

FinAnalytica Executive Briefing Series

The Truth about Fat Tails and Black Swans:

How Can FinAnalytica Help Hedge Fund Investors in the Current Market Crisis?

By:

Marc Gross

Managing Director

FinAnalytica, London

October 20, 2008

Briefing No. 1



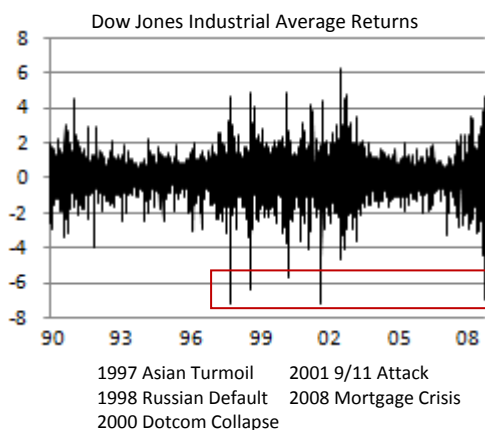
Introduction

We have just seen a financial Black Swan. Most people don't talk much about these types of events because by their very nature they are extremely rare, but as the world now knows, they can have a profound impact on our lives. Because of their rarity and resulting lack of data, most risk management practitioners ignore such "tail risk" and focus instead on the comfortable complacency of "normal market conditions" where there is plenty of data and things usually meander along pretty much as we expect them to... except when they don't, and then crisis sets in.

The problem is that as financial instruments have become more complex, opaque and highly leveraged, these rare events have the very real potential to destroy even the most venerable of institutions. Part of the problem stems from making what seem to be reasonable assumptions: that market behaviour can be accurately described by normal bell-shaped probability distributions, a.k.a. Gaussian distributions. Nassim Taleb calls these normal distribution assumptions the "great intellectual fraud", and was quoted along with the renowned financial mathematician Benoit Mandelbrot (Financial Times, 3/26/06) as saying, "Despite the shortcomings of the bell (normal distribution) curve, reliance on it is accelerating... Finance academia is too entrenched in the paradigm to stop calling it an acceptable approximation."

The normality assumption certainly makes the mathematics a lot easier, but it does not explain the empirical results. The real world has fat tails; and if we are to say anything meaningful about risk we must by definition employ robust, fat-tailed distributions in our modelling process. Simple approximations and transformations of the normal model results are naive "fudge factors" that remain dangerously inaccurate.

According to the normal distribution, each of the market crises observed over the past decade should only have occurred once every 1,000 years or so. Clearly, the normal distribution completely misses the likelihood of market crisis and therefore provides risk estimates that dangerously underestimate true risk.



The Pain in the Tail

The risks we care most about don't occur in the complacency of normal market conditions; they occur precisely in the tails of the distribution. Thus accurate modelling of tail risk, and indeed tail dependency, is of primary importance. Normal distributions imply zero correlation between markets in crisis and that couldn't be further from the truth. The study of tail risk can provide very meaningful information about market crisis—past, present and future—that can and should guide our investment decisions.

Black Swans

Black swans are those rare events which, until they occur, may have been thought impossible. They are some of the most dangerous sources of risk because they are "unknown unknowns". They can blindside us because we never saw them coming. Part of the job of a risk manager is to constantly scan the horizon, thinking about the unthinkable, and identifying contingency plans to minimise catastrophic loss.

More Informative Risk Measures

One important realization is that from the perspective of an investor, not all risk measures are created equal. Firstly, there is the issue of the investment horizon. If my investment is illiquid and I don't directly control day to day investment decisions (such as is the case with hedge fund investors), an overnight risk figure based on a positional snapshot does not accurately reflect my risk. As an investor in a hedge fund, I'm along for the ride, and much of my risk stems from the dynamic trading strategy of the manager over a long term investment horizon. This can be very different from the risk

given by a portfolio snapshot. Many hedge funds have recently fled to substantial cash positions, but does this view really capture my risk profile over a one year lockup period? Probably not.

No Cat's were Harmed.....



The picture above by Phillippe Halsman, called Dali Atomicus, offers an excellent analogy to this point. Here we have a snapshot of a point in time. We have a clear image of location, but very little idea of what is actually happening or where things are likely to end up even a few seconds later. In such cases, an analysis of the motion itself, the returns of the fund, would provide significantly more insight than the snapshot. By comparing manager returns to transparent reference points (the branded market factors) using advanced statistical modelling techniques, we can compute meaningful information about systematic risk drivers and style drift. We can anticipate the market scenarios that are likely to help or hurt performance in the future.

Risk Asymmetry

It is an important fact that risk is by its nature highly asymmetrical. Most rational investors view upside volatility (extreme profit) very differently from downside volatility (extreme loss). Investors are certainly more sensitive to loss, and by differentiating between the two, we can gain a new perspective on risk and return.

The classical volatility risk measure, known more formally as standard deviation, is symmetric, i.e. it penalises extreme profit equally as much as extreme loss. We should be focusing on loss-based risk with downside risk measures such as expected tail loss (ETL), which is the average loss

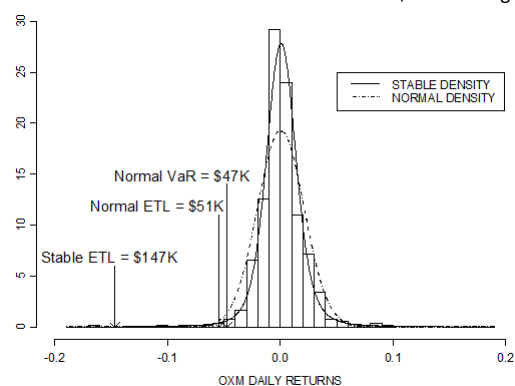
in events when you lose at least the VaR amount. Correspondingly we can analyse manager performance per unit of downside risk (known as STARR).

Expected Tail Loss

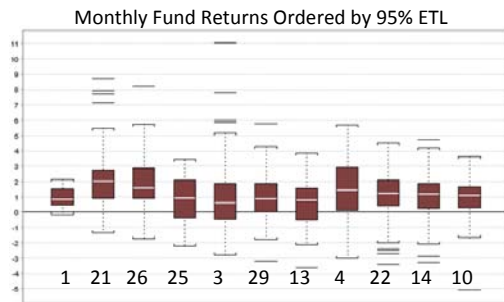
For investors, the traditional VaR estimate, representing the maximum expected loss over a given investment horizon for a given confidence interval, doesn't provide much enlightenment. OK, 5% of the time I will lose at least 10% of my assets. But "at least" is not very reassuring. In those 5% of really bad cases, can I expect an average loss of 11% (which I can live with), or 70% (which I would avoid at significant cost)? The answer to this question is of paramount importance to investors, especially in the face of a tail event.

In contrast, ETL, also called CVaR or expected shortfall, gives the investor a clear indication of the average loss they can expect in tail events beyond the VaR threshold. By actively managing ETL, investors can maximize return while truly minimizing the possibility of an unacceptable loss. We call this process downside risk budgeting. You can calculate ETL using a normal distribution assumption, but the resulting number will be disastrously optimistic in volatile markets. The figure below shows that true ETL risk is three times larger than that calculated under normal distribution assumptions.

1% Stable ETL vs Normal ETL vs Normal VaR - \$1M Overnight



In the chart below, managers 21 and 26 would have been penalised by the symmetric volatility measure of risk, ranking only 11th and 8th by standard deviation, while ranking second and third by the ETL measure.



ETL Rank	Manager	ETL	Std Dev Rank	Std Dev
1	Fund 1	0.100	1	0.622
2	Fund 21	0.742	11	2.092
3	Fund 26	1.670	8	1.854
4	Fund 25	2.050	3	1.462
5	Fund 3	2.400	13	2.547
6	Fund 29	2.503	7	1.718
7	Fund 13	2.885	4	1.586
8	Fund 4	2.970	10	2.065
9	Fund 22	3.050	6	1.706
10	Fund 14	3.085	5	1.589
11	Fund 10	3.380	2	1.397

Thus, by using downside risk adjusted return measures like STARR, we see a dramatically different picture of asset or manager desirability than is implied by the Sharpe ratio. This distinction naturally leads to downside risk optimal portfolios which persistently outperform their mean/variance counterparts at the same level of downside risk.

Factor Modelling

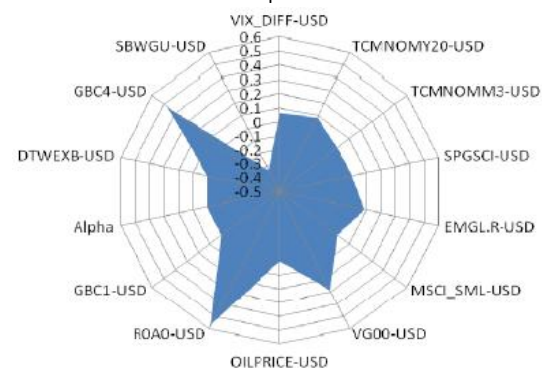
Another approach that supports the active management of tail risk and black swans is factor profiling. This is the process of relating the behaviour (performance) of a manager to transparent market factors over time, through the application of advanced statistical models.

Factor profiles can serve a number of purposes, and different techniques can be employed in support of them. For example, when scanning the horizon for black swans it is important to use the broadest possible factor set to systematically search for statistical relationships that cannot immediately be dismissed as spurious, and thus require further investigation. In such cases, a broad single-factor analysis, with ranking of significant factor relationships by explanatory power, may shed useful light on underlying risk drivers which are not immediately apparent.

Such objective information can validate or challenge qualitative views and can help target due diligence resources and guide manager interviews.

Synergies between quantitative and qualitative insight may be exploited using a subset of reasonable factors chosen in a stepwise, multifactor environment to analyse aggregated portfolio level risk, and identify the manager's contribution to the factor risk of the overall portfolio. One key benefit of a multifactor modelling environment is the ability to create complex multidimensional market stress scenarios to assess the likely impact on portfolio value. For example, even though our portfolio may never have suffered a "stagflationary" market environment, we have a clear idea of how market factors behaved during past crises and can project the current factor exposures through the lens of such periods. Skilled users can readily imagine complex scenarios that are plausible, but have never actually occurred, and assess their impact on portfolio profit and loss. Such stress testing and crisis simulation can effectively guide proactive tail risk management decisions, and be used to mitigate painful outcomes. They can also foster consensus among the investment committee on rebalancing decisions and support communication with clients about the nature of risk and breadth of possible outcomes.

Portfolio Robust Stepwise Factor Model



The spider chart above shows the dominant factor bets based on an automated robust stepwise multifactor selection. FinAnalytica offers its clients a branded global factor set because we believe that risk factors must be completely transparent for correct interpretation and effective communication.



Blow Up Risk

Multifactor analysis can also provide critical insight into potential blow up events. This means that by relating a manager's behaviour to transparent market factors, we have an opportunity to transcend the observed history of the manager, which is specific to a market period, and understand how it might perform in other market conditions. For example, we could be faced with a manager who has a three year track record of consistent positive returns from a long exposure to credit. If the manager has only existed during a benign credit environment, there would be little volatility or drawdown to indicate risk. Does this mean however that credit markets will always remain benign? A Sharp ratio of 10, or the lack of past drawdown, doesn't tell us anything meaningful about the real risk being taken.

Even in a benign market environment, we can measure statistical relationships to transparent credit factors that have blown up in the past. By extrapolating these measured statistical relationships into periods of credit crisis, we can gain a much more accurate estimate of the manager's potential loss during a credit crisis event.

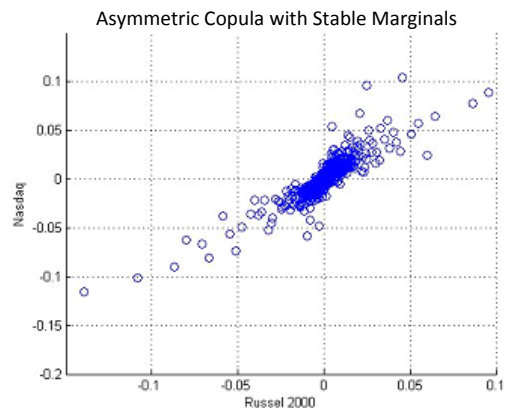
This ability to, at least partially, transcend the limitations of performance history is a primary source of value in proactive risk management.

Dynamic Correlations: Recognizing and Quantifying Correlation Shifts during Extreme Events

Even though the current crisis is unique in its origin and path, there are important lessons we can learn from past crises that will help to successfully navigate this one. The interrelationship between markets is complex, but some aspects are relatively stable. For example, we know from empirical observation that classical correlations between markets significantly overestimate the diversification benefits during times of market crisis. In other words, markets tend to become much more highly correlated in extreme negative events and much less correlated in positive, "bull" markets.

In the following graph, notice the "arrow head" shape of the correlation structure which is much

higher on the downside and more widely dispersed on the upside.



It is important for investors to recognize this persistent phenomenon, quantify it and incorporate it into their risk management process. Such asymmetrical correlation shifts will dramatically change the results of stress testing and can have a material impact on the resulting investment decisions.

Counterparty Risk

The current crisis also reminds us that counterparty risk is important to monitor and manage. One way to achieve this is to classify funds and assets by counterparty, and then to report on isolated and marginal contribution to portfolio risk. In this way, counterparty exposures can be monitored and adjusted if necessary.

Conclusion

In conclusion, it seems clear that world markets have entered a new period of crisis. Normality assumptions wrongly tell us that this chain of events have a vanishingly small probability. But the fact that such crises happen so regularly is the clearest evidence that robust fat-tailed returns models are necessary. Although each crisis is unique, there are still common elements that can be successfully modelled using advanced techniques. Accurately modelling factor risk and tail dependency might at first seem like an academic exercise, but in fact this process will almost certainly lead to better investment decision-making and higher return at the same or lower levels of downside risk. Such value can be easily quantified, and is likely to support the argument that a risk system purchase is a capital investment that offers rapid payback and excellent return on Investment.



About FinAnalytica

FinAnalytica is a leading provider of post-modern, “glass box” risk management and portfolio construction solutions for quantitative analysts and portfolio managers. FinAnalytica's Cognity 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.

CognityFoF offers funds of hedge funds and other multi-manager firms with complete risk management and portfolio construction analytics. CognityFoF is the only risk platform offering fat-tailed, skewed VaR and Expected Tail Loss (ETL) risk measures. Its downside 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, CognityFoF users can optimize their returns from a true downside risk perspective.

Corporate

FinAnalytica Inc.

1100 Dexter Avenue North

Seattle: Suite 100

Seattle, WA 98109 USA

Telephone: (206) 273 – 7889

Fax: (206) 299 – 9534

Sales & Marketing

New York: 122 East 42nd St., 17th Floor

New York, NY 10168 USA

Telephone: (212) 551 – 1143

Fax: (212) 551 – 1145

London: 1 Berkley Street

London W1J 8DZ UK

Telephone: +44 (0) 20 7016 8871

Fax: +44 (0) 20 7016 9100

Development & Research

FinAnalytica Bulgaria Ltd.

Bulgaria

Sofia: 1407 Sofia

21 Srebarna Str., Floor 5

Telephone: +359 2 962 4645

www.fanalytica.com