

# Learning from Amaranth: How to use Riskdata FOFiX to support Hedge Fund monitoring

## Executive Summary

The blow-up at Amaranth has generally been viewed by the analyst community as an operational risk problem rather than a market risk one:

- Unlike the LTCM crisis, there is no broad systemic impact on other funds or asset classes: the losses are limited solely to this particular fund and its investors.
- The blow up happened on a very specific series of large trades on North American gas calendar spreads, which have a tenuous relationship with macro economic factors such as the oil price. Even if, as the EDHEC study shows, there are co-integrated long term relationships between gas and oil, on a short term basis, the price fluctuations tend to be uncorrelated.

Moreover, according to a number of its investors Amaranth was quite transparent, providing good and high frequency qualitative information.

Therefore, it could be concluded that the Amaranth problem is beyond the scope of a quantitative risk system whose main aim is to detect systematic risks across a portfolio of hedge funds.

However, it is noteworthy that Riskdata's FOFiX system is able to deliver three clear quantitative signals on the Amaranth fund, *starting far before the first May Draw down*. We observe:

1. A rapidly increasing level of risk since the beginning of the year, culminating at 45% above that of the SP500 before the first draw down in May, and at 89% above the SP500 by the end of August.
2. A persistent and significant exposure to energy related factors (Oil, Equity Energy and Material Sectors, Oil & Gas producing Countries) followed by a surprising factor profile drift in August.
3. A very strong risk concentration on Gas from the beginning of the year when the analysis is expanded to include Gas factors. This is followed again by a surprising profile drift in August, with a significant downside risk.

This shows that a quantitative system like FOFiX can give strong support to the monitoring process, raising issues for qualitative analysis and enabling further discussions with the manager to get sound answers to the following questions – without requiring daily access to full portfolio transparency:

- What kinds of bad scenarios could happen?
- What are the levels of Risk and Exposures?
- What precise Risk Factors could result in a bad scenario?

Moreover, even if classical Risk measures such as VaR (for instance "open-source RiskMetrics<sup>®1</sup> methodology"- like techniques) gave an advanced signal (point 1), this by itself is not sufficient. There are many other occurrences of increased VaR on the markets that are not alarming. Methodologies accounting for Hedge funds specificities, such Riskdata FOFiX<sup>® 2</sup>(points 2 and 3), focus Risk Manager's attention on much narrower and clearer signals, while leveraging on qualitative insights.

<sup>1</sup> RiskMetrics is a registered trademark of RiskMetrics Group

<sup>2</sup> FOFiX is a registered trademark of Riskdata

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## Ex Post “Candid” View:

According to the *Washington Post*: “Natural gas traders said Hunter took risky positions too. He bet that the price of winter natural gas would rise and that the price of summer gas would fall -- the opposite of what has happened. He also bet that the gap between the March 2007 natural gas price and the April 2007 would increase. Instead, it fell from about \$2.60 per 1,000 cubic feet to about 80 cents.”

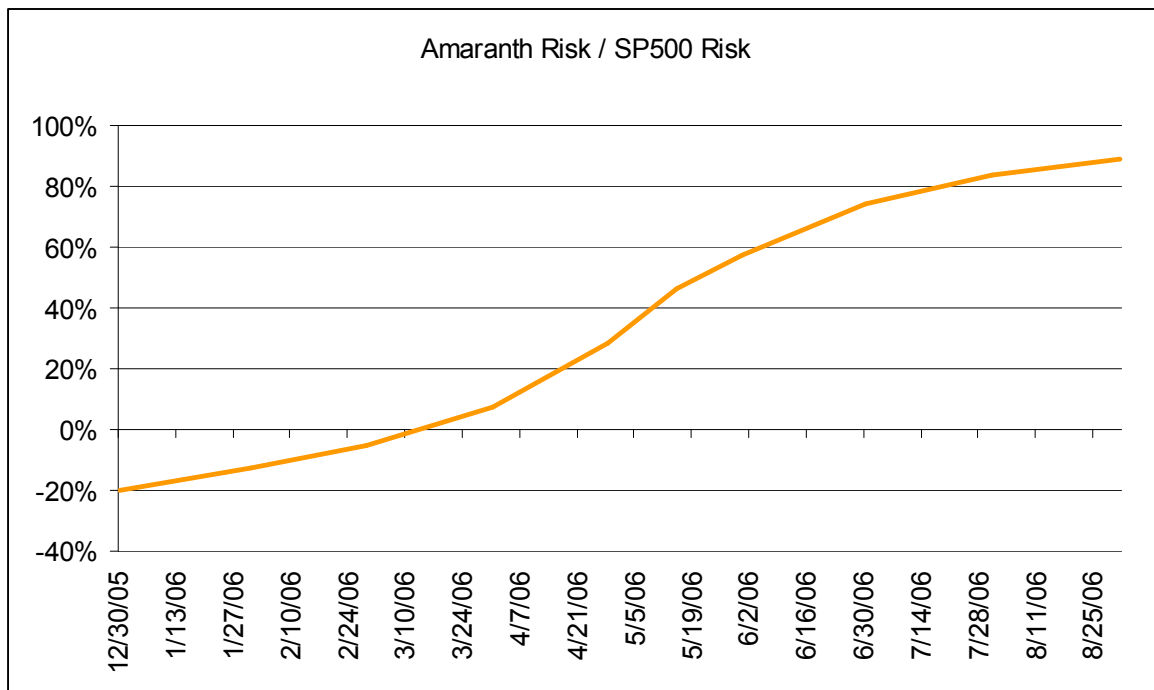
## Ex ante Analysis:

The ex post analysis may be useful for performance analysis, but the key question for any risk management system is to know if it was possible to anticipate the Amaranth blow up event through a structured quantitative analysis. In other words, could FOFiX have warned investors of the risks embedded in Amaranth’s track record before the end of August?

FOFiX’s quantitative indicators delivered clear quantitative signals since the beginning of the year.

### Warning n°1: Rapidly Increasing Risk Relative to the SP500

If we run the FOFiX analysis over a rolling observation window since the beginning of the year, we can observe a rapidly increasing level of ex-ante risk for Amaranth<sup>3</sup>: from a level 20% below that of the SP500 at the beginning of the year to a level 90% greater than the SP500 by the end of August. Clearly, this increase in the level of risk was noteworthy.



<sup>3</sup> Namely, we used ex ante vol as computed by Riskdata (function RTVOL)

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Just before the first drawdown, the ex-ante risk of Amaranth was observed as being 46% higher than the SP500:

|           | Amaranth Risk vs SP500 Risk | Amaranth | Brent Crude Oil IPE | SP500 |
|-----------|-----------------------------|----------|---------------------|-------|
| 30-Dec-05 | -20%                        | 2.5%     | 8.2%                | 3.2%  |
| 31-Jan-06 | -12%                        | 2.7%     | 8.2%                | 3.1%  |
| 28-Feb-06 | -5%                         | 2.8%     | 8.1%                | 3.0%  |
| 31-Mar-06 | 7%                          | 3.1%     | 8.0%                | 2.9%  |
| 28-Apr-06 | 28%                         | 3.5%     | 8.3%                | 2.7%  |
| 15-May-06 | 46%                         | 4.0%     | 8.0%                | 2.7%  |
| 31-May-06 | 57%                         | 4.3%     | 8.5%                | 2.7%  |
| 30-Jun-06 | 74%                         | 4.9%     | 7.9%                | 2.8%  |
| 31-Jul-06 | 84%                         | 4.9%     | 8.3%                | 2.6%  |
| 31-Aug-06 | 89%                         | 5.1%     | 7.4%                | 2.7%  |

## Warning n°2: High Negative Convexity, Persistent Exposure to Energy Related Factors and Pre-Crash Profile Instability

Even if we maintain the assumption that the user had no qualitative information on Amaranth, there is clear information available from the factor profiling exercise.

What we can observe here is a strong and stable energy bias up to the first June drawdown event, followed by a surprising profile drift. This clearly indicates that there is something strange happening to the return series.

Attached below are the factor profiles for a rolling 8 month time window using the Build Sequence function in FOFIX:

27 May 05 - 25 January 06: Here we can observe an advanced warning indicated by the negative convexity and strong energy bias, and exposure to a major commodities equity market.

| Factor      | Sensi | Beta+  | Beta-  | Beta++ | Beta-- | Type        | SubType | Country | Beta   | Gamma  |
|-------------|-------|--------|--------|--------|--------|-------------|---------|---------|--------|--------|
| SEENER_USAD | 0.53  | -0.11% | 1.45%  | -0.28% | 2.32%  | SECTOR      | Energy  | USA     | 0.67%  | -1.55% |
| EQMAIN_AUSD | 0.45  | 0.00%  | 0.37%  | 0.00%  | 2.02%  | EQUITY      | MAIN    | AUS     | 0.19%  | -0.37% |
| CALASM_USAR | 0.45  | -1.04% | -1.06% | -3.31% | -3.27% | CAP SIZE    | LASMALL | USA     | -1.05% | 0.03%  |
| COILCO_USAD | 0.45  | 0.20%  | 0.71%  | 0.55%  | 2.43%  | COMMODITY   | ENERGY  | USA     | 0.45%  | -0.52% |
| VOSHOR_USDV | 0.34  | 3.43%  | 2.56%  | 7.10%  | 2.21%  | VOLATILITY  | SHORT   | USA     | 2.99%  | 0.87%  |
| COFORE_CHFV | 0.29  | 1.77%  | -1.57% | 3.88%  | -3.59% | CONVERGENCE | FOREX   | CHE     | 0.10%  | 3.34%  |
| CUSPOT_ARSD | 0.28  | 0.00%  | 0.09%  | 0.00%  | 9.67%  | CURRENCY    | SPOT    | ARG     | 0.04%  | -0.09% |
| INSHOR_EURD | 0.24  | -0.20% | -0.22% | -0.75% | -0.84% | INT RATES   | SHORT   | EUR     | -0.21% | 0.02%  |
| STGROW_EURD | 0.20  | 0.25%  | 1.04%  | 1.53%  | 7.79%  | STYLE       | GROWTH  | EUR     | 0.65%  | -0.79% |
| CULONG_GBRS | 0.19  | 0.00%  | 1.85%  | 0.00%  | 15.80% | CURVE SLOPE | LONG    | GBR     | 0.93%  | -1.85% |
| COEQUI_EMAC | 0.05  | 1.50%  | -0.87% | 2.69%  | -0.68% | CORRELATION | EQUITY  | EMA     | 0.31%  | 2.36%  |
| CRAAA_USAR  | 0.03  | -0.15% | -0.16% | -0.51% | -0.47% | CREDIT      | AAA     | USA     | -0.16% | 0.01%  |

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**16 August 05 - 16 April 06:** Just before the first draw down, there was a stable and strong energy bias.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta-- | Type        | SubType | Country | Beta   | Gamma   |
|-------------|-------|--------|--------|---------|--------|-------------|---------|---------|--------|---------|
| COILCO_USAD | 0.41  | 0.43%  | 0.45%  | 1.22%   | 1.49%  | COMMODITY   | ENERGY  | USA     | 0.44%  | -0.02%  |
| SEENER_USAD | 0.40  | 0.51%  | 0.48%  | 1.34%   | 1.32%  | SECTOR      | Energy  | USA     | 0.50%  | 0.03%   |
| EQMAIN_CAND | 0.33  | 0.00%  | 0.61%  | 0.00%   | 6.97%  | EQUITY      | MAIN    | CAN     | 0.31%  | -0.61%  |
| COEQUI_EMAC | 0.30  | 2.74%  | -0.96% | 4.94%   | 0.45%  | CORRELATION | EQUITY  | EMA     | 0.89%  | 3.70%   |
| INSHOR_GBRD | 0.28  | -5.93% | 6.52%  | -24.71% | 30.34% | INT RATES   | SHORT   | GBR     | 0.30%  | -12.45% |
| VOLONG_GBPV | 0.27  | 0.95%  | -2.29% | 2.17%   | -6.61% | VOLATILITY  | LONG    | GBR     | -0.67% | 3.23%   |
| CULONG_JPNS | 0.25  | 1.64%  | 0.00%  | 10.28%  | 0.00%  | CURVE SLOPE | LONG    | JPN     | 0.82%  | 1.64%   |
| STGROW_EURD | 0.17  | 0.00%  | 1.39%  | 0.00%   | 10.39% | STYLE       | GROWTH  | EUR     | 0.69%  | -1.39%  |
| CALASM_GBRR | 0.15  | 0.61%  | 0.56%  | 1.73%   | 1.56%  | CAP SIZE    | LASMALL | GBR     | 0.59%  | 0.05%   |
| COEQUI_USDV | 0.13  | -0.55% | 0.97%  | -2.07%  | 10.56% | CONVERGENCE | EQUITY  | USA     | 0.21%  | -1.52%  |
| CUSPOT_GBPD | 0.10  | 0.59%  | -0.58% | 1.34%   | -1.75% | CURRENCY    | SPOT    | GBR     | 0.01%  | 1.17%   |
| CRHYIE_USAD | 0.08  | 0.00%  | 0.64%  | 0.00%   | 4.11%  | CREDIT      | HYIELD  | USA     | 0.32%  | -0.64%  |

**5 November 05 - 6 July 06:** Here again we can observe a warning signal as indicated by the factor profile drift; the profile itself is starting to become inconsistent when compared to the previously stable picture.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta--  | Type        | SubType   | Country | Beta   | Gamma  |
|-------------|-------|--------|--------|---------|---------|-------------|-----------|---------|--------|--------|
| SEMATE_EUOR | 0.60  | 0.00%  | 0.98%  | 0.00%   | 9.14%   | SECTOR      | Materials | EUO     | 0.49%  | -0.98% |
| EQMAIN_SCAD | 0.54  | 7.91%  | -2.45% | 56.09%  | -7.97%  | EQUITY      | MAIN      | SCA     | 2.73%  | 10.36% |
| STGROW_EURD | 0.41  | 0.81%  | 1.02%  | 2.10%   | 2.92%   | STYLE       | GROWTH    | EUR     | 0.92%  | -0.20% |
| COSECT_EUOC | 0.40  | -4.71% | 0.00%  | -17.88% | 0.00%   | CORRELATION | SECTOR    | EUO     | -2.36% | -4.71% |
| CULONG_JPNS | 0.39  | 2.82%  | 0.44%  | 8.15%   | 15.68%  | CURVE SLOPE | LONG      | JPN     | 1.63%  | 2.38%  |
| VOMGOL_USDV | 0.38  | -2.97% | 0.00%  | -14.18% | 0.00%   | VOLATILITY  | MGOLD     | USA     | -1.49% | -2.97% |
| INLONG_SWED | 0.37  | 0.00%  | 1.91%  | 0.00%   | 9.86%   | INT RATES   | LONG      | SWE     | 0.96%  | -1.91% |
| CALASM_EUOR | 0.37  | -1.38% | 1.65%  | -4.84%  | 4.26%   | CAP SIZE    | LASMALL   | EUO     | 0.14%  | -3.02% |
| COILCO_USAD | 0.36  | 0.70%  | 0.00%  | 4.05%   | 0.00%   | COMMODITY   | ENERGY    | USA     | 0.35%  | 0.70%  |
| CUSPOT_CHFD | 0.23  | 1.07%  | 0.00%  | 4.99%   | 0.00%   | CURRENCY    | SPOT      | CHE     | 0.54%  | 1.07%  |
| COFORE_CHFV | 0.20  | 0.34%  | 0.30%  | 0.75%   | 0.68%   | CONVERGENCE | FOREX     | CHE     | 0.32%  | 0.04%  |
| CRBAA_USAS  | 0.00  | 0.00%  | -4.92% | 0.00%   | -19.04% | CREDIT      | BAA       | USA     | -2.46% | 4.92%  |

**31 December 05 – 31 August 06:** The profile for this period becomes strange and completely inconsistent with the previous picture. Also clearly apparent is very strong convexity indicating significant negative skew.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta--  | Type        | SubType            | Country | Beta   | Gamma   |
|-------------|-------|--------|--------|---------|---------|-------------|--------------------|---------|--------|---------|
| VOSHOR_EURV | 0.51  | 1.21%  | 2.03%  | 3.44%   | 4.12%   | VOLATILITY  | SHORT              | EUR     | 1.62%  | -0.82%  |
| EQMAIN_SCAD | 0.44  | 5.82%  | -2.43% | 18.77%  | -8.04%  | EQUITY      | MAIN               | SCA     | 1.70%  | 8.25%   |
| CUSPOT_ARSD | 0.42  | 0.51%  | 0.53%  | 12.31%  | 40.90%  | CURRENCY    | SPOT               | ARG     | 0.52%  | -0.02%  |
| SETELE_USAR | 0.42  | 0.00%  | -2.60% | 0.00%   | -21.80% | SECTOR      | Telecommunications | USA     | -1.30% | 2.60%   |
| COMHGS_USAD | 0.38  | -5.93% | 5.84%  | -16.78% | 20.09%  | COMMODITY   | MHGS               | USA     | -0.04% | -11.77% |
| COSECT_EUOC | 0.38  | -3.99% | 0.00%  | -15.57% | 0.00%   | CORRELATION | SECTOR             | EUO     | -2.00% | -3.99%  |
| CALASM_EUOR | 0.36  | -1.98% | 2.39%  | -7.06%  | 6.22%   | CAP SIZE    | LASMALL            | EUO     | 0.20%  | -4.37%  |
| INLONG_EURD | 0.33  | -0.28% | -0.21% | -0.67%  | -0.56%  | INT RATES   | LONG               | EUR     | -0.25% | -0.07%  |
| CUSHOR_EUUS | 0.32  | -6.64% | 6.18%  | -25.74% | 23.23%  | CURVE SLOPE | SHORT              | EUU     | -0.23% | -12.82% |
| COEQUI_USDV | 0.26  | 2.49%  | 0.00%  | 15.05%  | 0.00%   | CONVERGENCE | EQUITY             | USA     | 1.24%  | 2.49%   |
| STGROW_EURD | 0.20  | 1.07%  | 1.34%  | 2.76%   | 3.84%   | STYLE       | GROWTH             | EUR     | 1.21%  | -0.27%  |
| CRHYIE_USAD | 0.12  | 2.18%  | 2.97%  | 7.49%   | 10.70%  | CREDIT      | HYIELD             | USA     | 2.58%  | -0.79%  |

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## Warning n°3: High and Persistent Exposure to Gas Spreads

If we have the possibility to further investigate the Amaranth's portfolio using qualitative analysis, we can get better modelling results by expanding the factor set to include a basket of gas factors<sup>4</sup>. In such case, we observe a very strong and persistent signal of exposure to the NYMEX gas factor, first to directional futures, then to March / April calendar spread, with negative convexity and growing negative betas through time. This again is followed by a strange and inconsistent profile drift after the first draw down.

**27 May 05 - 25 January 06:** Here we can observe a strong warning illustrated by negative convexity. The factor with the highest sensitivity, NNGH7, is a proprietary factor we loaded representing the March 07 future NYMEX Gas contract.

| Factor      | Sensi | Beta+  | Beta-  | Beta++ | Beta-- | Type        | SubType   | Country | Beta   | Gamma  |
|-------------|-------|--------|--------|--------|--------|-------------|-----------|---------|--------|--------|
| _NNGH7      | 0.64  | 0.00%  | 0.78%  | 0.00%  | 0.78%  | COMMODITY   | COMMODITY | USA     | 0.39%  | -0.78% |
| SEENER_USAD | 0.53  | -0.11% | 1.45%  | -0.28% | 2.32%  | SECTOR      | Energy    | USA     | 0.67%  | -1.55% |
| EQMAIN_AUSD | 0.45  | 0.00%  | 0.37%  | 0.00%  | 2.02%  | EQUITY      | MAIN      | AUS     | 0.19%  | -0.37% |
| CALASM_USAR | 0.45  | -1.04% | -1.06% | -3.31% | -3.27% | CAP SIZE    | LASMALL   | USA     | -1.05% | 0.03%  |
| VOSHOR_USDV | 0.34  | 3.43%  | 2.56%  | 7.10%  | 2.21%  | VOLATILITY  | SHORT     | USA     | 2.99%  | 0.87%  |
| COFORE_CHFV | 0.29  | 1.77%  | -1.57% | 3.88%  | -3.59% | CONVERGENCE | FOREX     | CHE     | 0.10%  | 3.34%  |
| CUSPOT_ARSD | 0.28  | 0.00%  | 0.09%  | 0.00%  | 9.67%  | CURRENCY    | SPOT      | ARG     | 0.04%  | -0.09% |
| INSHOR_EURD | 0.24  | -0.20% | -0.22% | -0.75% | -0.84% | INT RATES   | SHORT     | EUR     | -0.21% | 0.02%  |
| STGROW_EURD | 0.20  | 0.25%  | 1.04%  | 1.53%  | 7.79%  | STYLE       | GROWTH    | EUR     | 0.65%  | -0.79% |
| CULONG_GBRS | 0.19  | 0.00%  | 1.85%  | 0.00%  | 15.80% | CURVE SLOPE | LONG      | GBR     | 0.93%  | -1.85% |
| COEQUI_EMAC | 0.05  | 1.50%  | -0.87% | 2.69%  | -0.68% | CORRELATION | EQUITY    | EMA     | 0.31%  | 2.36%  |
| CRAAA_USAR  | 0.03  | -0.15% | -0.16% | -0.51% | -0.47% | CREDIT      | AAA       | USA     | -0.16% | 0.01%  |

**16 August 05 - 16 April 06:** Immediately preceding the first drawdown we observe a strong and stable energy bias, with the custom gas future factor still showing the highest sensitivity.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta-- | Type        | SubType   | Country | Beta   | Gamma   |
|-------------|-------|--------|--------|---------|--------|-------------|-----------|---------|--------|---------|
| _NNGH7      | 0.49  | 0.00%  | 2.11%  | 0.20%   | 2.11%  | COMMODITY   | COMMODITY | USA     | 1.05%  | -2.11%  |
| SEENER_USAD | 0.40  | 0.51%  | 0.48%  | 1.34%   | 1.32%  | SECTOR      | Energy    | USA     | 0.50%  | 0.03%   |
| EQMAIN_CAND | 0.33  | 0.00%  | 0.61%  | 0.00%   | 6.97%  | EQUITY      | MAIN      | CAN     | 0.31%  | -0.61%  |
| COEQUI_EMAC | 0.30  | 2.74%  | -0.96% | 4.94%   | 0.45%  | CORRELATION | EQUITY    | EMA     | 0.89%  | 3.70%   |
| INSHOR_GBRD | 0.28  | -5.93% | 6.52%  | -24.71% | 30.34% | INT RATES   | SHORT     | GBR     | 0.30%  | -12.45% |
| VOLONG_GBPV | 0.27  | 0.95%  | -2.29% | 2.17%   | -6.61% | VOLATILITY  | LONG      | GBR     | -0.67% | 3.23%   |
| CULONG_JPNS | 0.25  | 1.64%  | 0.00%  | 10.28%  | 0.00%  | CURVE SLOPE | LONG      | JPN     | 0.82%  | 1.64%   |
| STGROW_EURD | 0.17  | 0.00%  | 1.39%  | 0.00%   | 10.39% | STYLE       | GROWTH    | EUR     | 0.69%  | -1.39%  |
| CALASM_GBRR | 0.15  | 0.61%  | 0.56%  | 1.73%   | 1.56%  | CAP SIZE    | LASMALL   | GBR     | 0.59%  | 0.05%   |
| COEQUI_USDV | 0.13  | -0.55% | 0.97%  | -2.07%  | 10.56% | CONVERGENCE | EQUITY    | USA     | 0.21%  | -1.52%  |
| CUSPOT_GBPD | 0.10  | 0.59%  | -0.58% | 1.34%   | -1.75% | CURRENCY    | SPOT      | GBR     | 0.01%  | 1.17%   |
| CRHYIE_USAD | 0.08  | 0.00%  | 0.64%  | 0.00%   | 4.11%  | CREDIT      | HYIELD    | USA     | 0.32%  | -0.64%  |

<sup>4</sup> Henry Hub Spot, Nymex Gas future for March & April 07, 08 and 09, Avril / March Calendar Spreads on Nymex for 07, 08 and 09

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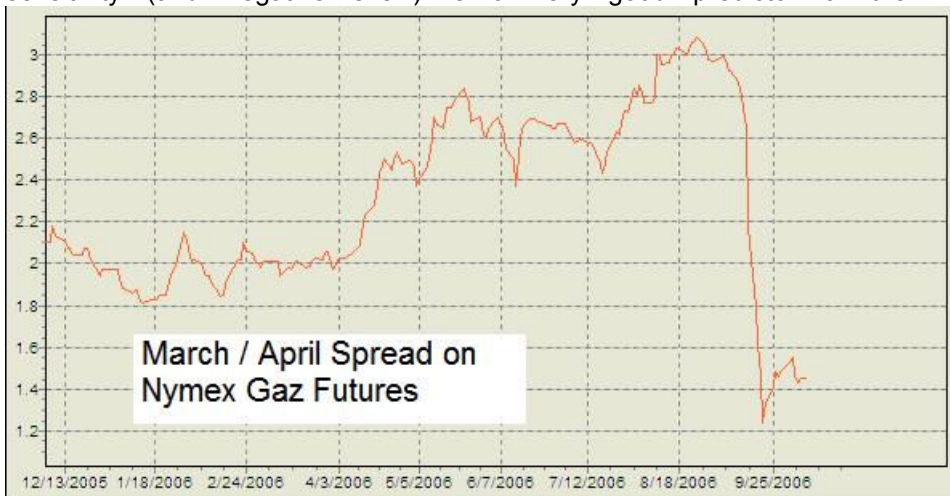
**5 November 05 - 6 July 06:** Here we can begin to observe profile drift, while at the same time, the gas calendar spread March / April 08 indicates high sensitivity and a very high negative convexity. Such high negative skew is a clear signal of potential extreme loss.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta-- | Type        | SubType   | Country | Beta   | Gamma  |
|-------------|-------|--------|--------|---------|--------|-------------|-----------|---------|--------|--------|
| SEMATE_EUOR | 0.60  | 0.00%  | 0.98%  | 0.00%   | 9.14%  | SECTOR      | Materials | EUO     | 0.49%  | -0.98% |
| EQMAIN_SCAD | 0.54  | 7.91%  | -2.45% | 56.09%  | -7.97% | EQUITY      | MAIN      | SCA     | 2.73%  | 10.36% |
| GSPMARAP08  | 0.50  | 0.00%  | 0.28%  | 0.00%   | 5.32%  | COMMODITY   | COMMODITY | USA     | 0.14%  | -0.28% |
| STGROW_EURD | 0.41  | 0.81%  | 1.02%  | 2.10%   | 2.92%  | STYLE       | GROWTH    | EUR     | 0.92%  | -0.20% |
| COSECT_EUOC | 0.40  | -4.71% | 0.00%  | -17.88% | 0.00%  | CORRELATION | SECTOR    | EUO     | -2.36% | -4.71% |
| CULONG_JPNS | 0.39  | 2.82%  | 0.44%  | 8.15%   | 15.68% | CURVE SLOPE | LONG      | JPN     | 1.63%  | 2.38%  |
| VOMGOL_USDV | 0.38  | -2.97% | 0.00%  | -14.18% | 0.00%  | VOLATILITY  | MGOLD     | USA     | -1.49% | -2.97% |
| INLONG_SWED | 0.37  | 0.00%  | 1.91%  | 0.00%   | 9.86%  | INT RATES   | LONG      | SWE     | 0.96%  | -1.91% |
| CALASM_EUOR | 0.37  | -1.38% | 1.65%  | -4.84%  | 4.26%  | CAP SIZE    | LASMALL   | EUO     | 0.14%  | -3.02% |
| CUSPOT_CHFD | 0.23  | 1.07%  | 0.00%  | 4.99%   | 0.00%  | CURRENCY    | SPOT      | CHE     | 0.54%  | 1.07%  |
| COFORE_CHFV | 0.20  | 0.34%  | 0.30%  | 0.75%   | 0.68%  | CONVERGENCE | FOREX     | CHE     | 0.32%  | 0.04%  |
| CRBAA_USAR  | 0.00  | -0.45% | -0.55% | -1.66%  | -1.40% | CREDIT      | BAA       | USA     | -0.50% | 0.09%  |

**31 December 05 – 31 August 06:** This profile seems strange and is completely inconsistent with the previous picture. Such inconsistency, when it appears should clearly lead to further investigations with the manager.

| Factor      | Sensi | Beta+  | Beta-  | Beta++  | Beta--  | Type        | SubType            | Country | Beta   | Gamma   |
|-------------|-------|--------|--------|---------|---------|-------------|--------------------|---------|--------|---------|
| VOSHOR_EURV | 0.51  | 1.21%  | 2.03%  | 3.44%   | 4.12%   | VOLATILITY  | SHORT              | EUR     | 1.62%  | -0.82%  |
| EQMAIN_SCAD | 0.44  | 5.82%  | -2.43% | 18.77%  | -8.04%  | EQUITY      | MAIN               | SCA     | 1.70%  | 8.25%   |
| CUSPOT_ARSD | 0.42  | 0.51%  | 0.53%  | 12.31%  | 40.90%  | CURRENCY    | SPOT               | ARG     | 0.52%  | -0.02%  |
| SETELE_USAR | 0.42  | 0.00%  | -2.60% | 0.00%   | -21.80% | SECTOR      | Telecommunications | USA     | -1.30% | 2.60%   |
| COMHGS_USAD | 0.38  | -5.93% | 5.84%  | -16.78% | 20.09%  | COMMODITY   | MHGS               | USA     | -0.04% | -11.77% |
| COSECT_EUOC | 0.38  | -3.99% | 0.00%  | -15.57% | 0.00%   | CORRELATION | SECTOR             | EUO     | -2.00% | -3.99%  |
| CALASM_EUOR | 0.36  | -1.98% | 2.39%  | -7.06%  | 6.22%   | CAP SIZE    | LASMALL            | EUO     | 0.20%  | -4.37%  |
| INLONG_EURD | 0.33  | -0.28% | -0.21% | -0.67%  | -0.56%  | INT RATES   | LONG               | EUR     | -0.25% | -0.07%  |
| CUSHOR_EUUS | 0.32  | -6.64% | 6.18%  | -25.74% | 23.23%  | CURVE SLOPE | SHORT              | EUU     | -0.23% | -12.82% |
| COEQUI_USDV | 0.26  | 2.49%  | 0.00%  | 15.05%  | 0.00%   | CONVERGENCE | EQUITY             | USA     | 1.24%  | 2.49%   |
| STGROW_EURD | 0.20  | 1.07%  | 1.34%  | 2.76%   | 3.84%   | STYLE       | GROWTH             | EUR     | 1.21%  | -0.27%  |
| CRHYIE_USAD | 0.12  | 2.18%  | 2.97%  | 7.49%   | 10.70%  | CREDIT      | HYIELD             | USA     | 2.58%  | -0.79%  |

If one takes the spread April / March 2008 on Nymex gas futures (GSPMARAP08), which was the last strong and persistent signal before the profiles become inconsistent, we can clearly see that this factor sensitivity (and negative skew) is a very good predictor of the final blow up event.



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## Conclusion:

In conclusion it is clear that the Amaranth blow-up event highlights the value of using Riskdata's FOFiX system to support a manager's operational risk monitoring.

It enables to:

- Track the evolution of manager's risk profile through time, understand changes in ex ante volatility and interpret significant changes as an advanced signal of potential problems.
- Confirm and refine new qualitative information as it becomes available. In fact Amaranth was reasonably transparent in its "Qualitative" information disclosure, including weekly NAV estimates to a number of investors. FOFiX analysis corroborated the qualitative information disclosed by Amaranth to its investors. More importantly, the qualitative insight allowed the user to further refine the analysis by incorporating more specific sources of risks and to assess the potential impact of such specific risks on the portfolio value. In other words, this analysis clearly shows the need for rigorous interaction between the qualitative and quantitative analytical processes.
- Objectively confirm or question feedback from the qualitative analysis, thus leveraging the opportunity to add custom risk factors. If used well, such qualitative analysis helps the user to assess the factor sensitivities and drill down into the detail using weekly factor analysis.

## Lessons Learned

Some of the lessons one can learn from this about how to use FOFiX are:

- Use analysis based on weekly (as opposed to monthly) NAVs wherever possible; particularly when investment strategies are changing rapidly and the fund shows rapidly-changing bets and risk profiles.
- Consider the "Convergence" of Factors. Clearly where a number of strong and persistent sensitivities are related and point to a common underlying cause, a qualitative assessment must be used to try and identify the source with the factor set expanded accordingly.
- Check if portfolio sensitivities and betas are truly in line with the amount of risk that you wish to take.
- Investigate sudden and unexplainable shifts in profile before concluding that they are spurious. Search for possible underlying causes through a qualitative review of the manager.

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