hedge Fund 9	0.280	0.550	0.069	
Hedge Fund 10	0.087	- 0.105	0.327	
Hedge Fund 11	- 0.052	- 0.847	0.004	
Hedge Fund 12	0.548	0.827	0.103	
Hedge Fund 13	0.420	0.880	0.177	
Hedge Fund 14	0.637	0.861	0.403	
Hedge Fund 15	0.627	0.947	0.262	
Hedge Fund 16	0.001	- 0.270	- 0.125	
Hedge Fund 17	0.428	0.711	0.287	
Hedge Fund 18	0.384	0.460	0.023	
Hedge Fund 19	0.588	0.838	0.376	
Hedge Fund 20	0.129	0.310	0.234	
Hedge Fund 21	0.358	0.554	0.177	
Hedge Fund 22	0.433	0.143	0.302	
*EMBI+ Index	0.500	0.388	0.149	
*Euro Duration	- 0.100	0.066	- 0.150	
GSCI Total Return	- 0.261	- 0.242	- 0.251	
*JP Morgan Government Bond Index	- 0.007	0.377	- 0.086	
*LACI Index	0.736	0.691	0.522	
*Nikkei 225 Index	0.284	0.522	- 0.054	
*OSX Index	0.117	- 0.184	0.137	
*Russel(Value-Growth)	0.389	0.185	0.212	
*S&P 500 Index	0.404	0.361	0.106	
*SXXP Index	0.472	0.388	0.321	
*UKX Index	0.418	0.483	0.221	
*UBCIG10 Index	0.452	0.713	0.013	
*US Swap Spreads	- 0.257	- 0.177	- 0.189	
*US Duration	- 0.161	0.278	- 0.113	
*USGG10YR Index	- 0.143	0.325	- 0.088	
*USGG2YR Index	- 0.133	0.292	- 0.220	
*USGG30YR Index	- 0.198	0.254	0.016	
*UTIL Index	0.290	0.597	0.241	
Lehman Aggregate Bond Index	0.203	0.023	- 0.169	
Lehman Mortgage Backed Securities Index	0.302	0.041	0.027	
ML Fixed Rate ABS	0.141	0.617	0.124	
ML Euro High Yield	0.152	0.699	0.194	
MSCI EMF LATIN AMERICA-Emerging Markets-Net	0.681	0.790	0.474	
MSCI EMF FAR EAST-Emerging Markets-Asia Pacific-Net	0.393	0.727	0.234	
MSCI EMF ASIA-Emerging Markets-Asia Pacific-Net	0.410	0.764	0.248	
MSCI AC EUROPE-Emerging Markets-Net	0.387	0.230	0.151	
MSCI EM EASTERN EUROPE-Emerging Markets-Net	0.508	0.381	0.142	
Wilshire Large Growth Index	0.386	0.365	0.360	
Wilshire Large Value Index	0.383	0.462	0.100	
Wilshire Small Growth Index	0.302	0.439	0.130	
Wilshire Small Value Index	0.321	0.315	0.170	
*FMBS30YR	- 0.191	0.323	0.037	
*Kospi	0.470	0.457	0.415	
SSB BIG - LATIN AMERICA	0.410	0.438	0.029	
SSB BIG - ASIA PACIFIC	0.175	0.314	0.049	
SSB STRIPS Index, all maturities	0.170	0.245	0.069	



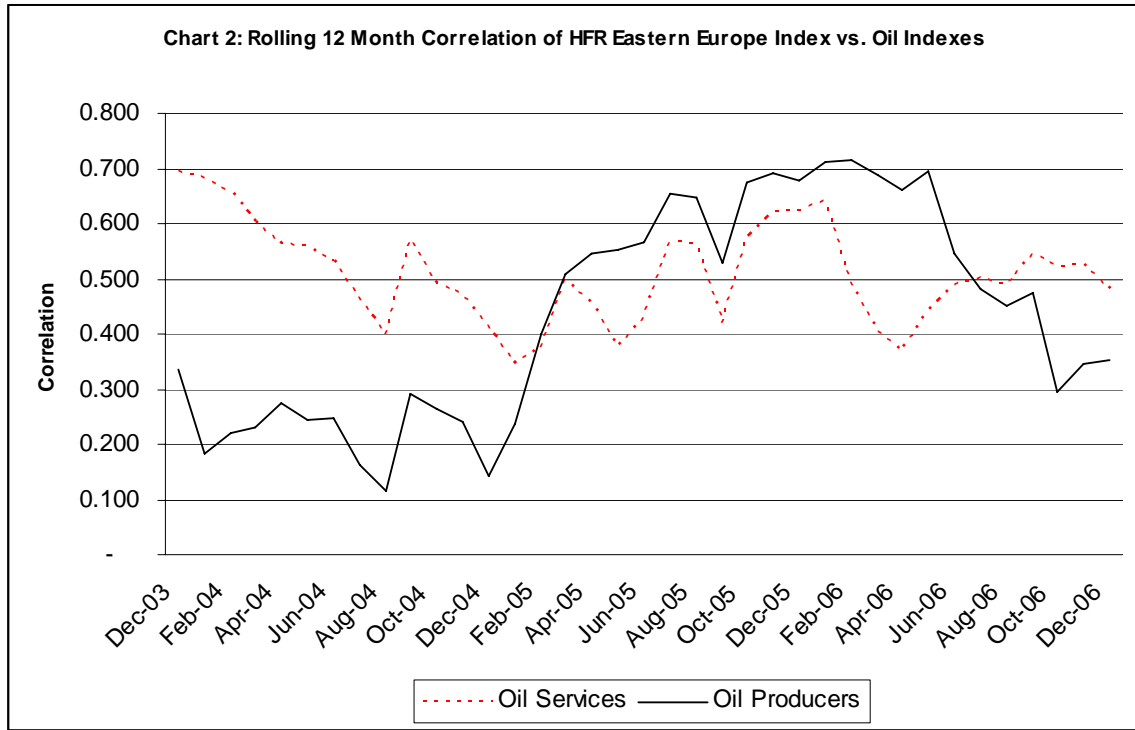
How Enterprise Risk Management is the Answer – January 2007

Table 2: Rolling 24 Month Style Analysis

	CTA Index	Convert Arb Index	Distressed Index	EM: Asia Index	EM: Eastern Europe/CIS Index	EM: Latin America Index	Equity Mkt Neutral	Event Driven Index	Ft: Convert Arb Index	Ft: High Yield Index	Ft: MBS	Market Timing Index	Reg D	Energy Index	Misc. Index	Real Estate Index	Technology Index	Short Selling Index	R2
Jan-05	11.2%	42.5%	-	-	0.1%	-	4.8%	-	1.5%	1.3%	2.4%	-	2.2%	4.1%	-	16.5%	13.5%	0.83	
Feb-05	7.9%	37.1%	-	2.0%	-	0.9%	13.4%	3.8%	-	25.9%	-	-	-	-	0.1%	9.0%	-	0.85	
Mar-05	13.6%	23.4%	-	-	-	4.6%	11.2%	8.8%	-	11.1%	-	-	-	-	-	14.9%	12.4%	0.78	
Apr-05	8.5%	45.5%	-	-	-	2.4%	13.0%	15.3%	-	5.2%	-	-	-	-	1.1%	6.3%	2.7%	0.81	
May-05	2.7%	46.4%	32.9%	-	-	-	-	-	-	-	-	-	0.8%	11.3%	-	-	5.9%	0.76	
Jun-05	2.3%	40.7%	9.1%	-	-	-	-	-	26.6%	-	-	-	2.0%	10.0%	-	-	9.3%	0.75	
Jul-05	-	44.4%	2.4%	-	-	-	-	-	29.2%	-	-	-	7.3%	9.7%	-	-	7.0%	0.75	
Aug-05	-	42.4%	-	-	0.5%	-	-	-	17.7%	-	-	-	18.7%	1.2%	11.5%	-	8.0%	0.69	
Sep-05	-	64.0%	-	-	11.1%	-	-	-	-	-	-	-	-	-	15.6%	-	9.4%	0.68	
Oct-05	-	59.0%	-	-	13.7%	-	-	-	-	-	-	-	-	-	15.0%	-	12.3%	0.69	
Nov-05	-	56.6%	-	-	13.4%	-	-	-	-	-	3.5%	-	-	-	15.4%	-	11.1%	0.68	
Dec-05	-	58.6%	-	-	13.0%	-	-	-	-	-	-	-	-	-	18.5%	-	9.9%	0.69	
Jan-06	-	56.7%	-	-	11.5%	-	-	-	-	-	-	-	-	-	22.1%	-	9.7%	0.74	
Feb-06	-	62.2%	-	-	18.9%	-	-	-	-	-	-	-	-	-	13.3%	-	5.6%	0.75	
Mar-06	-	62.6%	-	-	18.0%	-	-	-	-	-	-	-	-	-	14.7%	-	4.7%	0.79	
Apr-06	23.7%	-	-	-	31.8%	-	-	-	-	-	-	-	-	-	31.0%	-	13.5%	0.60	
May-06	23.9%	-	-	-	55.8%	-	-	-	-	-	-	-	-	-	20.4%	-	-	0.62	
Jun-06	10.2%	-	-	-	39.9%	31.9%	-	-	-	-	-	-	-	-	18.0%	-	-	0.50	
Jul-06	11.7%	-	-	-	44.5%	24.2%	-	-	-	-	-	-	-	-	17.9%	-	1.8%	0.51	
Aug-06	7.0%	-	-	-	45.1%	13.6%	-	-	-	-	-	-	-	-	17.8%	-	16.5%	0.49	

Table 3: Rolling 12 Month Style Analysis

	CTA Index	Convert Arb Index	Distressed Index	EM: Asia Index	EM: Eastern Europe/CIS Index	EM: Latin America Index	Event Driven Index	Ft: Convert Arb Index	Merger Arb Index	Reg D	Energy Index	Financial Index	Health Care Index	Misc. Index	Real Estate Index	Technology Index	Short Selling Index	R2
Jan-05	11.4%	23.9%	2.8%	11.4%	-	-	8.3%	-	-	-	-	1.9%	-	-	-	20.6%	19.6%	0.94
Feb-05	23.8%	-	15.0%	2.3%	-	-	0.1%	-	-	-	0.5%	23.5%	17.5%	-	-	-	17.4%	0.95
Mar-05	32.6%	-	0.8%	0.4%	0.8%	0.0%	13.0%	-	-	-	-	-	23.3%	-	7.0%	-	22.9%	0.94
Apr-05	21.2%	52.6%	0.3%	-	-	-	3.7%	-	22.2%	-	-	-	-	-	-	-	-	0.83
May-05	0.1%	45.5%	34.3%	-	-	-	-	-	-	-	-	-	-	11.4%	-	-	8.6%	0.75
Jun-05	7.8%	22.1%	-	-	-	-	-	51.5%	-	-	1.9%	-	-	-	-	-	16.6%	0.80
Jul-05	3.0%	-	-	-	-	-	-	78.3%	-	2.8%	-	-	-	-	-	-	15.9%	0.79
Aug-05	-	78.1%	-	-	6.9%	-	-	-	-	11.9%	-	-	-	-	-	-	3.1%	0.76
Sep-05	-	51.7%	-	-	20.2%	-	-	-	-	-	-	-	-	20.0%	-	-	8.1%	0.74
Oct-05	-	51.4%	-	-	20.9%	-	-	-	-	-	-	-	-	20.1%	-	-	7.7%	0.75
Nov-05	-	50.6%	-	-	22.6%	-	-	-	-	-	-	-	-	20.2%	-	-	6.6%	0.74
Dec-05	-	49.9%	-	-	22.2%	-	-	-	-	-	-	-	-	21.3%	-	-	6.6%	0.75
Jan-06	-	48.5%	-	-	27.6%	-	-	-	-	-	-	-	-	15.5%	-	-	8.3%	0.79
Feb-06	-	30.8%	-	-	32.1%	-	-	-	-	-	-	-	-	23.7%	-	-	14.2%	0.87
Mar-06	-	43.1%	-	-	40.8%	-	-	-	-	-	-	-	-	14.3%	-	-	1.9%	0.90
Apr-06	20.4%	-	-	-	61.5%	-	-	-	-	-	-	-	-	9.8%	-	-	8.3%	0.67
May-06	10.1%	-	-	4.2%	86.7%	-	-	-	-	-	-	-	-	-	-	-	-	0.75
Jun-06	-	-	-	-	51.1%	48.9%	-	-	-	-	-	-	-	-	-	-	-	0.63
Jul-06	-	-	-	-	54.3%	42.7%	-	-	-	-	-	-	-	-	-	3.0%	-	0.64
Aug-06	-	-	-	-	60.1%	15.7%	-	-	-	-	-	-	-	-	-	24.2%	-	0.62



How Enterprise Risk Management is the Answer – January 2007

Table 4: Optimization Results

	Current Portfolio	Constrained Optimization Statistics
Monthly Mean Return	1.43%	1.44%
Monthly Vol	1.15%	1.07%
Monthly VaR (95%)	-1.89%	-1.77%
Monthly VaR (99%)	-2.67%	-2.50%
Monthly CVaR 99%	-2.68%	-2.51%
Max Monthly Loss	-3.05%	-2.90%
Stressed VaR 99%	-5.79%	-4.64%
Information Ratio	1.24	1.34

Hedge Fund 1	4.19%	0.00%
Hedge Fund 2	4.50%	7.69%
Hedge Fund 3	0.88%	1.46%
Hedge Fund 4	3.02%	2.74%
Hedge Fund 5	2.88%	8.00%
Hedge Fund 6	5.28%	8.00%
Hedge Fund 7	5.21%	8.00%
Hedge Fund 8	6.35%	8.00%
Hedge Fund 9	5.85%	8.00%
Hedge Fund 10	3.51%	8.00%
Hedge Fund 11	9.87%	8.00%
Hedge Fund 12	2.01%	0.00%
Hedge Fund 13	6.35%	0.00%
Hedge Fund 14	1.81%	0.00%
Hedge Fund 15	3.92%	0.00%
Hedge Fund 16	7.31%	8.00%
Hedge Fund 17	2.94%	8.00%
Hedge Fund 18	4.67%	0.00%
Hedge Fund 19	3.14%	8.00%
Hedge Fund 20	5.74%	8.00%
Hedge Fund 21	7.17%	0.12%
Hedge Fund 22	3.40%	0.00%

Pro forma Statistics (Last 3 Years)	Current Portfolio	Constrained Optimization
Annualized Return	13.27%	12.85%
Annualized Vol	4.33%	3.56%
VaR 95% (Monthly)	-2.05%	-1.69%
Max DD	2.43%	1.14%
Information Ratio	3.07	3.61

*Barclay CTA Index	0.17	0.11
CAC 40 Index	0.18	0.12
*EMBI+ Index	0.27	0.14
FTSE 100	0.20	0.09
Goldman Sachs Natural Resource Index	0.13	0.11
GSCI Total Return	0.07	0.08
Lehman Aggregate Bond Index	0.08	-0.10
Lehman High Yield Credit Bond Index	0.31	0.22
*MSCI EAFE - Gross	0.23	0.16
MSCI Europe - Gross	0.21	0.15
Nasdaq Composite Index	0.12	0.08
Russell 1000 Index	0.18	0.10
Russell 2000 Index	0.20	0.16
Russell 3000 Growth Index	0.15	0.09
*S&P 500 Index	0.17	0.09
S&P 600 Small Cap Index	0.21	0.17

Table 5: Correlation between Managers Used in Optimization

Hedge Fund 1	1.00	-0.05	0.17	-0.12	-0.23	0.15	-0.14	0.03	0.28	0.09	-0.07	0.55	0.43	0.64	0.63	0.01	0.43	0.39	0.89	0.12	0.35	0.43
Hedge Fund 2	-0.05	1.00	-0.09	0.20	0.31	0.37	-0.05	-0.01	-0.08	-0.03	-0.04	0.11	0.15	0.00	0.29	-0.01	0.12	0.07	0.23	0.19	0.15	-0.02
Hedge Fund 3	0.17	-0.09	1.00	0.31	0.15	-0.06	-0.01	0.31	0.15	0.41	0.22	0.12	0.33	0.39	0.51	0.17	0.49	0.42	0.39	0.35	0.36	0.49
Hedge Fund 4	-0.12	0.20	0.31	1.00	-0.22	0.01	0.13	0.16	0.00	0.14	-0.02	0.07	-0.03	0.10	0.26	-0.08	-0.03	-0.04	0.19	0.38	0.05	0.15
Hedge Fund 5	-0.23	0.31	0.15	0.15	-0.22	1.00	0.22	-0.03	0.07	-0.09	-0.04	0.53	0.01	0.16	-0.20	0.01	0.28	0.23	0.21	0.19	0.10	0.12
Hedge Fund 6	0.15	0.37	-0.06	0.01	0.22	1.00	0.14	-0.27	0.04	0.04	-0.18	0.17	0.15	0.19	0.44	-0.01	-0.04	-0.01	0.11	0.07	0.16	0.18
Hedge Fund 7	-0.14	-0.05	-0.01	0.13	-0.03	0.14	1.00	-0.27	-0.10	0.27	-0.22	-0.10	-0.23	0.12	0.10	-0.52	-0.08	0.05	-0.01	0.19	-0.08	0.01
Hedge Fund 8	0.03	-0.01	0.31	0.16	0.07	-0.27	1.00	0.13	0.08	0.37	0.32	0.27	0.37	0.37	0.45	0.30	0.45	0.37	0.31	0.34	-0.03	0.49
Hedge Fund 9	0.28	-0.08	0.15	0.00	-0.09	0.04	-0.10	0.13	1.00	0.33	0.20	0.23	0.08	0.29	0.37	0.22	0.15	-0.01	0.08	0.21	0.16	0.45
Hedge Fund 10	0.09	-0.03	0.41	0.14	-0.04	0.04	0.27	0.08	0.33	1.00	0.02	0.42	0.38	0.35	0.51	-0.14	0.27	0.25	0.27	0.33	0.40	0.53
Hedge Fund 11	-0.07	-0.04	0.22	-0.02	0.53	-0.18	-0.22	0.37	0.20	0.02	1.00	0.25	0.30	-0.09	-0.23	0.27	0.26	0.18	0.16	0.26	0.31	0.14
Hedge Fund 12	0.55	0.11	0.12	0.07	0.01	0.17	-0.10	0.32	0.23	0.42	0.25	1.00	0.70	0.75	0.94	0.19	0.52	0.28	0.67	0.30	0.44	0.66
Hedge Fund 13	0.43	0.15	0.33	-0.03	0.16	0.15	-0.23	0.27	0.08	0.38	0.30	0.70	1.00	0.72	0.92	0.35	0.58	0.46	0.63	0.32	0.64	0.73
Hedge Fund 14	0.64	0.00	0.39	0.10	-0.20	0.19	0.12	0.37	0.29	0.35	-0.09	0.75	0.71	1.00	0.82	0.00	0.41	0.65	0.52	0.42	0.81	0.65
Hedge Fund 15	0.63	0.29	0.51	0.26	0.01	0.44	0.10	0.45	0.37	0.51	-0.23	0.94	0.92	0.82	1.00	0.17	0.65	0.66	0.83	0.40	0.81	0.72
Hedge Fund 16	0.01	-0.01	0.17	-0.08	0.28	-0.01	-0.52	0.30	0.22	-0.14	0.27	0.19	0.35	0.00	0.17	1.00	0.32	0.18	0.13	0.00	0.31	0.19
Hedge Fund 17	0.43	0.12	0.49	-0.03	0.23	-0.04	-0.08	0.45	0.15	0.27	0.26	0.52	0.80	0.41	0.65	0.32	1.00	0.74	0.54	0.25	0.28	0.66
Hedge Fund 18	0.39	0.07	0.42	-0.04	0.21	-0.01	0.05	0.37	-0.01	0.25	0.18	0.28	0.46	0.66	0.86	0.18	0.74	1.00	0.49	0.40	0.38	0.71
Hedge Fund 19	0.58	0.23	0.39	0.18	0.19	0.11	-0.01	0.31	0.08	0.27	0.16	0.67	0.63	0.52	0.83	0.13	0.54	0.49	1.00	0.36	0.41	0.54
Hedge Fund 20	0.12	0.19	0.35	0.38	0.10	0.07	0.19	0.34	0.21	0.33	0.26	0.30	0.32	0.42	0.40	0.00	0.25	0.40	0.36	1.00	0.31	0.66
Hedge Fund 21	0.35	0.15	0.36	0.05	0.12	0.16	-0.08	-0.03	0.16	0.40	0.31	0.44	0.64	0.61	0.81	0.31	0.28	0.38	0.41	0.31	1.00	0.65
Hedge Fund 22	0.43	-0.02	0.49	0.15	0.11	0.18	0.01	0.49	0.45	0.53	0.14	0.66	0.73	0.65	0.72	0.19	0.66	0.71	0.54	0.66	0.65	1.00