



FinAnalytica Executive Briefing Series

Rebuilding Trust between Managers and Investors:

How Can Risk Management
Become a Profit Centre and
Source of Competitive
Advantage?

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Introduction

It's hard to know who to listen to these days. It seems that everyone has ideas about what has caused the current market crisis, but few seem to offer credible ideas about how to address the underlying problems going forward.

Some things seem irrefutable:

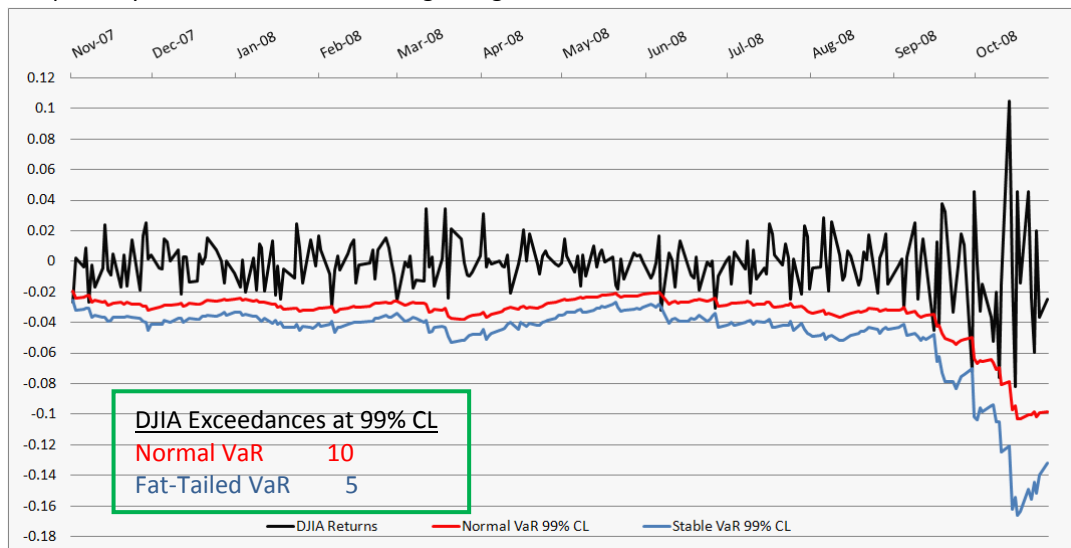
- Many risk models failed because they relied on the assumption of normal, a.k.a. Gaussian, distributions and static market correlations, and thus could not adequately model extreme event behaviour.
- Accurate and robust risk management is a critical catalyst in rebuilding trust between asset managers and institutional investors.

If firms demonstrate sound, proactive risk management practices and communicate transparently with their investors regarding

to come up with both better risk mitigation strategies and internal incentive structures for more decentralized risk management processes.

“Also, regulators and policy makers should become more sensitive to the inadequacy of current risk modelling approaches. Their misleading risk assessment may not only jeopardize individual financial institutions but, due to the institutions’ synchronization of misjudgement, will also be a destabilizing factor in national and international financial systems.”

Dr. Svetlozar Rachev & Dr. Stefan Mittnik,
 University of Karlsruhe, January 11, 2006
 Published interview www.risiko-manager.com
New Approaches for Portfolio Optimization: Parting with the Bell Curve



the true nature of risk and the market scenarios that are likely to impact the portfolio P&L in future, they will have a strong competitive advantage in retaining and growing AUM.

It is also useful to go back in time and relate past predictions to the current situation.

A Warning from the Past

“Designers of risk models have to shed the attitude ‘don’t let facts interfere with truth’. Risk models have to be based on empirical realities, since the converse is unlikely to happen. This will enable financial institutions

In quantitative disciplines, we rely on out of sample backtesting to systematically compare prediction to outcome. The out of sample backtest results for the Dow Jones Industrial Average through October 27, 2008 show that using a normal distribution assumption to estimate Value at Risk (VaR), even using exponentially weighted moving averages to capture volatility clustering, led to 10 instances of realised loss exceeding the predicted VaR threshold (exceedances) over the 350 days. This is significantly in excess of the maximum seven exceedances we would expect in order to prove the Gaussian model’s predictive power with 95% confidence. This



illustrates beyond a doubt that VaR results based on normal distribution assumptions are simply wrong.

	VaR Exceedances	
	Normal	Fat-Tailed
S&P 500	16	6
NASDAQ	11	5
Russell 2000	10	5
DAX	12	4
Hang Seng	11	6
Nikkei 225	12	7
RTSI	10	6
BSE SENSEX	10	4

Conversely, using a fat-tailed model for the Dow Jones Industrial Average resulted in five observed exceedances of the VaR threshold over the same period, which is well within the bounds required to prove the model's predictive capabilities. Similar improvements in accuracy of the fat-tailed model are shown for other indices in the table above.

We note that normal models, as in the case here, typically use simplistic exponentially weighted moving averages (EWMA) to capture volatility clustering. The fat-tailed VaR is based on the more flexible ARMA-GARCH model to better account for this phenomenon.

The analysis is repeated for eight other major global indices with similar result. In all instances the fat-tailed approach provides significantly improved VaR estimates over the Gaussian assumption.

Risk Measurement or Risk Management?

For many years, risk management has been viewed by senior executives as a cost centre; a necessary evil to tick the boxes of regulators or demanding clients, and acquired at the lowest cost and effort. This typically resulted in junior level staff with little practical experience and even less real authority monitoring realised volatility as a passive observer. This practice is akin to selecting the surgeon for your child's life-saving operation based on who has the lowest surgical fees and is available to operate on your next day off. It may sound strange, but this is effectively how many firms chose their risk management process.

This paradigm is at the root of a great deal of poor investment decision making, and is at least in part responsible for the mess in which we currently find ourselves. Incentivising performance, without any consideration of the ex-ante risk employed to achieve it, introduces perverse incentives to abuse the natural risk asymmetry inherent in many markets.

Instead, an engaged, proactive risk management function can become a valuable profit centre which generates substantial enterprise value with limited capital investment. This can be achieved by decentralizing risk at all stages of the investment process, and ensuring that the cost of achieving performance, in terms of allocated risk budget, is inextricably tied to every decision. Such a process inevitably leads to:

- Improved asset and manager selection by identifying and correctly pricing risk asymmetry and fat-tail risk.
- Better targeting of expensive and limited due diligence resources toward investments where the identified systematic risk drivers contradict qualitative assumptions.
- Early detection of style drift and market crisis.
- Improved investment performance and consensus decision-making through tail risk budgeting.
- Minimization of extreme loss through complex stress testing and crisis simulation.
- Rebuilding of trust between investors and asset managers through risk transparency and accurate risk estimation.

By demonstrating and communicating such a structured investment process, incorporating tail risk budgeting at every stage of decision making, managers can stem the tide of redemptions and gain competitive advantage in rebuilding AUM.

Back to Bedrock: Shoring up the Foundations
 "Modern" Portfolio Theory was instrumental in the creation of our current risk management and portfolio construction paradigms. But there have been many advances in statistics and computational

finance over the past 60 years that undermine its tenets. Clearly, MPT needs updating. We call the new paradigm “post modern” because it incorporates more sophisticated techniques to explain empirical observations that directly contradict the MPT framework.

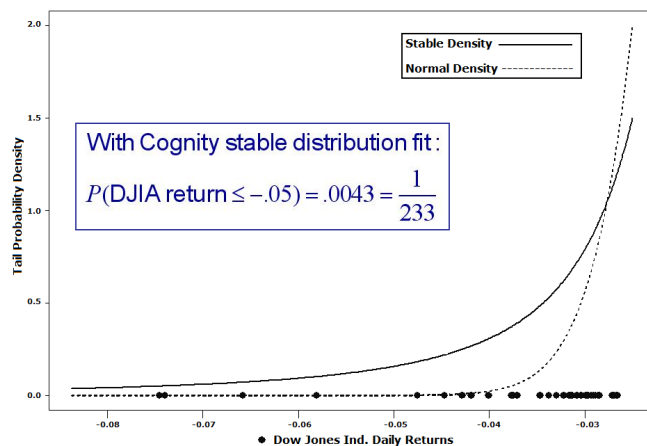
Firstly, there is some debate about the very idea of how one measures “risk”. Traditionally, risk was measured as annualised standard deviation, variance, tracking error, and the like. There are a number of problems with this approach. As an investor, I am not indifferent to upside and downside volatility. Downside performance is bad. It costs me money and causes concern about future wealth. Upside volatility in fact is not risk, but something we prefer. Nobody can begrudge the occasional windfall. Can we really assume that risk is symmetrical? The clear answer is no. There are an increasing number of investment instruments and strategies, especially in alternative investing, which exhibit highly asymmetrical risk patterns. To consider them as being equally attractive is simply wrong.

Traditional measures like the Sharpe ratio can be easily manipulated by those skilled in risk asymmetry. I can build a very successful investment track record by selling insurance on some rare or infrequent event (i.e. tsunami, or corporate credit defaults). I will happily show unwavering returns as I collect the risk premiums (and large annual bonuses). What I am actually doing is effectively pushing all of my risk into the left tail of the distribution. My unsuspecting investors, relying on their normal bell-shaped distribution assumptions, will mistake this for evidence of a low risk strategy and thus underestimate the probability of catastrophic loss by epic proportions. For years I may show steady positive returns, until the tsunami hits or the credit default rate jumps. It’s not that the risk wasn’t present from day one, it’s just that it is highly asymmetrical. I get a small, steady return over a long period, punctuated by a sharp period of extreme (sometimes terminal) loss. Just because the source of risk didn’t materialize each year doesn’t mean it’s

not there. Risk is not so much about what did happen but about what “could happen” based on the range of possible outcomes.

“The Gaussian assumption in finance was put forth more than a century ago. Markowitz developed his portfolio approach, which rests on that assumption, half a century ago. This assumption was challenged for the first time by Benoit Mandelbrot in the mid 1960s. By now most practitioners and regulators – including, for example, Alan Greenspan – are well aware of the fat-tail phenomenon. However, for a long time the mathematics and the practical implementation of full-scale models handling fat tails in a consistent manner has been an insurmountable stumbling block. It is only very recently that this has been overcome with FinAnalytica’s integrated risk management system Cognity.”

Dr. Stefan Mittnik
 University of Munich, January 11, 2006
 Published interview www.risiko-manager.com
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This probability comparison for the Dow Jones Industrial Average clearly shows that the normal, Gaussian density function places a zero probability on a daily loss above 5%, while the more accurate fat-tailed model correctly recognises that losses of 5% or more will occur on average about once per year.

Is VaR Enough?

As an example, let’s imagine that your child needs life-saving surgery and there are two surgical techniques available:



- The first procedure offers a 90% survival rate. Of those who survive, the recovery time is short and there are no lasting ill effects.
- The second procedure offers a 99.999% survival rate (none of the million patients have ever died but it is conceptually possible), but all of the patients have a much longer recovery time and 10% have mild ongoing disability for the remainder of their natural lives.

So the question is – which surgical option do you chose for your nearest and dearest?

Up to the 90th percentile the outcomes are very similar, with the first surgical option offering faster recovery and no chance of ongoing disability. Despite this, the outcomes in the worst 10% of cases are so onerous that the aversion coefficient becomes almost infinite. Any price is worth paying when it's my child on the operating table. In such cases, simple statistics are insufficient to support the right answer, because only by a scenario-based view can we imagine the impact of an unthinkable outcome. The decision also rests heavily on the objective function used. If my goal is to minimise recovery time and short term pain to my child, I am more likely to choose the first procedure as opposed to an objective of minimising the chances of premature death.

I'm not saying either decision would be right or wrong. If it were my own life at stake, one could argue I should be free to take a gamble. But given the fiduciary responsibility I have to my kids, the choice on their behalf seems clear. This should be analogous to the decisions taken by company directors, who share a fiduciary responsibility to their shareholders. Unfortunately however, such responsibilities are difficult to execute if truly accurate risk measurement tools are not readily available in a simple transparent form. If you don't visualize the worst case scenario, it can't happen... right? Wrong! Just because we haven't experienced an

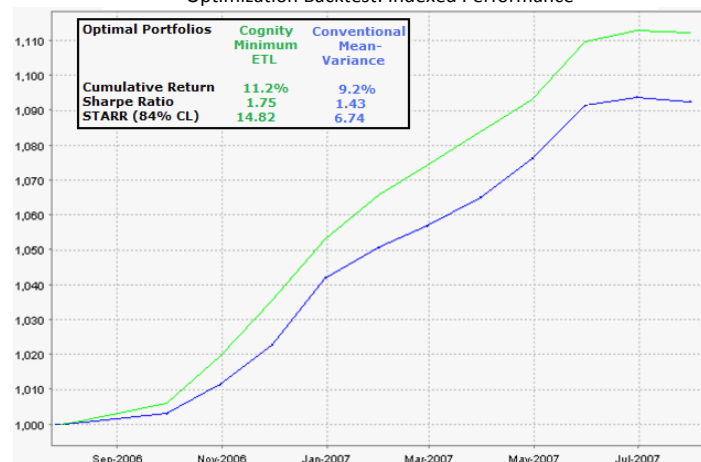
earthquake or hundred year flood personally doesn't mean the risk isn't there. It just means the risk happens rarely, but has a big impact on outcomes when it does. We spend billions of public funds building flood defences in London and retrofitting buildings in San Francisco precisely because the outcomes, no matter how infrequent, are unacceptable and should be avoided as best we can.

As it turns out, there has been some interesting research by behavioural scientists Daniel Kahneman and Amos Tversky which indicates that humans are notoriously bad at intuitively understanding the probabilities of outcomes, and predisposed to prefer steady small gains and infrequent sharp losses as opposed to the opposite. This makes most of us an easy target for short gamma strategies.

By identifying fat tails and risk asymmetry, the investor is much better equipped to actively manage extreme events and take steps to proactively mitigate unacceptable outcomes. In business terms, the improvements in asset and manager selection that come from identifying and correctly pricing risk asymmetry and fat-tail risk are likely to lead to:

- Penalty for managers who have a likelihood of extraordinary loss.
- Reward for managers with persistent upside potential.
- A very different ranking of manager attractiveness based on extreme downside risk-adjusted return measures.

Optimization Backtest: Indexed Performance





Such a measure does exist. Expected Tail Loss (ETL), also known as Conditional VaR or Expected Shortfall, measures the average loss when VaR is exceeded at some confidence interval.

As seen above in performance terms, backtests indicate that up to 200 bps per annum in typical performance improvement is available through better manager selection, management of tail risk and crisis diversification.

Let me repeat that: by minimising Expected Tail Loss (ETL) instead of variance, we are able to achieve nearly 200 bps in excess annual return at the same level of volatility, and at the same time reduce tail risk by about half. Put another way, at the same level of expected return, the investor could reduce extreme loss (tail risk) by about two thirds.

Correlation Shifts in Market Crisis

It is also important to note that correlations can shift dramatically in extreme market conditions. These dynamically changing correlations can have a profound impact on the value of the portfolio, because increasing correlation mitigates and reduces the diversification effects portfolio managers rely on. Modelling this process of dynamic correlation shift is complicated because the shifts are asymmetrical, meaning they tend to increase much more on the downside than on the upside. FinAnalytica accurately models these correlation shifts using an asymmetrical copula model, which leads to a much more realistic and accurate representation of the likely impact of market crisis.

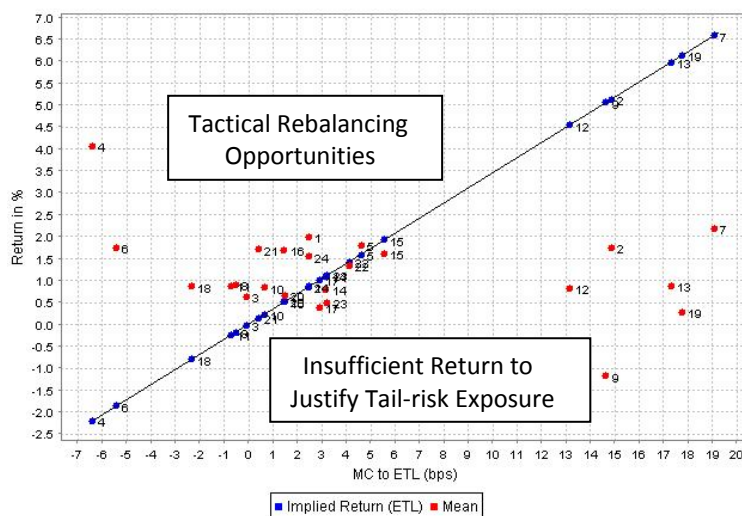
Tail Risk Budgeting

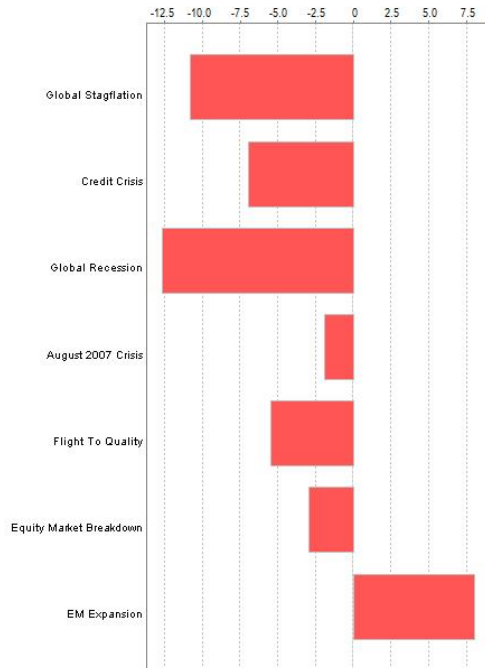
The concept of risk budgeting is important because it provides a structure on which to build consensus amongst the investment committee on issues of portfolio rebalancing. It ensures that each allocation decision is held up to the scrutiny of internal consistency. A manager who contributes to portfolio risk

must contribute to its return proportionally. Otherwise, equilibrium tells us we should reallocate risk elsewhere and achieve higher return for the same amount of risk.

Although portfolio managers can have difficulty accurately forecasting future fund or asset performance, they can turn the process on its head and solve for the return the asset *should* deliver in order to justify its risk budget consumption. The resulting “implied return” is easily compared against a manager’s explicit expectation (or gut reaction) to see if there is a gap. Large gaps indicate that allocation of risk may be inconsistent with the expectation of return and that reallocation might provide greater returns without any additional cost in terms of risk (diversification’s “free lunch”).

Tail risk budgeting is different from the traditional form of risk budgeting in that instead of using volatility or VaR as the measure of risk, it assesses each fund’s marginal contribution to Expected Tail Loss (ETL) and its implied return based on ETL optimal weights. As this may be computed using a scenario-based view of what “could” happen, considering observed fat tails and possible correlation shifts, the range of outcomes represents a more accurate view of what is likely to happen in a market crisis and allows the investor to take proactive steps to mitigate any unacceptable outcomes. The result is improved investment performance and consensus decision-making based on clear, shared objectives.





As seen in the chart above, the process of extreme loss minimization is further enhanced through complex stress testing and crisis simulation. Multifactor profiling leads to stress testing and crisis simulation that can help identify the possible market scenarios that might lead to levels of loss which jeopardise the survival of the firm. It is an excellent tool for thinking the unthinkable; and understanding risk in terms of scenario impact, recognizing that certain outcomes are simply unacceptable at any cost.

Conclusion

By demonstrating a structured investment process that systematically brings together quantitative and qualitative insight, asset managers are able to clearly communicate their added value and manage the expectations of the investor. Such open dialogue, utilizing a common language of risk, delivers desperately needed transparency and accountability and can help rebuild the trust between investors and asset managers.

“Post Modern” risk-based models are not just academic ideals, but can offer effective solutions to difficult empirical phenomena such as fat tailed risk and asymmetrical correlation shifts, which need to be modelled accurately. However, such risk models are not a panacea. No scientific tool by itself is able to deliver the silver bullet “right answer”.

But comprehensive, interactive risk systems like Cognity can help skilled managers ask the right questions. They help users to identify inconsistencies, understand and articulate complex market relationships, and assess the likely impact of multidimensional crisis scenarios on the value of their investment. In that sense they are not a crystal ball. Instead, used judiciously, they can be a tool of better investment decision making, allocation of resources and honest communication that delivers very substantial return on investment.



About FinAnalytica

FinAnalytica is a leading provider of post-modern portfolio and risk management solutions for quantitative analysts and portfolio managers. FinAnalytica's Cognition software suite incorporates the latest and most transparent advances in analytics, including comprehensive treatment of real world fat-tailed and skewed asset returns. FinAnalytica clients include leading fund of funds, hedge funds and asset management firms.

CognitionFoF offers funds of hedge funds and other multi-manager firms with complete risk management and portfolio construction analytics. CognitionFoF is the only risk platform offering fat-tailed, skewed VaR and Expected Tail Loss (ETL) risk measures. Its risk budgeting capabilities allow fund managers to maximize their expected returns per unit of allocated downside risk using Marginal Contribution to ETL, Percent Contribution to ETL and ETL-based Implied Return measures. Pro-actively managing their tail risk in a flexible, interactive and highly dynamic environment, CognitionFoF users can optimize their returns from a true downside risk perspective.

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