Lessons Learned from the 2006 Energy Hedge Fund Debacles

Ms. Hilary Till

Principal, Premia Capital Management, LLC

Research Associate,
EDHEC Risk and Asset Management Research Centre

Co-editor, Intelligent Commodity Investing

20 July 2007

Presentation Outline

I. Demand for Energy Investments

II. The Case of MotherRock

III. The Case of Amaranth

IV. Conclusion

I. Demand for Energy Investments

I. Demand for Energy Investments

A. The Macro Case

B. Performance

C. Energy Derivatives Relative-Value Trading

D. Structural Breaks

I. Demand for Energy Investments

A. The Macro Case

- The macro case for commodity investments has relied on the following two factors:

  (1) adverse supply shocks resulting from the aging energy infrastructure in the U.S. and Europe, and

  (2) expanding demand, particularly from China.

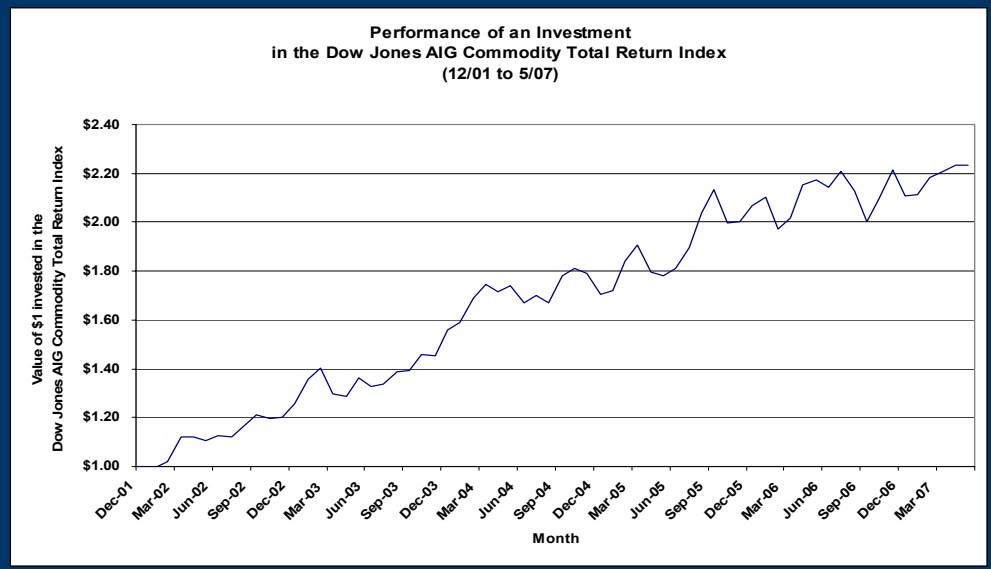
Bas-Relief adornment on an utility building at Dearborn and Washington in Chicago.

I. Demand for Energy Investments

A. The Macro Case

- Since the end of 2001, investors have been rewarded for investing in broad-based commodity indices.

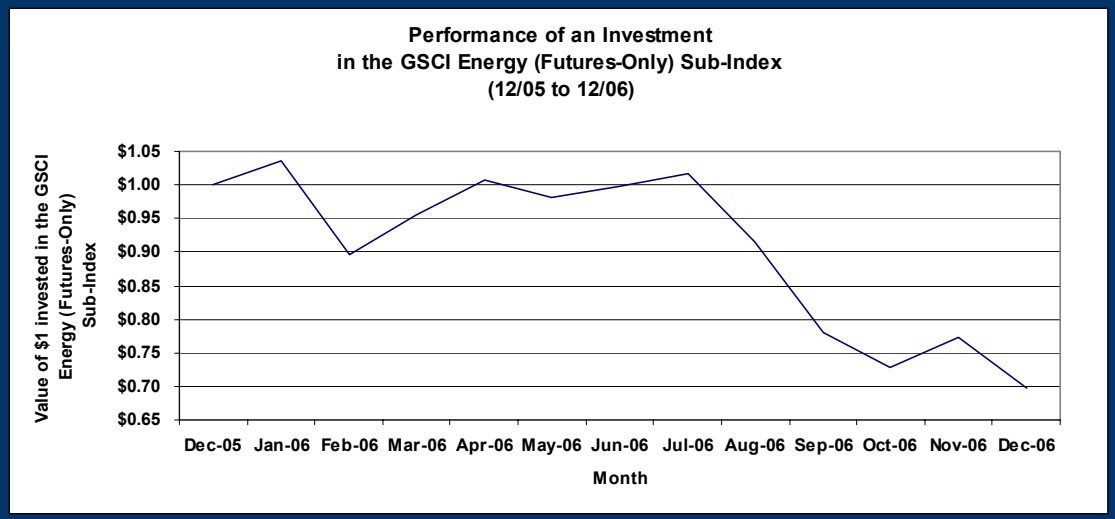
- The DJAIGCI has had annualized returns of 16.00% (from 12/31/01 to 5/31/07.)



I. Demand for Energy Investments

B. Performance of Energy Futures Investments

- But passively investing in energy futures contracts is not for the faint-hearted.
- The Goldman Sachs energy (futures-only) sub-index lost -30.6% in 2006.



I. Demand for Energy Investments

C. Energy Derivatives Relative-Value Trading

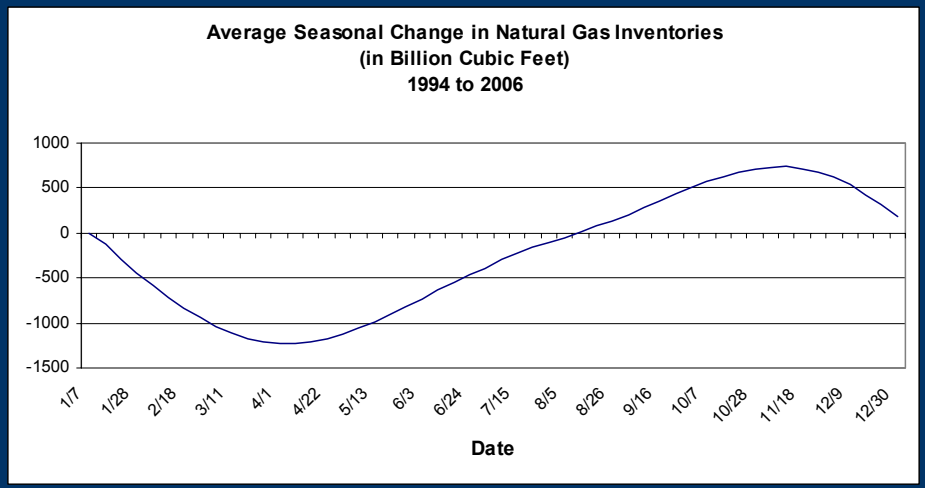
- Therefore, energy and commodity investors had been drawn to relative-value commodity hedge funds.

- As discussed in Till (2007), there are potentially profitable opportunities around build/draw cycles in commodity inventories. These opportunities tend to be monetized through calendar spreads.

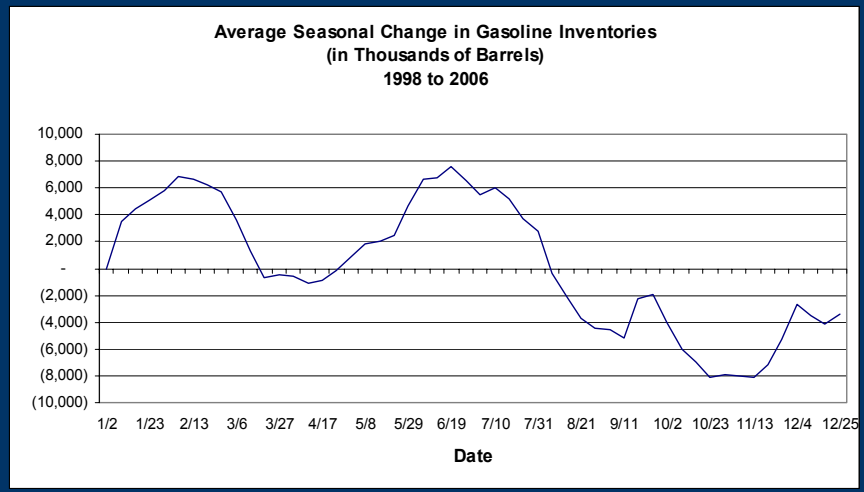
I. Demand for Energy Investments

C. Energy Derivatives Relative-Value Trading

Average Seasonal Change in Natural Gas Inventories 1994 - 2006



Average Seasonal Change in Gasoline Inventories 1998 - 2006



I. Demand for Energy Investments

C. Energy Derivatives Relative-Value Trading

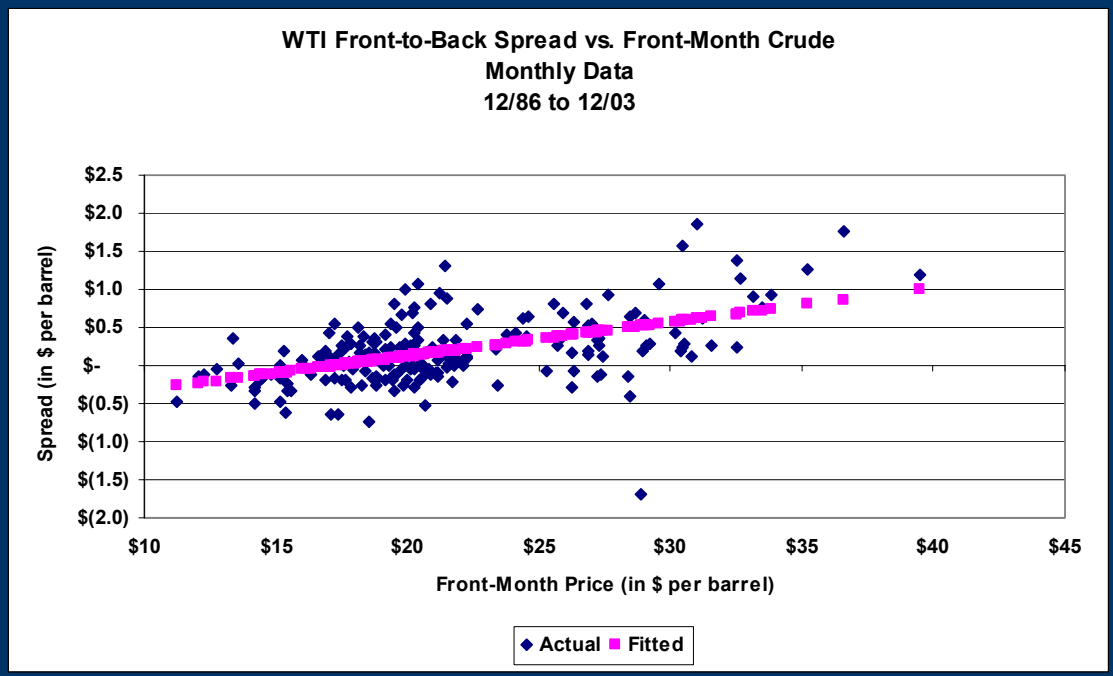
- For active commodity strategies, expertise in forward curves and storage economics is crucial. Feldman and Till (2006) discuss the structural importance of forward curves in commodity investing.

- But even with energy calendar-spread trading, there have been frequent structural breaks over the last 3 years.

I. Demand for Energy Investments

D. Structural Breaks

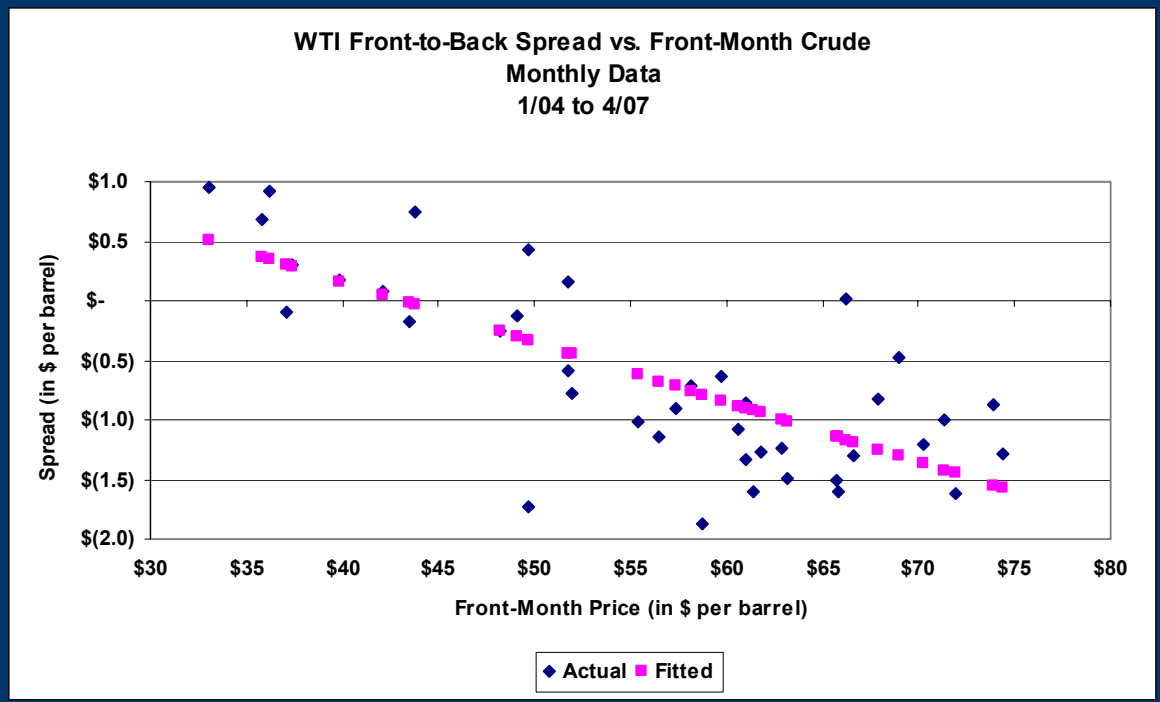
Relationship of Crude Calendar Spreads to Outright Positions



I. Demand for Energy Investments

D. Structural Breaks

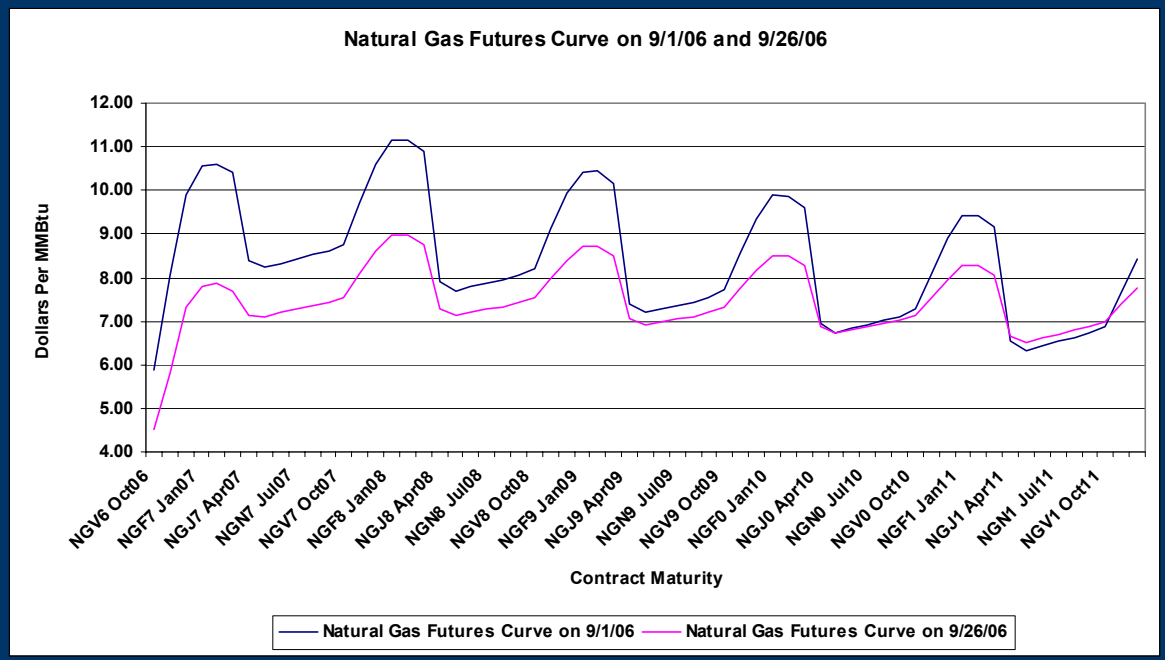
Relationship of Crude Calendar Spreads to Outright Positions: Structural Change



I. Demand for Energy Investments

D. Structural Breaks

Discontinued Reliability of Natural-Gas Calendar Spread Trades



Similar graphic in Petzel (2006).

II. The Case of MotherRock

- About a month before the Amaranth debacle, an energy hedge fund, which specialized in Natural Gas trading, announced it was shutting down.

- On 8/3/06, the market learned that MotherRock had shut down. The fund was once responsible for $450-million in assets under management.

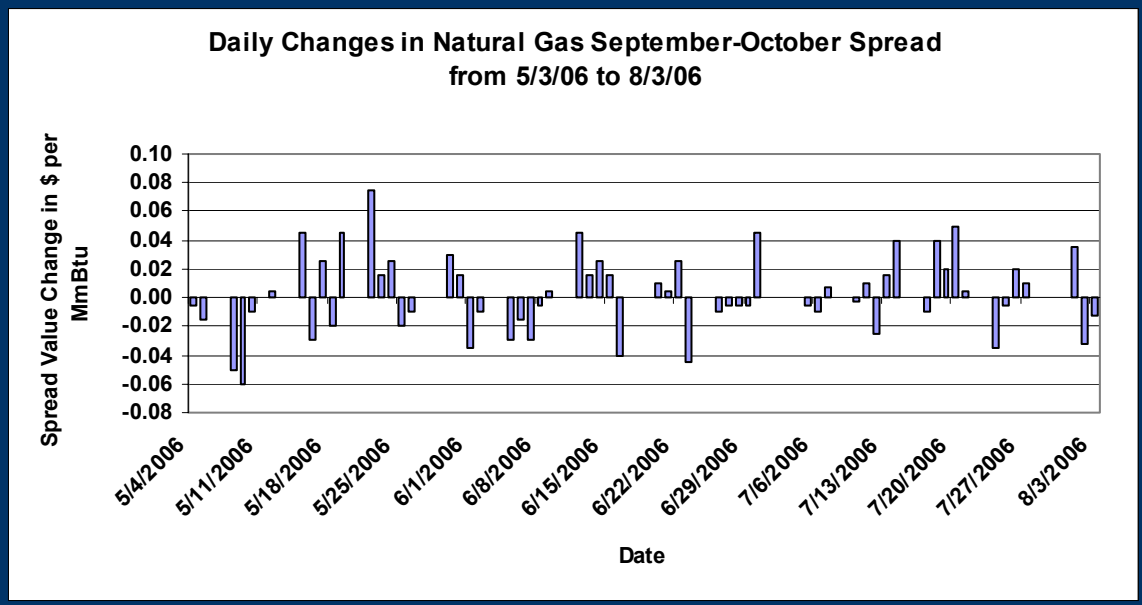
- About one month later, the fund had apparently told its "investors not to expect to get any money back."

II. The Case of MotherRock

- The market had a preview of the intense liquidation pressure that could occur on the Natural Gas futures curve on 8/2/06, one day prior to the fund announcing its closure.

II. The Case of MotherRock

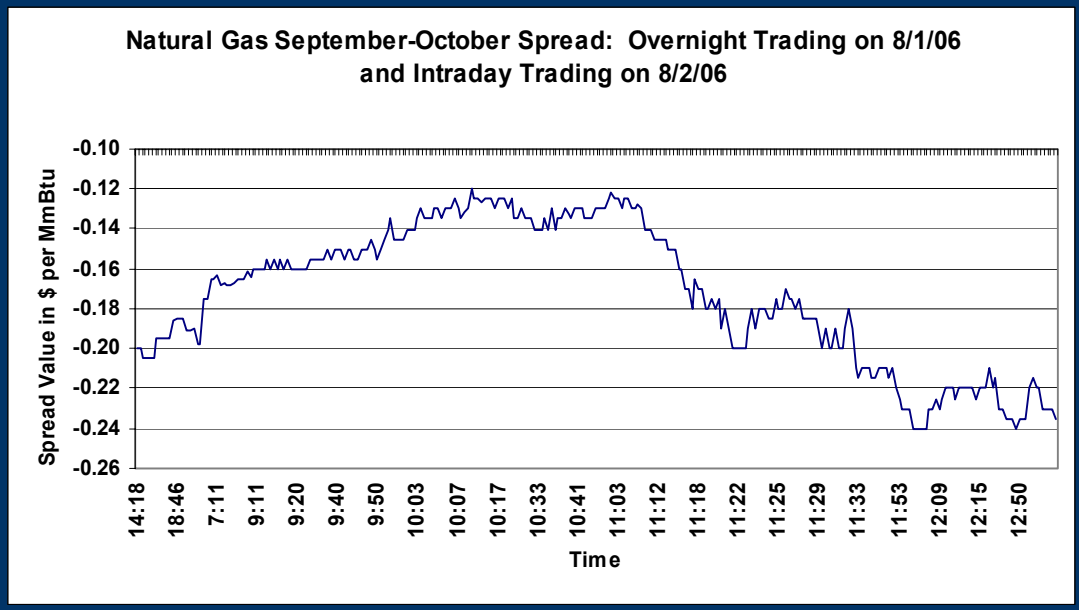
- As of 8/1/06, the daily standard deviation of the Natural Gas September – October (NG U-V) spread had been 2.67c based on the previous three months of data.



Source: Till (2006).

II. The Case of MotherRock

- The intraday peak-to-trough move in the NG U-V spread was 12c on 8/2/06.



- Therefore, the spread's intraday move, which is illustrated in the graph above, was 4.5 (= 12/2.67) standard deviations.

Source: Till (2006).

III. The Case of Amaranth

A. Introduction

B. Reverse-Engineering Amaranth's Natural Gas Positions

C. Further Inferences

D. Lessons

III. The Case of Amaranth

A. Introduction

- Amaranth Advisors, LLC – A multi-strategy hedge fund.
- Founder's original expertise was in convertible bonds.
- The fund later specialized in merger arbitrage, leveraged loans, blank-check companies, and in energy trading.
- As of June 30, 2006, energy trades accounted for about half of the fund's capital and generated about 75% of their profits.

Source: Updated from Till (2006).

III. The Case of Amaranth

A. Introduction

- How can a respected, diversified multi-strategy hedge fund, whose size was reportedly $9.2 billion as of the end of August, lose 65% of its assets in a little over a week, in the biggest hedge-fund failure ever (so far)?

- According to published reports, Amaranth Advisors, LLC employed a Natural Gas spread strategy that would have benefited under a number of different weather-shock scenarios.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- The exact Natural Gas positions that were held by the Amaranth Multi-Strategy Funds have still not been publicly disclosed.

- JP Morgan Chase's CEO, Jamie Dimon, has stated that the Amaranth energy portfolio contained 20,000 trades, according to Baer (2006).

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- That said, as academic and practitioner research has found over the past 10 years, one can frequently replicate complex hedge-fund strategies with a handful of well-chosen, and possibly obscure, factors. See, for example, Géhin and Vaissié (2006).

- Also, when there are large inflection points in a fund's profits-and-losses (p/l), the exposures of a fund can sometimes be inferred, which is one of the insights in Weisman and Abernathy (2000).

- This appears to be the case with Amaranth.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- Till (2006) provides an early returns-based analysis of Amaranth's Natural-Gas exposures based on information that was publicly available as of 9/26/06.

- This analysis was largely based on information provided in Davis (2006).

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

For example, Davis (2006) noted:

- Amaranth's head trader "made bets that would pay off if, say, a hurricane or cold winter sharply reduced supplies by the end of the winter. He also was willing to buy gas in even further-away years …"

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

Davis (2006) (continued):

- Also, an investment banking official contended that Amaranth had been "helping the [Natural Gas] market function better and gas producers to finance exploration, such as by agreeing to buy the rights to gas for delivery in 2010."

- Amaranth's head trader had "'opened a market up and provided a new level of liquidity to all players.'"

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- According to Reuters (2006), on Thursday, 9/14/06, "the fund experienced roughly $560 million in trading losses on their natural gas positions."
- Davis, Zuckerman, and Sender (2007) provided new details on the Amaranth case, which are used in the updated analysis that follows.
- On Friday, 9/15/06, Amaranth's vulnerability became apparent, as it was "bleeding cash and facing a Monday demand for money [from its clearing broker] for money it didn't have."

III. The Case of Amaranth

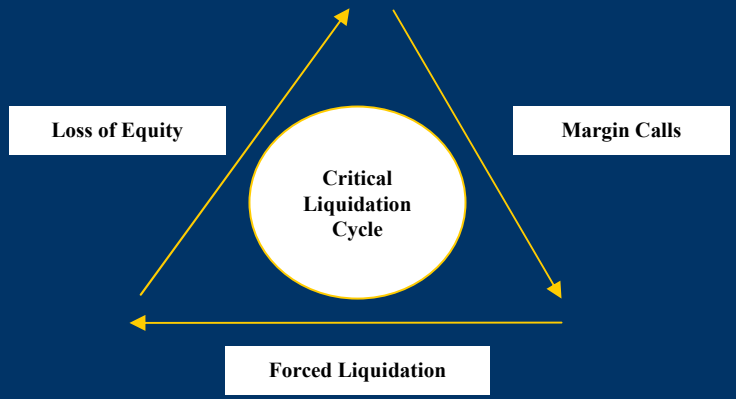
B. Reverse-Engineering Amaranth's Natural Gas Positions

- By the end of Friday, September 15th, Amaranth was down more than $2 billion from its August value.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- This set off a critical liquidation cycle, which in the past has been formally modeled by de Souza and Smirnov (2004), as being short a barrier put option.



III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- On Saturday, 9/16/06, Merrill Lynch agreed to assume about a quarter of the fund's Natural-Gas exposure in return for a payment of $250 million.

- As of Tuesday, 9/19/06, the fund's losses (presumably on the remaining 75% of the portfolio) totaled $800 million.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- Natural Gas positions that would have produced the 9/14/06 and 9/15/06-to-9/19/06 losses are as follows:

  [1] 38,618 Short October versus Long January Natural Gas spreads from 2006 through 2011; and

  [2] 81,874 Long March 2007 Natural Gas contracts.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- The strongest point we can make regarding this calculation is that the fund's key risk positions were highly correlated to our inferred exposures.

- Given that the fund had 20,000 line items, these are clearly not the exact positions of the fund.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- Also, a number of other spread positions were highly correlated with the positions noted above.

- For example, the Long March versus Short April Natural Gas spreads from 2007 through 2011 were 90% correlated to the March 2007 Natural Gas contract based on examining daily data from 6/14/06 to 9/14/06.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- And, the Short October versus Long January Natural Gas spreads from 2006 through 2011 were 68% correlated to the Natural Gas spread combination of Long Winter (December, January, February, and March) and Short Summer (June, July, August, and September) for delivery in 2007/8 through 2010/11.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- These spread and outright positions express different ways of implementing the same basic bet …

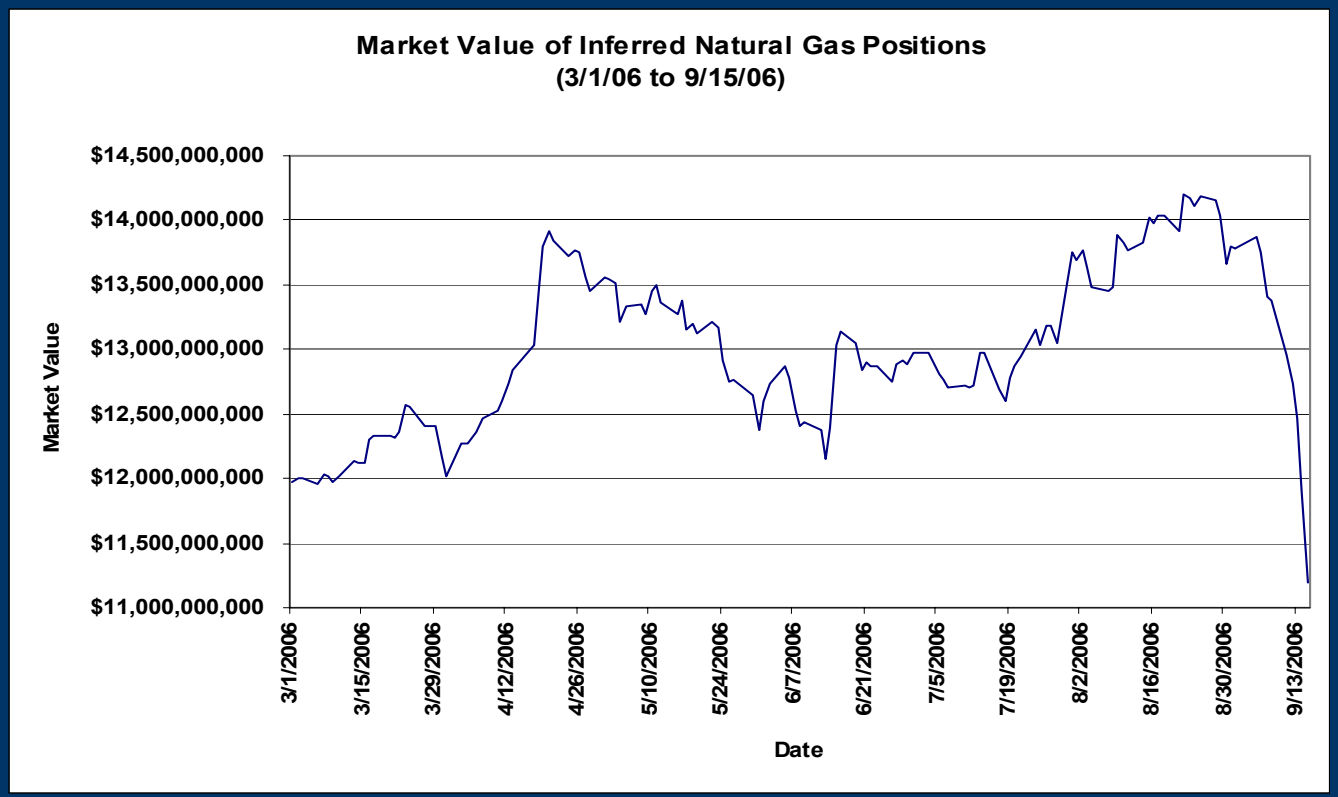
- … a hurricane or cold shock would cause Winter contracts to rally outright and also with respect to other parts of the Natural Gas curve in forward years.

- Chincarini (2006) also modeled the Amaranth exposures as likely being long Winter / short non-Winter positions across the Natural Gas futures curve.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

Evolving Market Value of Inferred Natural Gas Exposures



III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- We can double-check our inferred exposures against other reported facts about the Amaranth case.

- According to Davis *et al.* (2007), the energy book made "made a stunning $1.5 billion in six weeks last spring." Also, Davis (2006) noted that energy trading had resulted in a $1 billion loss in May.

- The inferred exposures produce both such gains and losses, as shown in the previous slide.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- The Davis *et al.* (2007) article stated that the fund had become sufficiently distressed by the morning of Wednesday, 9/20/07, that the fund agreed to pay $2.15 billion in order transfer its energy positions to Citadel and to Amaranth's clearing broker, JP Morgan Chase.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- This payment may be regarded as surprisingly large, given that the daily standard deviation on the fund's inferred energy positions was $195-million, using daily data from 6/13/06 to 9/13/06.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- But there are two features of markets that have to be taken into consideration before using Value-at-Risk metrics in understanding or forecasting risk.

  [1] "Fair-value" prices should be parameterized, rather than be represented as a single point.

  The "fair-value" price for any investment is actually a function of the size of a transaction, how quickly the transaction needs to occur, and the risk preferences of the trader, according to Weinstein and Abdulali (2002).

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

[2] Commodity markets do not have two-sided flow. A commodity trader needs to understand what flow or catalyst will allow a trader out of a position.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

- Commodity markets have "nodal liquidity."
- The natural counterparties to Amaranth's trades ultimately would have been the physical-market participants who had either locked in the value of forward production or storage.
- The physical-market participants would likely have had physical assets against their derivatives positions so would have had little economic need to unwind these trades at Amaranth's convenience.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions

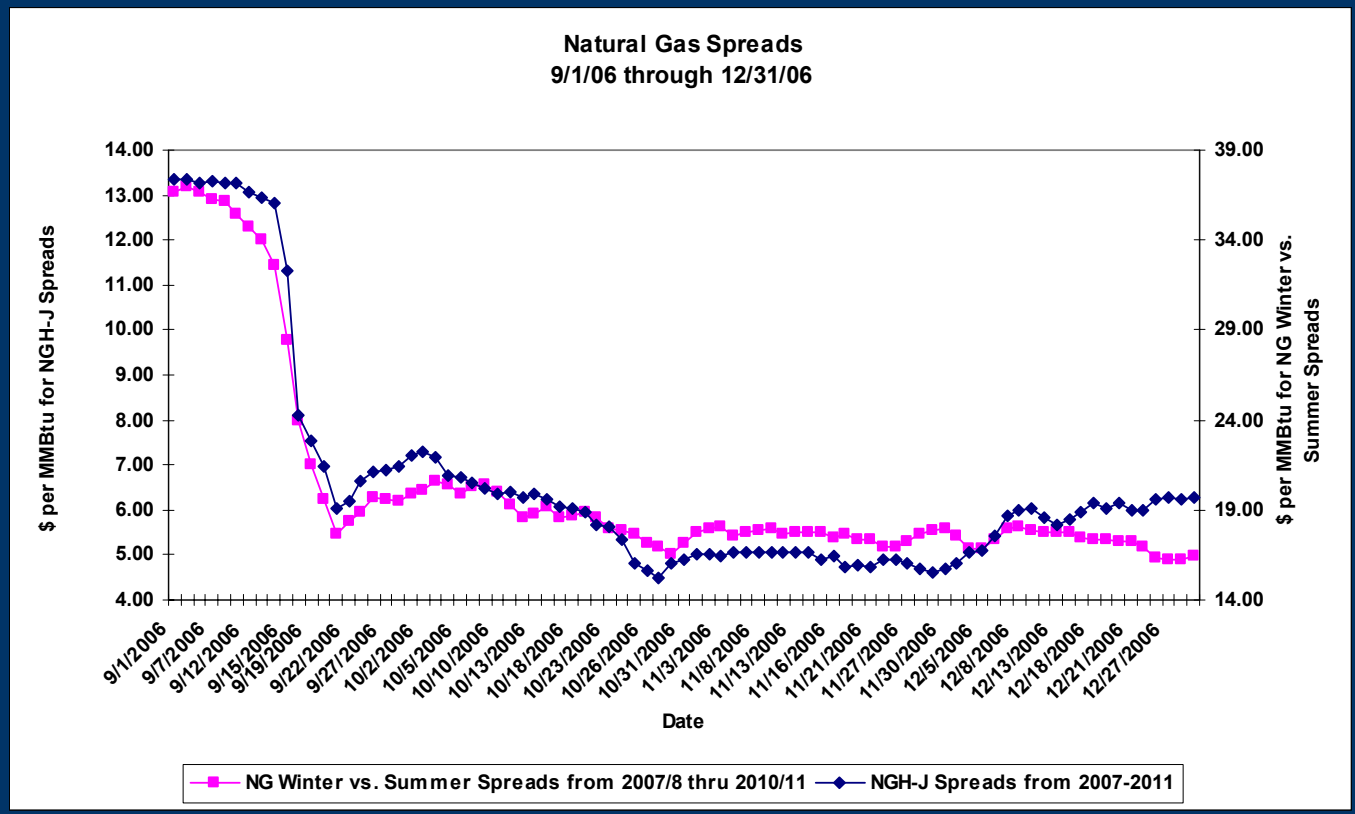
- According to Baer (2006), JP Morgan Chase sold its half of the Amaranth positions to Citadel for $725-million on September 29th, 2006.

- We can infer how long it took to unwind the Amaranth positions by seeing if there were any footprints in Natural-Gas price patterns from September 20th onwards.

- This is done on the next slide.

III. The Case of Amaranth

B. Reverse-Engineering Amaranth's Natural Gas Positions



III. The Case of Amaranth

C. Further Inferences

- The Winter versus the rest-of-the-curve spreads recovered in the immediate aftermath of the portfolio transfer to JP Morgan and Citadel.

- The spreads then declined throughout the month of October, and in the main bottomed out by 10/30/06.

- We can infer, therefore, that the unwind pressure may have substantially subsided by 10/30/06.

III. The Case of Amaranth

C. Further Inferences

- According to Burton and Weiss (2006), by Oct. 15, Citadel's energy portfolio had about one-third the risk of the original Amaranth trades.
- Therefore, we can estimate the impact on Citadel's p/l of the Amaranth position unwind during October.
- The impact was relatively minor compared to the concession that Amaranth had paid to the financial intermediaries.

III. The Case of Amaranth

C. Further Inferences

- We had previously noted that the natural other side of Amaranth's positions were commercial entities involved in the production and storage of Natural Gas.

- Forward Natural Gas spreads stabilized for the two months after 10/30/06, so we may assume that the orderly liquidation of positions by financial intermediaries had discontinued.

- At that point, there was no evidence of liquidation selling, and two-sided flow seems apparent from the price patterns.

III. The Case of Amaranth

C. Further Inferences

- The following analysis assumes that commercial hedgers had elected to realize their hedging windfall once the liquidation pressure had subsided during November and December 2006.

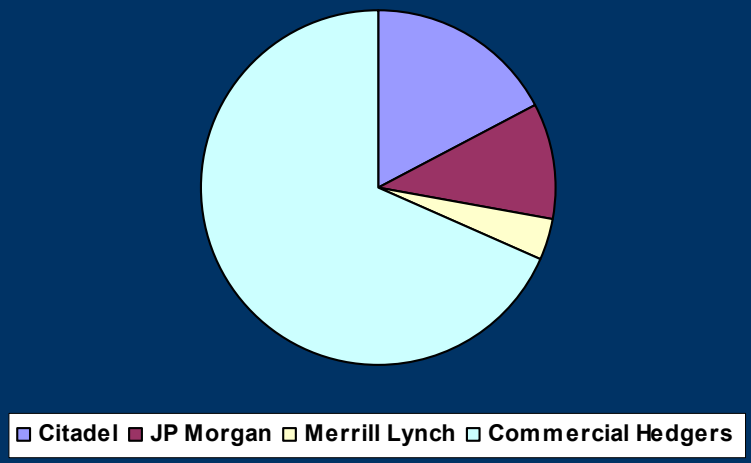
- Therefore, we are now in a position to provide an approximate breakdown in p/l, which was shared by those who had benefited from the Amaranth debacle.

III. The Case of Amaranth

C. Further Inferences

- Commercial hedgers would have been the beneficiaries of 2/3 of the price-pressure effect caused by Amaranth's unwind, with financial intermediaries earning the remaining 1/3.

Inferred Tally of Winners from the Amaranth Unwind



III. The Case of Amaranth

D. Lessons

- Based on our returns-based analysis, we can draw the following lessons about the Amaranth debacle.

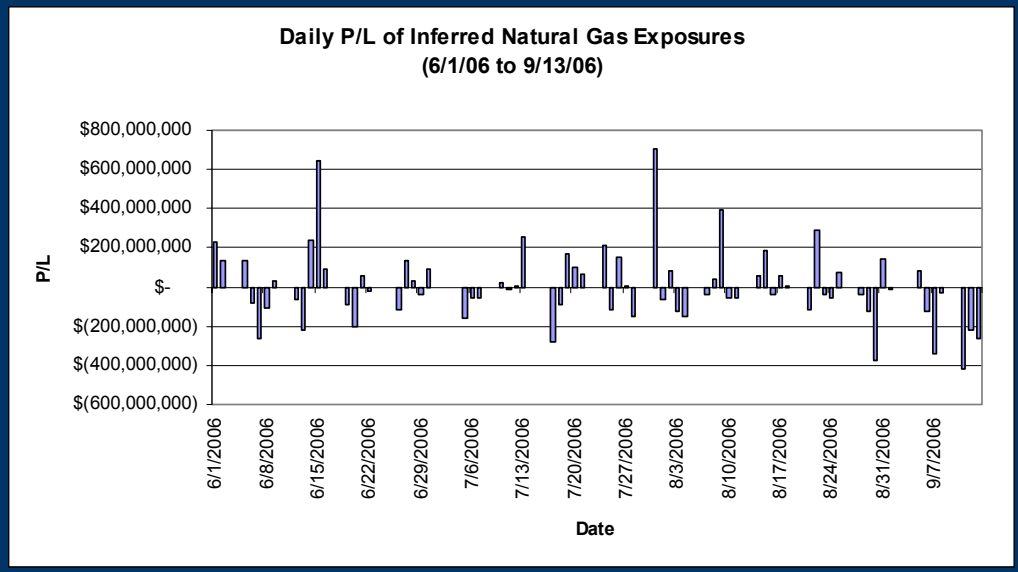
- Investors would not have needed position-level transparency to realize that Amaranth's energy trading was quite risky.

- A monthly sector-level analysis of the fund's p/l would have revealed that a -24% monthly loss would not have been unusual.

III. The Case of Amaranth

D. Lessons

- Risk metrics using recent historical data would have vastly underestimated the extreme liquidation-pressure-related moves in the fund's p/l.



III. The Case of Amaranth

D. Lessons

- Scenario analyses of the range of spread relationships and outright prices that had happened in the past would have revealed how risky the fund's position-taking was in its magnitude.

- Amaranth was likely providing an economic service by providing liquidity for physical-market participants.

- But the scale of its positions was obviously much too large for its capital base.

III. The Case of Amaranth

D. Lessons

- The derivatives markets are wonderful risk-transfer mechanisms for many economically essential activities.
- It is economically desirable for the capital markets to incentivize the creation of sufficient storage capacity of Natural Gas for peak winter demand in the U.S.
- The Natural Gas curve stabilized one day after the energy portfolio was transferred to JP Morgan Chase and Citadel.

III. The Case of Amaranth

D. Lessons

- If the capital markets can develop smooth mechanisms for transferring entire portfolios of hedge-funds-in-distress, then it is unlikely that we will continue to have massive distressed liquidations, as occurred with Long Term Capital Management (LTCM) and Amaranth.

- This would reflect a mature development for the hedge fund industry.

- Transferring portfolios, while minimizing price-pressure effects, is already very well developed in the institutional/pension fund industry.

III. The Case of Amaranth

D. Lessons

- Now, even with this preliminary conclusion, one should still be cautious about concluding that the alternative investment industry has the wherewithal to absorb major hedge fund failures.

- In the Long Term Capital Management crisis, the hedge-fund-in-distress had positions that were highly correlated or identical to the core positions held by leveraged, money-center banks.

III. The Case of Amaranth

D. Lessons

- In the Amaranth crisis, the fund's key risk positions were in the U.S. Natural Gas derivatives markets; these are not positions that are central to the risk-taking activities of the main international banks.

- Therefore, the impact of Amaranth's losses was largely confined to its investors.

III. The Case of Amaranth

D. Lessons

- Also, as noted previously, it is likely that physical Natural-Gas market participants were the ultimate risk takers on the other side of Amaranth's trades, and so benefited from the temporary dislocations that ensued from the fund's distress.

- In other words, it does not appear that the commercial Natural-Gas industry was damaged by this financial crisis; in fact, commercial-market participants likely benefited.

IV. Conclusion

- A true test of the alternative investment industry's robustness would have to be one where a large hedge fund not only became distressed, but also held substantial positions that were highly correlated to those held by the major international banks.

IV. Conclusion

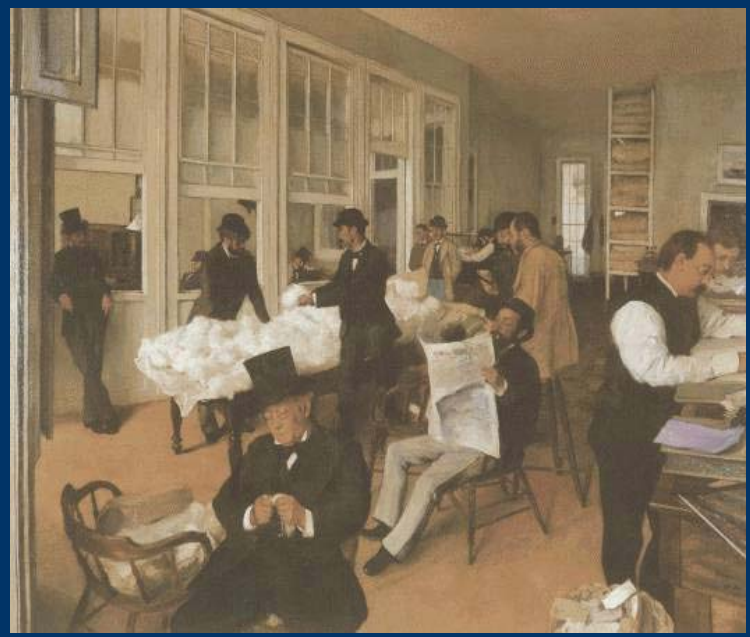
- As far as commodity hedge funds are concerned, it is absolutely essential for a commodity trader to understand how their positions fit into the wider scheme of behaviors in the physical commodity markets.

- Before initiating any large-scale trades in the commodity markets, a trader needs to understand what flow or catalyst will allow a trader out of a position.

- This presents constant challenges to a trader when attempting to navigate the very dynamic flows of the commodity markets.

References

- Baer, Justin, "JPMorgan Sold Its Amaranth Energy Trades to Citadel," Bloomberg, 11/29/06.
- Burton, Katherine and Jenny Strasburg, "Amaranth Says It Plans Liquidation After More Hedge Fund Losses," Bloomberg, 9/30/06.
- Burton, Katherine and Miles Weiss, "Citadel Says Hedge-Fund Profit Rose Fivefold in 2006," Bloomberg, 11/29/06.
- Chincarini, Ludwig, "The Amaranth Debacle: A Failure of Risk Measures or a Failure of Risk Management?", 12/21/06. Available at SSRN: **http://ssrn.com/abstract=952607.**
- Davis, Ann, "How Giant Bets on Natural Gas Sank Brash Hedge-Fund Trader," *Wall Street Journal*, 9/19/06.
- Davis, Ann, Gregory Zuckerman, and Henny Sender, "Hedge-Fund Hardball: Amid Amaranth's Crisis, Other Players Profited," *Wall Street Journal*, 1/30/07.
- De Souza, Clifford and Mikhail Smirnov, "Dynamic Leverage," *Journal of Portfolio Management*, Fall 2004, pp. 25 -39.
- EDHEC-Risk, "Interview with Hilary Till," http://www.edhec-risk.com, 2/16/07.
- Feldman, Barry and Hilary Till, "Separating the Wheat from the Chaff: Backwardation as the Long-Term Driver of Commodity Futures Performance; Evidence from Soy, Corn and Wheat Futures from 1950 to 2004", *EDHEC-Risk Publication* (www.edhec-risk.com), which, in turn, was cited in the BIS Quarterly Review, March 2007. A version of this article is in the *Journal of Alternative Investments* as "Backwardation and Commodity Futures Performance: Evidence from Evolving Agricultural Markets," Winter 2006, pp. 24-39.



Source of graphic: Degas, Edgar, "The Cotton Exchange at New Orleans," 1873, Musée Municipal, Pau, France.

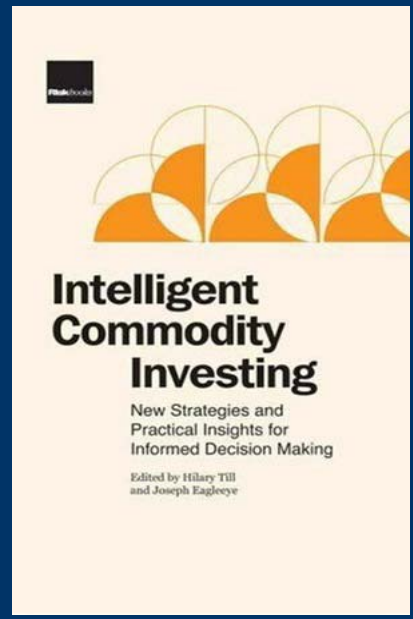
References

- Géhin, Walter and Vaissié, Mathieu, "The Right Place for Alternative Betas in Hedge Fund Performance," *Journal of Alternative Investments*, Summer 2006, pp. 9-18.
- Goldstein, Matthew, "MotherRock to Holders: Go Pound Salt," TheStreet.com, 9/14/06.
- Petzel, Todd, "Hedge Funds: Lessons Learned from Amaranth," *GARP (Global Association of Risk Professionals) Risk Review*, September/October 2006, pp. 4-5.
- Reuters, "Amaranth Says Determined To Stay in Business," 9/22/06.
- Till, Hilary, "EDHEC Comments on the Amaranth Case: Early Lessons from the Debacle," *EDHEC-Risk Publication*, http://www.edhec-risk.com, 10/2/06, which, in turn, was cited in the European Central Bank's Financial Stability Review, December 2006; and in the Staff Report of the United States Senate's Permanent Subcommittee on Investigations, 6/25/07.
- Till, Hilary, "A Long-Term Perspective on Commodity Futures Returns," in Hilary Till and Joseph Eagleeye (eds) Intelligent Commodity Investing (London: Risk Books), 2007, http://www.riskbooks.com/intelligentcommodity, pp. 39-82.
- *Wall Street Journal*, "Amaranth Letter to Shareholders," 9/29/06.
- Weinstein, Eric and Adil Abdulali, "Hedge Fund Transparency: Quantifying Valuation Bias for Illiquid Assets," *Risk Magazine*, June 2002, pp. S25-S28.
- Weisman, Andrew and Jerome Abernathy, "The Dangers of Historical Hedge Fund Data," in Leslie Rahl (ed) Risk Budgeting (London: Risk Books), 2000, pp. 65-81.

Presentation Prepared By Katherine Farren, Premia Capital Management, LLC, on 22 June 2007.

Ms. Hilary Till

Co-Editor,
Intelligent Commodity Investing
www.riskbooks.com/intelligentcommodity



Research Associate,
EDHEC Risk and Asset Management Research Centre
www.edhec-risk.com

Principal, Premia Capital Management, LLC
www.premiacap.com