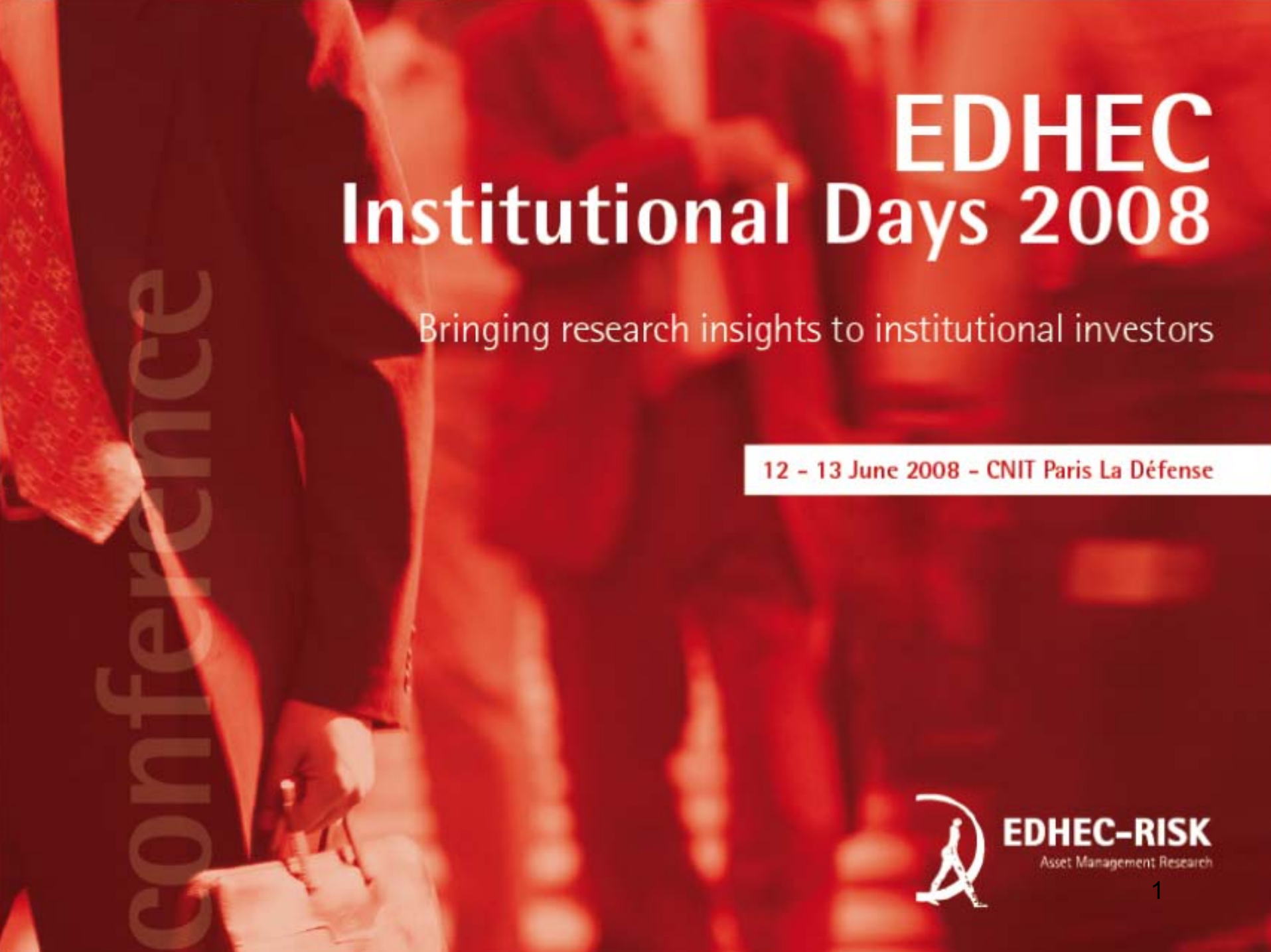

EDHEC Institutional Days 2008

Bringing research insights to institutional investors

12 - 13 June 2008 - CNIT Paris La Défense

EDHEC-RISK
Asset Management Research

EDHEC Institutional Days 2008

Bringing research insights to institutional investors

Actively-Managed Commodity Futures Programmes

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EDHEC-RISK

Outline

I. Benefits and Limitations

II. Key Variables

III. Investment Process

IV. Risk Management

V. Postscript on Amaranth

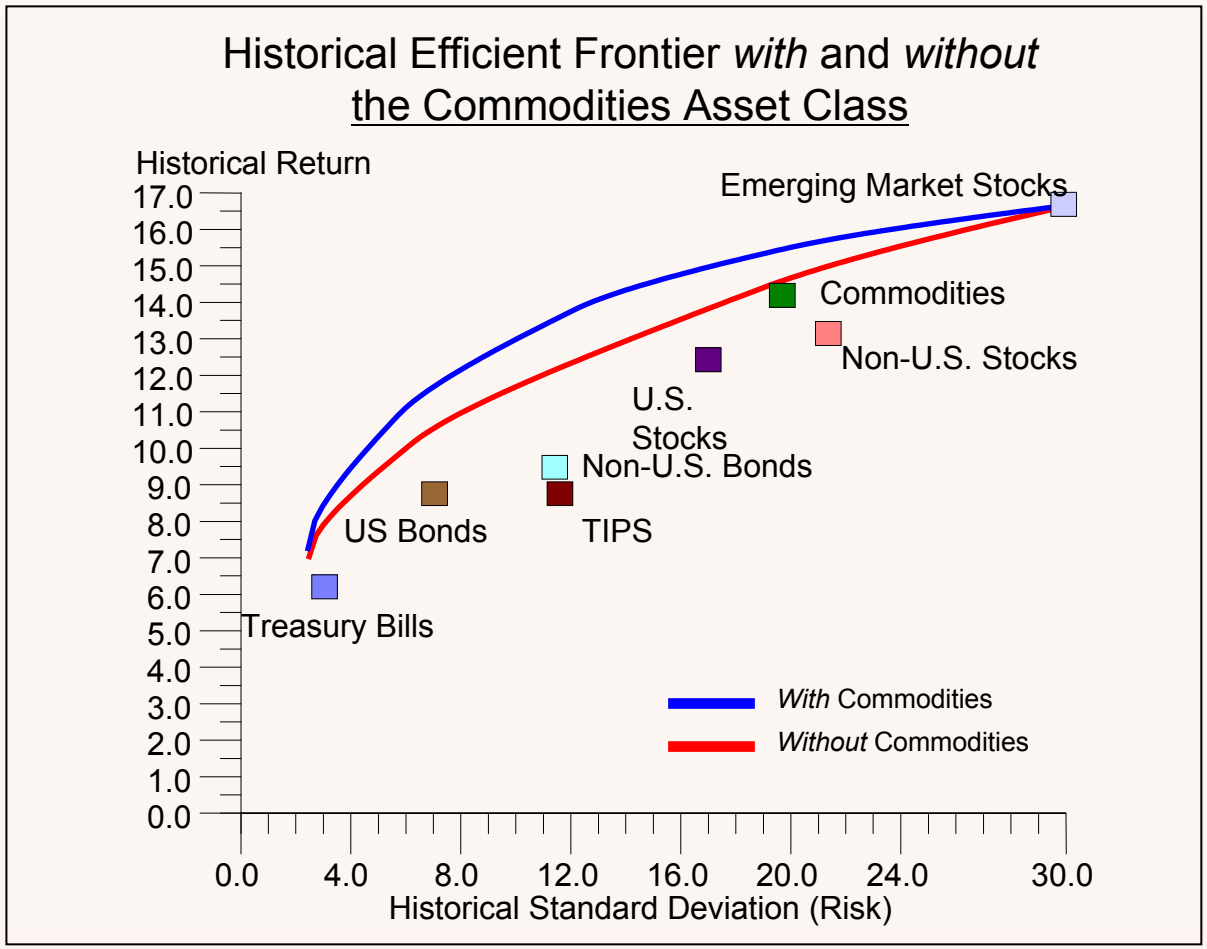
VI. Conclusion

I. Benefits and Limitations

- Active commodity strategies can be used as a satellite to an investor's core index exposure to commodities.
- With commodity indexes, an investor obtains consistent exposure to the inherent returns of the asset class.

Source: Till and Eagleeye (2006).

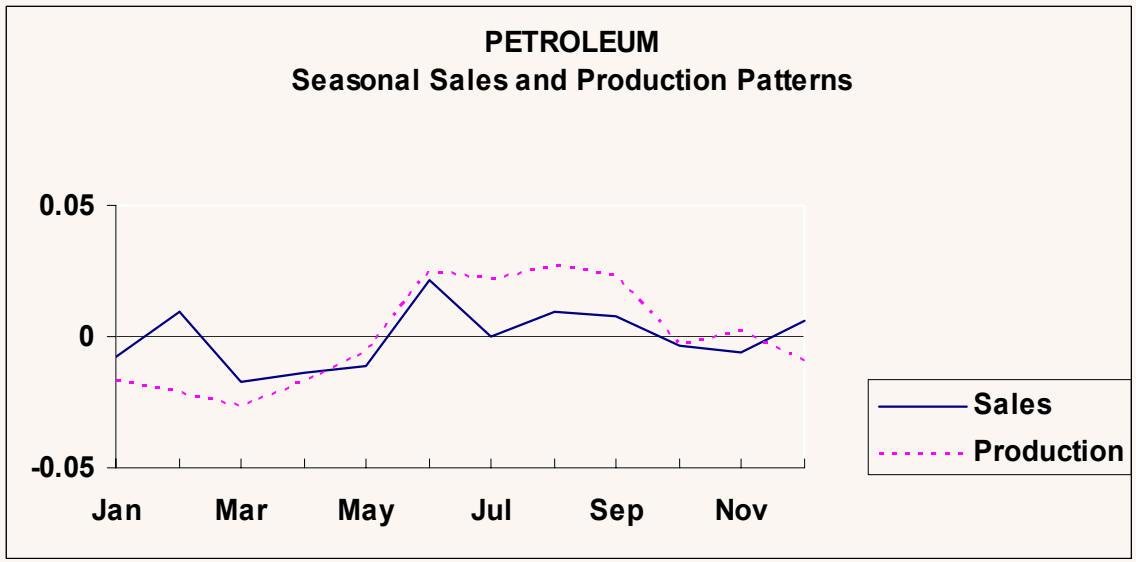
I. Benefits and Limitations



Source: Idzorek (2007).

I. Benefits and Limitations

- With a purely active strategy, there is no guarantee that a manager will remain consistently long of commodities, especially …



[The seasonal coefficient plotted for each month is the average percentage difference for that month from a logarithmic time trend. The sample period is from 5/1967 through 12/82.]

- … because of the seasonal cycles in commodities.

Source: Miron (1996).

I. Benefits and Limitations

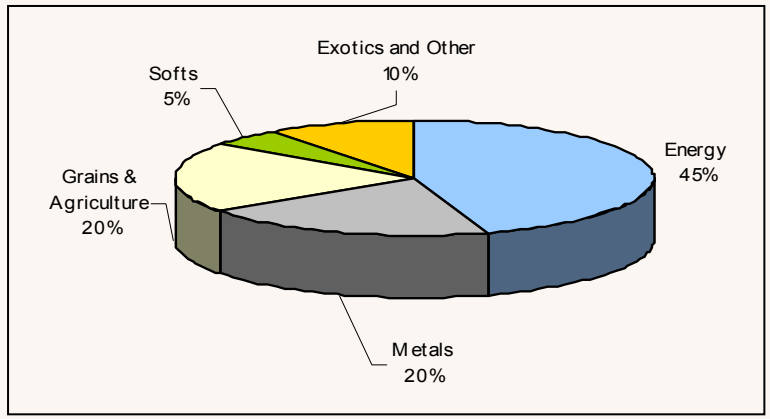
- A core risk management principle for most hedge funds is that total risk should be managed by neutralizing systematic risk through hedging.
- This can mean that an active commodity manager may not be positioned for a commodity (and specifically, oil) price spike, …
- … precisely when this would be most beneficial for an investor's overall portfolio.

I. Benefits and Limitations

Benefits

- Investors may be able to source skilled managers who can achieve superior returns with acceptable risk.

Estimated Sector Breakdown of Active Portfolio



Active Commodity Returns

	Compound Annual Return	Annualized Standard Deviation	Sharpe Ratio	Worst Draw Down
Active Commodity Traders and Hedge Fund Managers				
1991 - 2005	18.62%	8.21%	1.80	-16.58%
2002 - 2005	20.99%	6.70%	2.86	-3.50%

Source: Akey (2007).

I. Benefits and Limitations

Limitations

- Capacity constraints:
  We can't *all* profit from exploiting inefficiencies
- Speculative position limits
- The use of over-the-counter transactions can increase the capacity of strategies, …
- … but this introduces counterparty credit risk to the portfolio.

II. Key Variables

- Professor Miffre has already covered strategies, which are explicitly based on momentum and term structure.

Other (Related) Sources of Return:

- Hedge Pressure
- Scarcity
- Weather-Fear Premia

II. Key Variables

Hedge Pressure

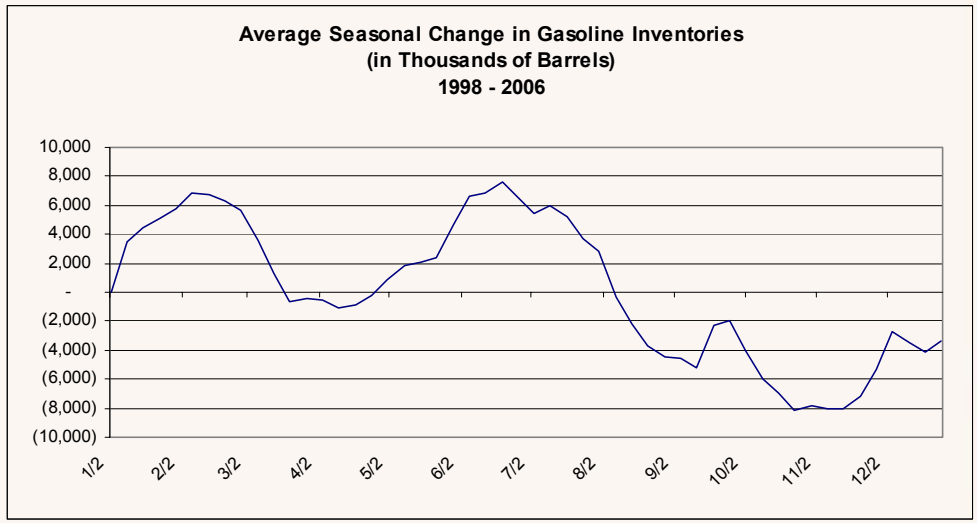
- There is a persistent return from taking a position on the other side of commercial hedge pressure.
- In some commodity futures markets, producers are in a more vulnerable position than consumers and …
- … so will be under more pressure to hedge than consumers.

II. Key Variables

Hedge Pressure

- Example: Gasoline
- There appears to be a systematic positive return due to a congenital weakness on the demand side for hedging.

Average Seasonal Change in Gasoline Inventories 1998 - 2006



Source: Updated from Eagleeye (2007).

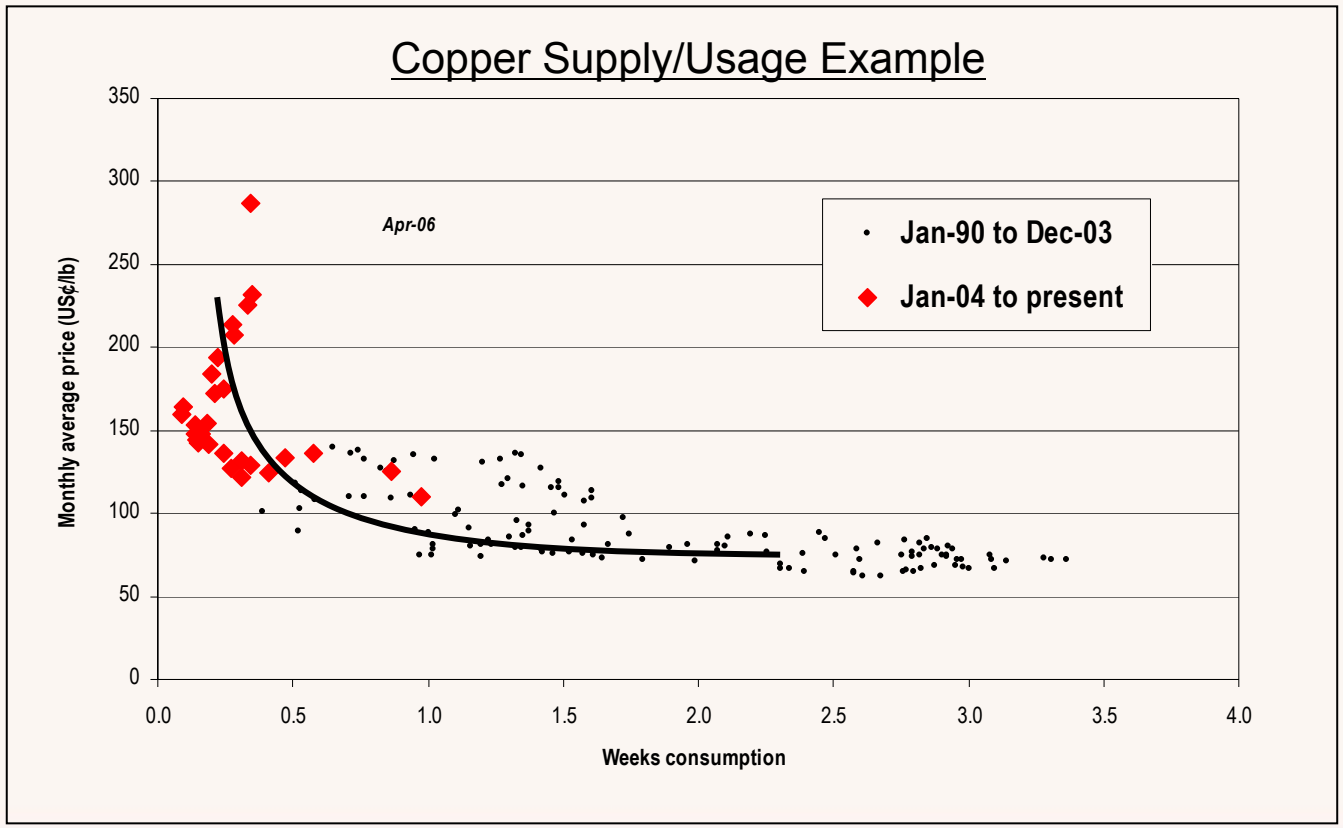
II. Key Variables

Hedge Pressure

- Example: Grain Markets
- Historically, there have been seasonal times when commercial hedging tends to be long rather than short.
- Therefore, there are times when an investor's positioning needs to be from the short side rather than from the long side.

II. Key Variables

Scarcity



Source: Heap (2006).

II. Key Variables

Weather-Fear Premia

- A futures price will sometimes embed a fear premium due to upcoming, meaningful weather events ..
- … that can dramatically impact the supply or demand of a commodity.

II. Key Variables

Past Performance is No Guarantee of Future Success

Examples:

- Soybean production (US -> Latin America);
- Coffee production (Brazil -> Vietnam).

III. Investment Process

Sizing as a Function of Risk

- Risk is “the currency of trading,” notes Grant (2004).
- “Each trading account has … a finite amount of this currency, and it is vital to manage portfolio affairs in such a way that respects this resource constraint.”

III. Investment Process

Volatility

- One wants to ensure that under normal conditions, …
- … a commodity position has not been sized too large that a trader cannot sustain the random fluctuations in profits and losses that would be expected to occur.

III. Investment Process

Worst-Case Loss

- Using long-term data, one should also examine the worst performance of a commodity trade under similar circumstances in the past.

Rembrandt's Storm on the Sea of Galilee, Isabella Stewart Gardner Museum, Boston, and Cover of Against the Gods: The Remarkable Story of Risk by P. Bernstein, 1996, (New York: John Wiley & Sons).

III. Investment Process

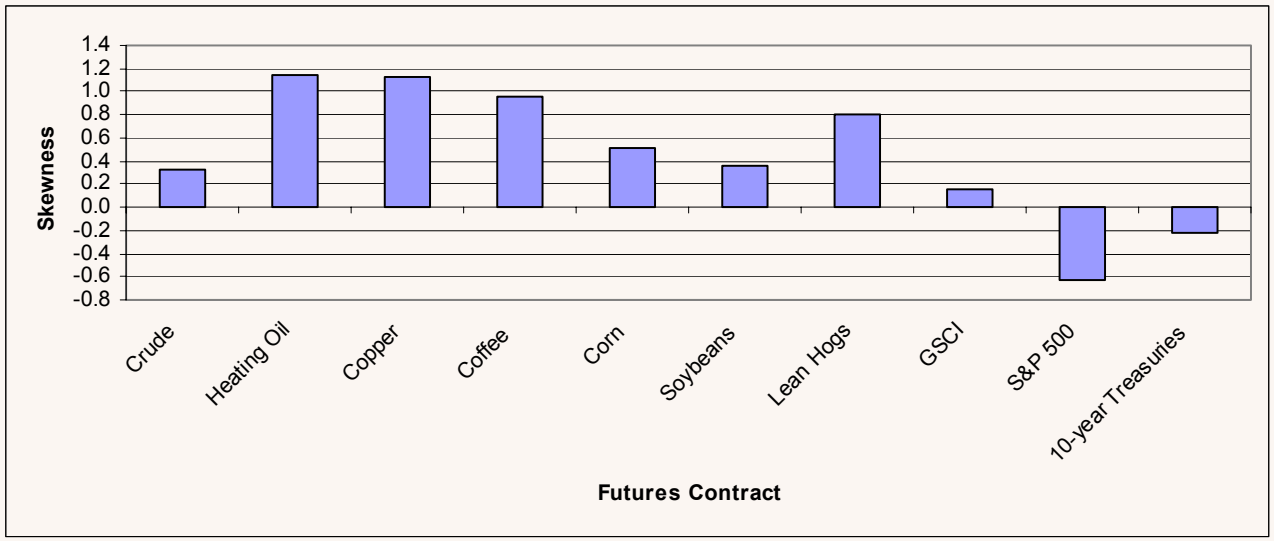
Optimal Sizing

- The inability of "the market as a whole to carry negative inventories," as Deaton and Laroque (1992) put it, …
- … causes commodity markets to be prone to violent upward price spikes.

III. Investment Process

Optimal Sizing

- The following is a summary of the skewness of a number of commodities as compared to U.S. equities and bonds:



[Monthly futures returns, 4/1994 – 3/2003. Source: Bloomberg, GSCI, SSgA]

Source: Excerpted from Hooker (2004).

III. Investment Process

Optimal Sizing

- When constructing total-return commodity portfolios, one should take into consideration the asymmetric nature of commodity returns.

- The risk capital allocated to individual *long* commodity positions needs to be much larger than the capital allocated to individual *short* commodity positions.

III. Investment Process

Entry and Exit Rules:

Seasonal Strength and Weakness

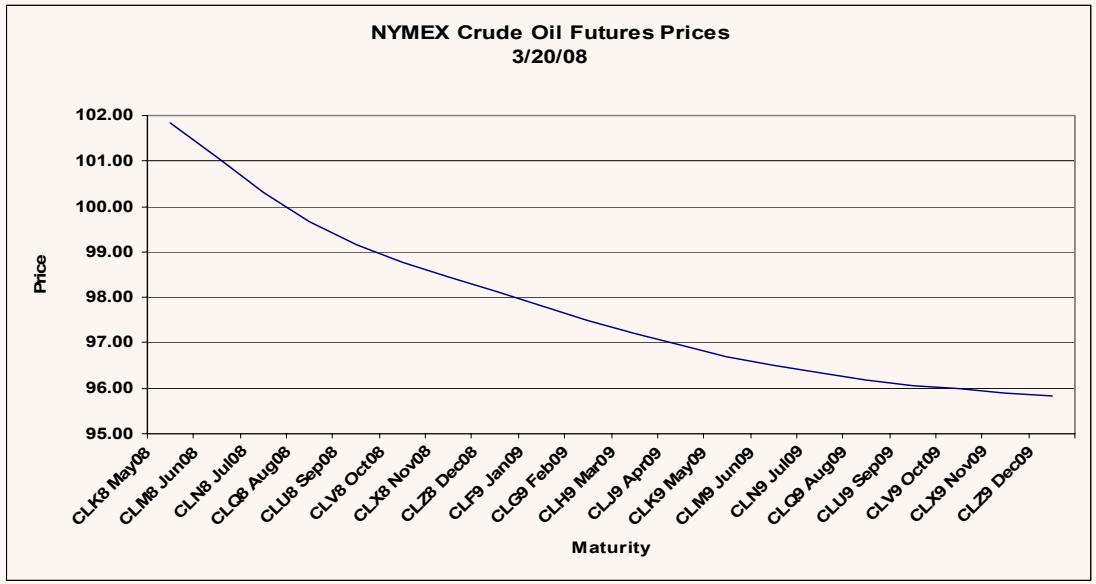
- The turning points for price-pressure effects are on average around peak (trough) inventory levels because that is when hedging by commercials would be at their highest (lowest).

Source: Cootner (1967).

III. Investment Process

Entry and Exit Rules:
Positive Curve Dynamics

- Another entry and exit signal is based on whether a futures curve for a commodity is in backwardation or not.



III. Investment Process

Entry and Exit Rules:

Structural Break

- If a loss on a particular commodity futures trade exceeds the historical worst case, …
- … this can be an indication of a break from past structural phenomena that had been detectable in historical data.
- In that case, a trader would exit a trade since one no longer has a handle on the magnitude of additional losses.

III. Investment Process

Trade Construction

- One can have a correct commodity view, but how one constructs the trade to express this view can make a large difference in profitability.

- In the commodity futures markets, one can choose to implement trades through outright futures positions, spreads, and/or options.

III. Investment Process

Diversification

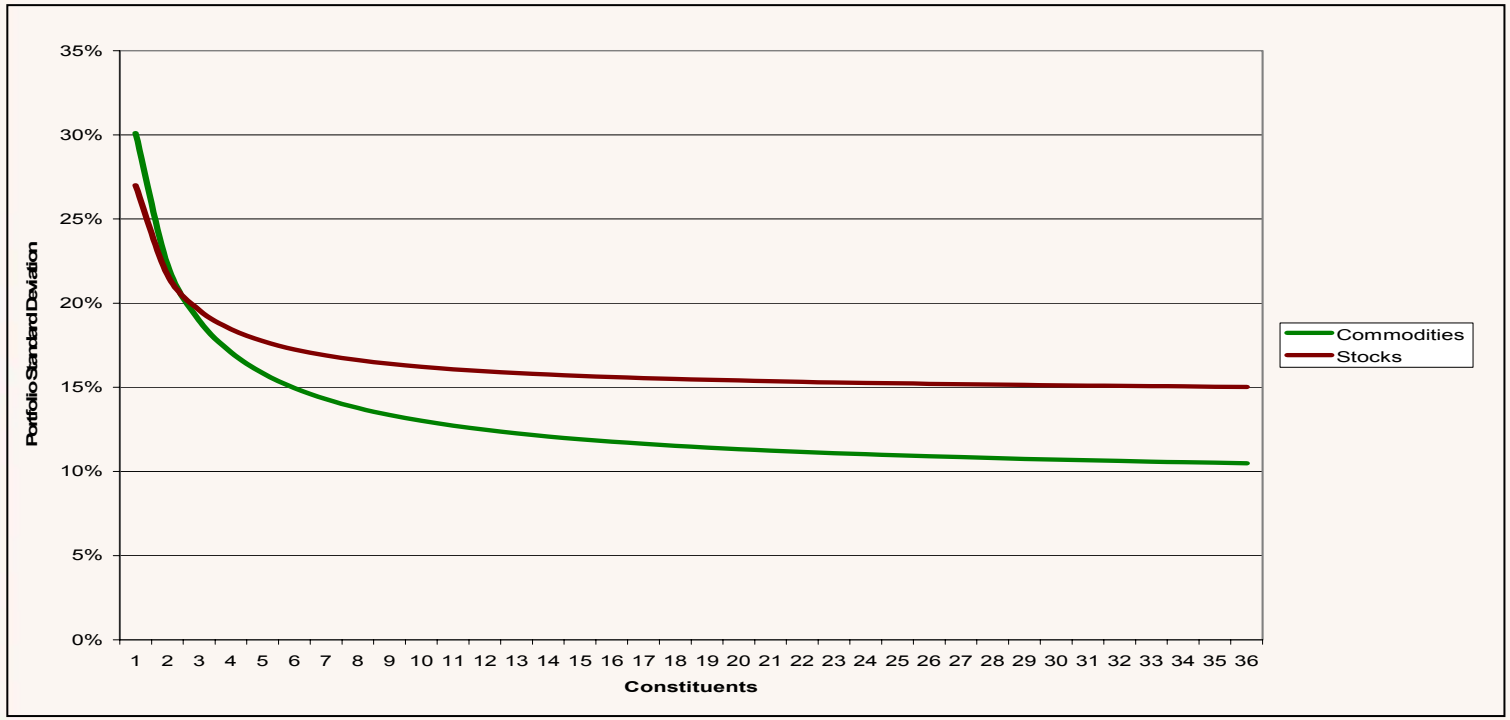
- Uniquely among asset classes, commodities can offer uncorrelated investment opportunities across individual commodity markets.

- Moreover, energy-sector commodities are frequently *negatively* correlated to non-energy-sector commodities.

III. Investment Process

Natural Internal Diversification

- This greatly aids in setting up dampened risk portfolios.



Source: Idzorek (2007).

III. Investment Process

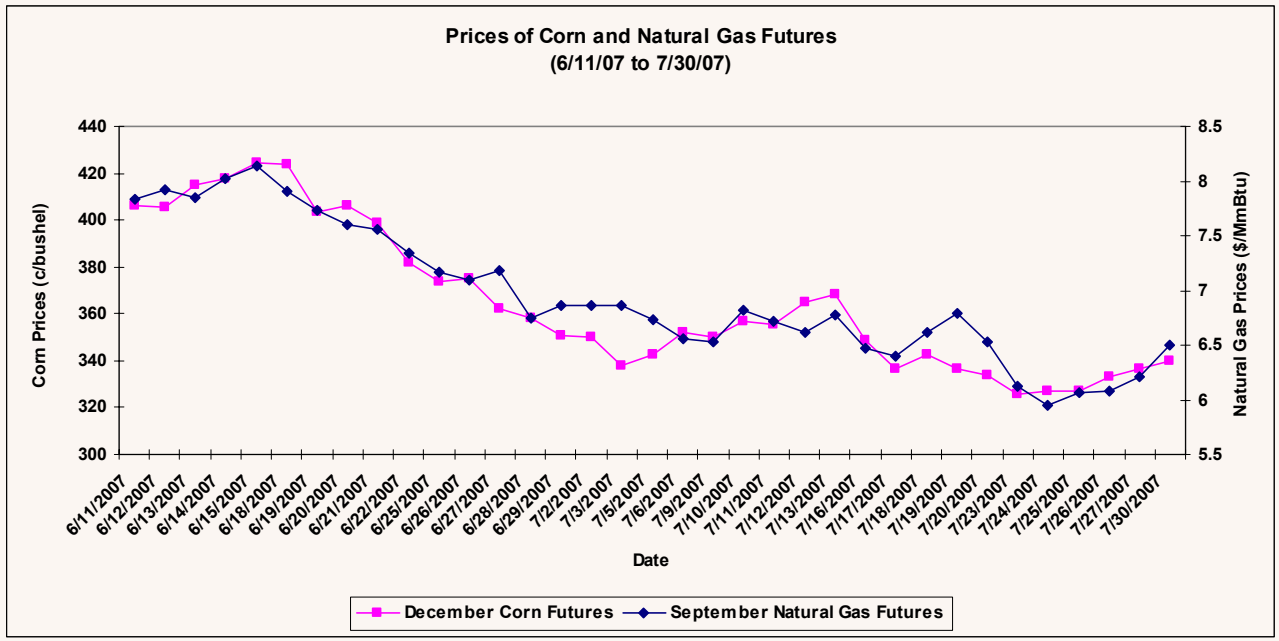
Avoidance of Inadvertent Concentration Risk

- In order to meet the goal of creating a diversified portfolio, …
- … a commodities portfolio manager needs to exercise due care in ensuring that each additional trade is in fact a risk diversifier rather than a risk amplifier.

III. Investment Process

Avoidance of Inadvertent Concentration Risk

Corn and Natural Gas Prices During the Summer of 2007



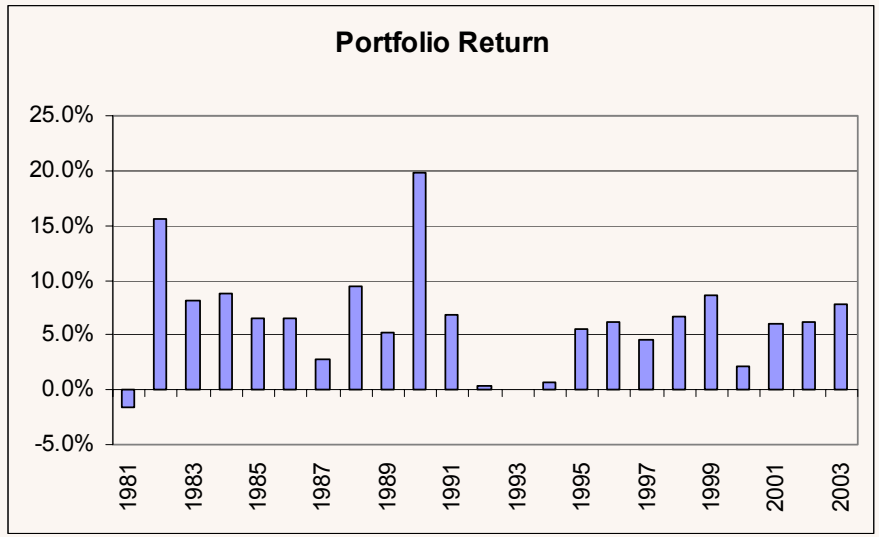
Source: Eagleeye and Till (2007).

III. Investment Process

Long-Option-Like Payoff Profile

- A final consideration in combining trading strategies is to attempt to ensure that the portfolio will have a long-option-like payoff profile.

Verification of (Historical) Long-Options-Like Profile

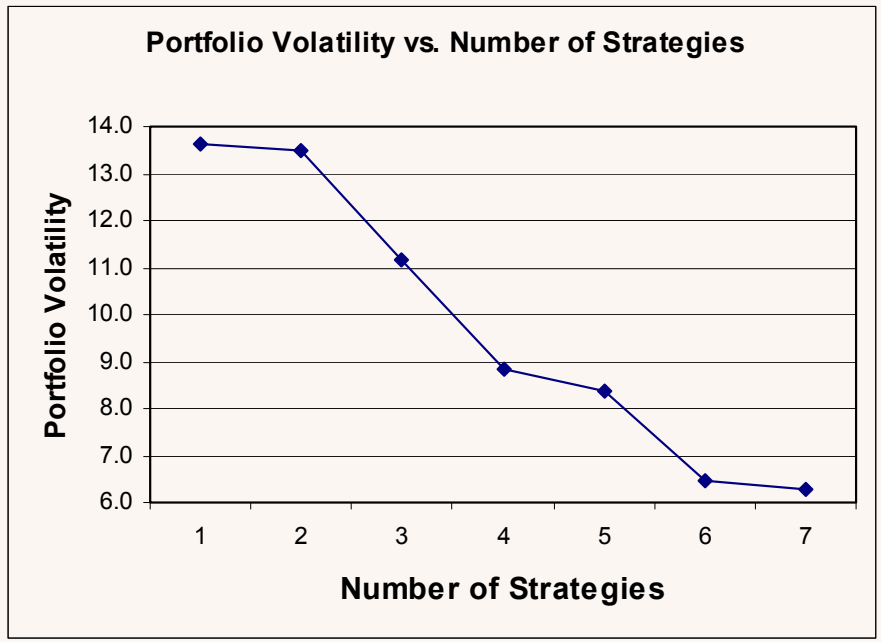


Source: Till and Eagleeye (2006).

III. Investment Process

Portfolio Construction

- Goal is to have at least seven uncorrelated strategies in the portfolio at any one time.



- These strategies (typically) have correlations amongst each other of between –20% and +20%.

Source: Till (2001).

III. Investment Process

Portfolio Construction

- With such low correlations, portfolio volatility is quite dampened as one adds each of these strategies to an investment portfolio.

- But then the portfolio manager has to be careful with eventful correlations.

III. Investment Process

Natural Hedges

- A program with a long commodity bias has a systematic risk to severe shocks to business confidence.

- Therefore, a long-biased commodity manager may have a tendency to include long fixed-income positions in the portfolio as a natural hedge to this systematic risk.

IV. Risk Management

Idiosyncratic Risks

- A commodity manager needs to address both idiosyncratic risks *and* macro risks when designing a risk-management program.
- Idiosyncratic-Risk Examples:
  - Mad Cow Disease (Live Cattle); and
  - New York Harbor Freezing Over (Heating Oil).

Source: Till and Gunzberg (2006).

IV. Risk Management

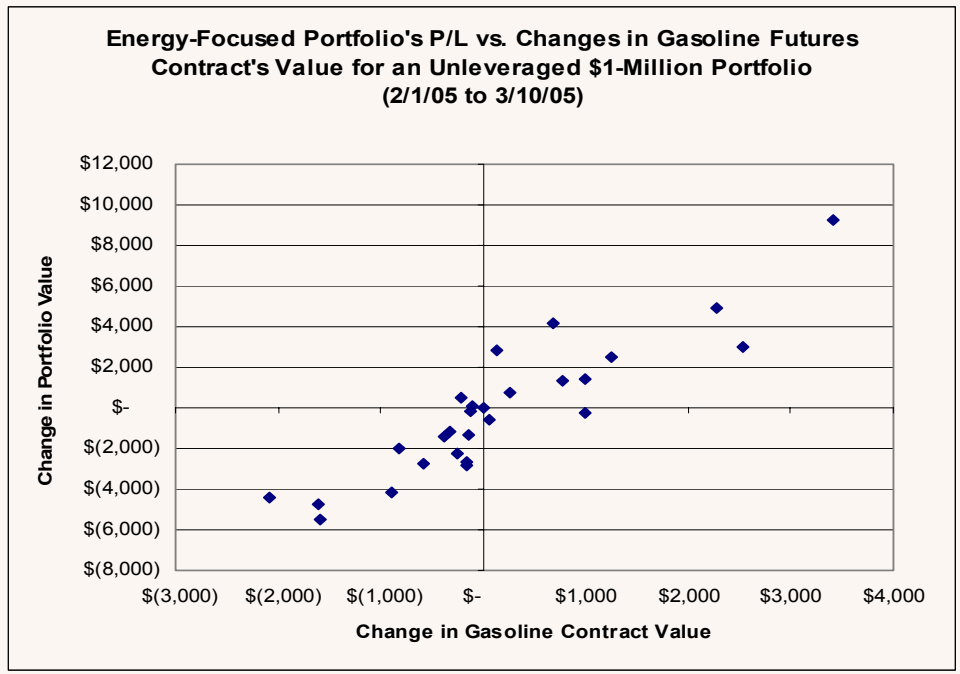
Macro Risks

- Macro risks include discovering those risks in the portfolio that can create inadvertent correlations amongst seemingly uncorrelated positions.
- Macro-Risk Examples:
  - 9/11/01 Event (Economically Sensitive Commodities);
  - Widespread Deleveraging of Risky Assets (Popular Commodity Plays); and
  - End-of-Winter Cold Shock (Energy Positions).

IV. Risk Management

Beta Risk

- A commodity manager may have limits on the amount of exposure to the outright direction of an individual commodity market, especially if that manager specializes in relative-value trades.



Source: Akey, Till, and Kins (2006).

IV. Risk Management

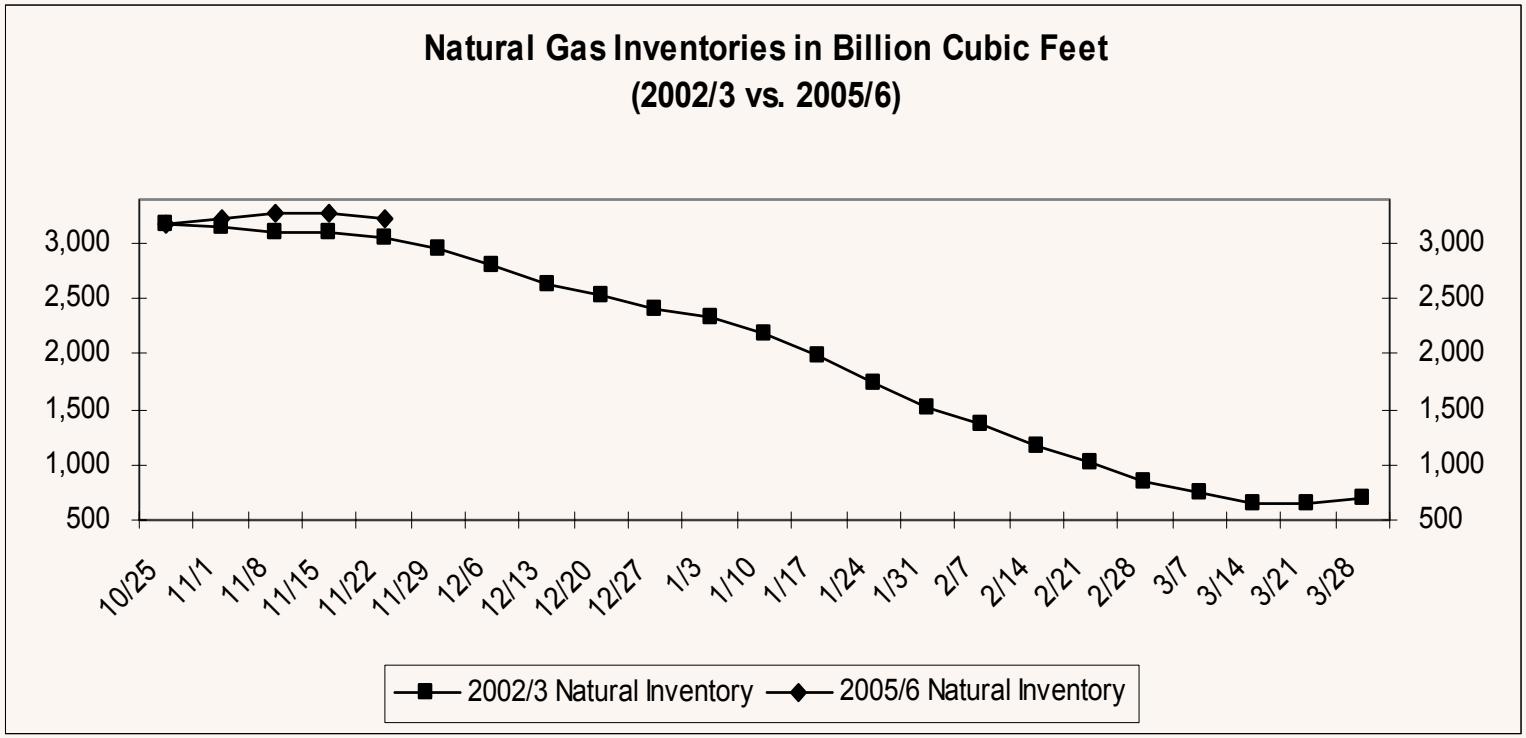
Extreme Weather Risk

- The next slide shows an example of monitoring the potential for extremely cold weather to cause a near stock-out in storage for natural gas.

- When U.S. natural gas storage inventories have been drawn down to uncomfortably low levels at the end of winter, the natural gas price has historically responded by exploding.

IV. Risk Management

Extreme Weather Risk



Source: Akey, Till, and Kins (2006).

IV. Risk Management

Structural Break Monitoring

Example: Deferred Heating Oil Crack Spread.

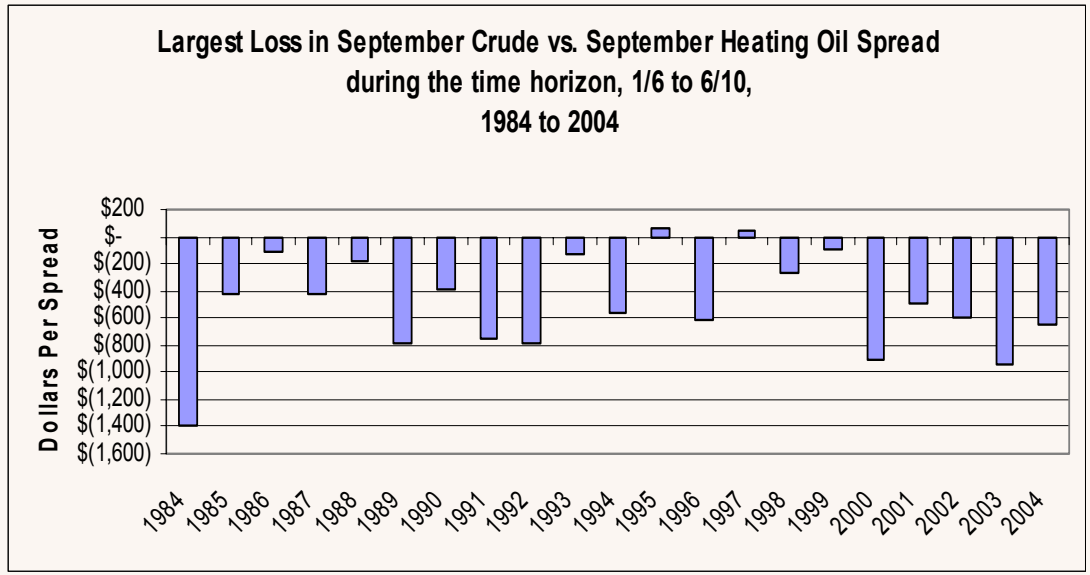
- One reliable strategy had been to expect that deferred-month crude oil futures would outperform deferred-month heating oil futures from the beginning of the year through the summer.

Source: Till (2006a).

IV. Risk Management

Structural Break Monitoring

- A commodity program will not experience the full brunt of a structural break if one exits a trading strategy after experiencing losses that are greater than have been the case in the past.

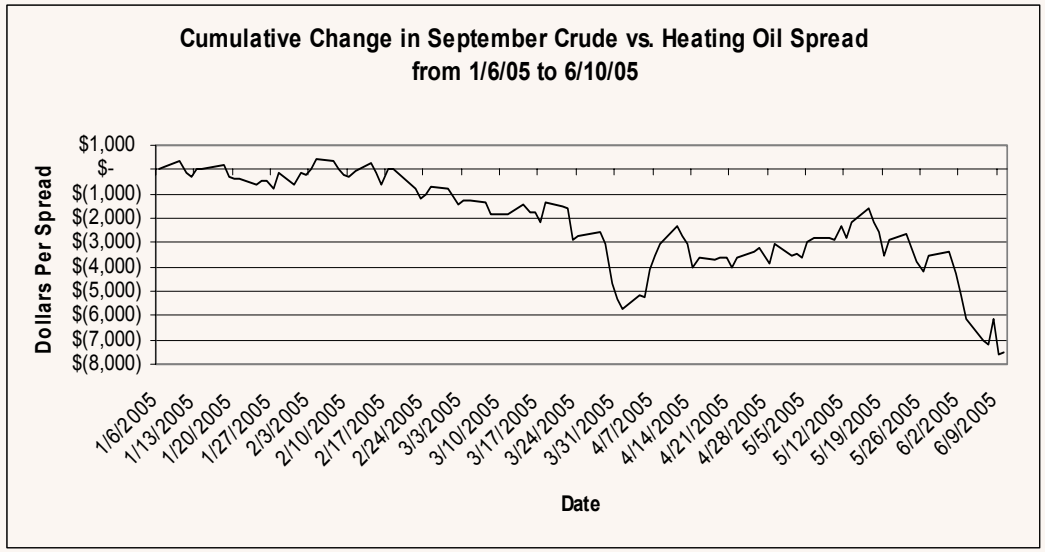


Source: Till (2006a).

IV. Risk Management

Structural Break Monitoring

- In 2005, note that the losses in the crude-versus-heat spread far exceeded the previous worst-case losses, which were illustrated in the previous slide.



Source: Till (2006a).

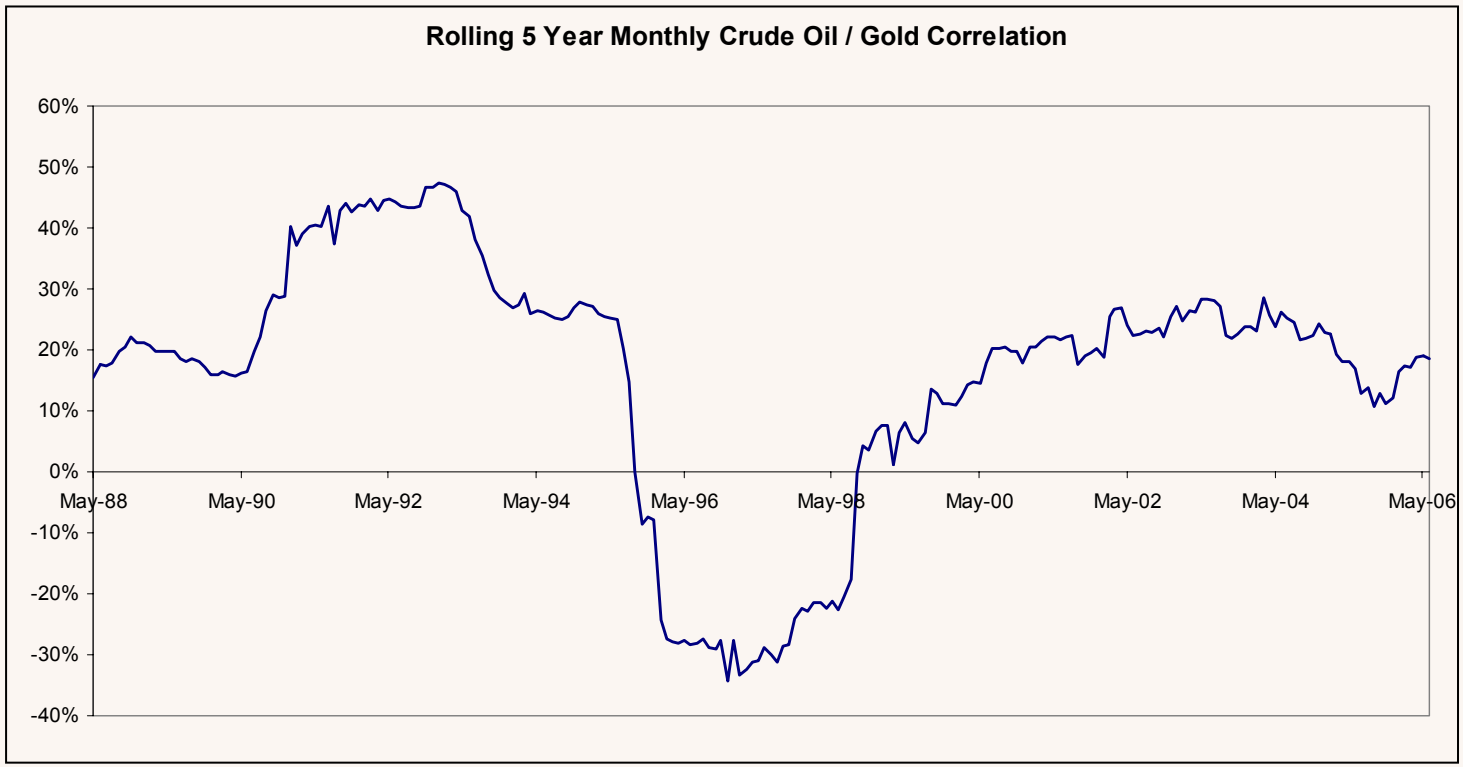
IV. Risk Management

Rolling Value-at-Risk (VaR)

- In examining VaR, a commodity manager attempts to ensure that a portfolio's positions have not been sized so large …
- … that he or she cannot sustain the random fluctuations in profits and losses that might ensue.

IV. Risk Management

Dynamic Correlations



Source: Schwab (2007).

IV. Risk Management

Macro Risk:

The Monitoring of Risky-Asset Deleveraging

- Long-biased commodity programs can be at risk to a widespread deleveraging of risky investments, as occurred during May and June of 2006; end-of-February 2007; mid-August 2007; and in March of 2008.

IV. Risk Management

Macro Risk:

The Monitoring of Risky-Asset Deleveraging

May 10, 2006 through June 13, 2006

"Risk Indicator"	
VIX (Equity Implied Vol)*	12.0%
"Risk Assets"	**Percent Change**
Bovespa (IBX50)	-23.5%
Nasdaq	-10.4%
S&P 500	-7.3%
Nikkei	-10.4%
Silver	-32.4%
Copper	-18.2%
Gasoline (RFG)	-3.6%
"Safe Havens"	**Percent Change**
Long Bond	1.8%
Dollar vs. Yen (Long Dollars)	4.5%

* The VIX increased from 11.78% on 5/10/06 to 23.81% on 6/13/06.

IV. Risk Management

Macro Risk:

The Monitoring of Risky-Asset Deleveraging

Global Unwind	16-Aug-07
VIX (Equity Implied Vol)*	31%
	Daily
Risk Assets	Percent Change
Bovespa (IBX50)	-2.11%
Nasdaq	-1.01%
Nikkei	-1.99%
Silver	-8.44%
Copper	-7.26%
Gasoline	-1.52%
NZD vs. Yen	-5.32%
"Safe Haven"	Percent Change
Long Bond	0.94%
Crack Spreads (Refinery Margins)	Daily Change
Gasoline Crack	$1.05
Heat Crack	$0.48

* Absolute level of the VIX (and not change in level as in previous slide.)

Intraday Performance of Commodities Within the Dow Jones AIG (DJAIG) Commodity Index

8/16/2007 10:07am CST

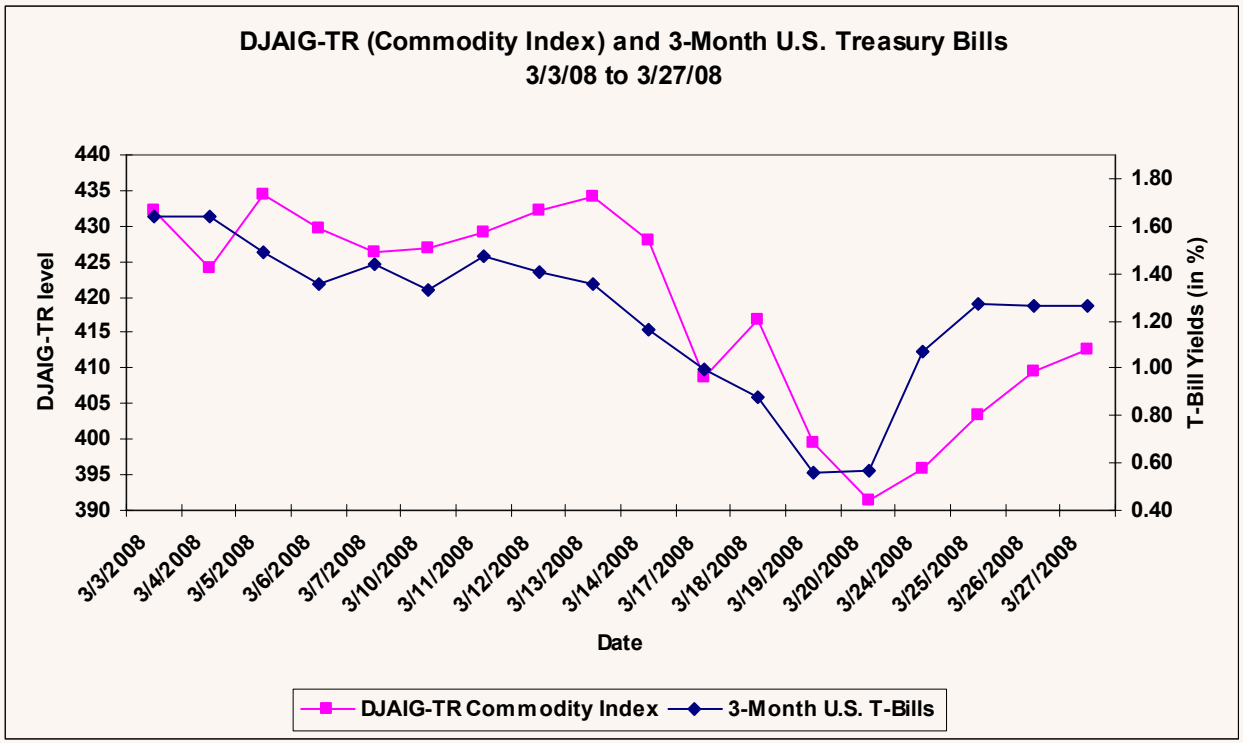
Commodity		Price	Change	% Change
LMAHDS03	Aluminum	2543.00y	-9.00	-0.353
NGX7	Natural Gas	7.791	-0.046	-0.587
W Z7	Wheat	688 3/4	-8 1/4	-1.18
LCV7	Live Cattle	94.600	-1.325	-1.38
LHV7	Lean Hogs	67.550	-1.025	-1.49
LMZSDS03	Zinc	3230.00y	-65.00	-1.97
XBX7	RBOB Gasoline	187.43	-3.95	-2.06
GCZ7	Gold	665.20	-14.50	-2.13
CTZ7	Cotton	58.85	-1.33	-2.21
CLX7	Crude Oil	71.10	-1.73	-2.38
HOX7	Heating Oil	201.55	-4.99	-2.42
C Z7	Corn	336 1/2	-8 3/4	-2.53
LMNIDS03	Nickel	26500.0y	-800.0	-2.93
SBV7	Sugar	9.16	-0.29	-3.07
KCZ7	Coffee	119.30	-3.90	-3.17
BOZ7	Soybean Oil	35.27	-1.25	-3.42
SIZ7	Silver	12.290	-0.445	-3.49
S X7	Soybeans	821	-33 1/2	-3.92
HGZ7	Copper	314.80	-17.40	-5.24

Source: Till (2008d).

IV. Risk Management

Macro Risk:

The Great Unwind / The Great Bail-Out



Source: Till (2008b).

IV. Risk Management

Risk Report By Strategy

- The next two slides show an example risk report for a commodity portfolio.
- This report shows the Value-at-Risk per strategy as well as each strategy's worst-case loss during normal times and during "eventful" periods.

IV. Risk Management

Risk Report By Strategy

	Strategy	Value-At-Risk	Worst-Case Loss During Normal Times	Worst-Case Loss During Eventful Period
1	Gasoline Front-to-Back Spread	2.59%	-5.59%	-4.31%
2	Deferred Outright Gasoline	3.81%	-2.50%	-2.76%
3	Deferred Outright Natural Gas	0.67%	-0.15%	-0.29%
4	Deferred Eurodollar Futures	2.42%	-5.92%	-0.96%
5	Hog Spread	3.87%	-2.66%	-3.23%
6	Deferred Gasoline Spread	1.60%	-0.29%	-0.53%
7	Cattle Spread	1.62%	-0.50%	-1.34%
	Portfolio	9.24%	-8.89%	-2.27%

Source: Till and Eagleeye (2006).

IV. Risk Management

Risk Report By Strategy

	Strategy	Incremental Contribution to Portfolio Value-at-Risk*	Incremental Contribution to Worst-Case Portfolio Event Risk*
1	Gasoline Front-to-Back Spread	1.62%	0.64%
2	Deferred Outright Gasoline	2.93%	-0.72%
3	Deferred Outright Natural Gas	0.52%	0.16%
4	Deferred Eurodollar Futures	0.77%	-2.86%
5	Hog Spread	1.18%	-0.29%
6	Deferred Gasoline Spread	1.33%	0.29%
7	Cattle Spread	0.25%	-0.32%

* A positive contribution means that the strategy adds to risk while a negative contribution means the strategy reduces risk.

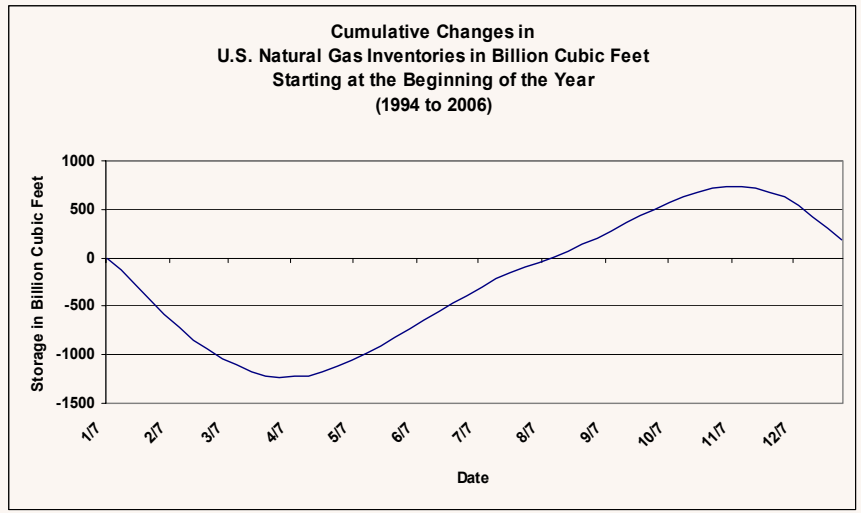
Source: Till and Eagleeye (2006).

V. Postscript on Amaranth

Short-Horizon Price-Pressure Effects

- There are short-horizon price-pressure effects on futures calendar spreads that are due to the seasonal hedging of commodity inventories, including in natural gas.

Average Seasonal Change in Natural Gas Inventories 1994 - 2006



- But: Size matters; and Value matters.

Sources: Till (2006b) and Till (2007).

V. Postscript on Amaranth

Size Matters

- The U.S. Senate Permanent Subcommittee on Investigations found that in late July 2006, Amaranth's natural gas positions for delivery in January 2007 represented …

- … "*a volume of natural gas that equaled the entire amount of natural gas eventually used in that month by U.S. residential consumers nationwide*." [Italics added.]

V. Postscript on Amaranth

Size Matters

- This is obviously too large for a financial entity that has no physical energy assets.
- If a financial firm cannot make or take physical delivery of a commodity, then that firm's exit strategy is *very* constrained.

V. Postscript on Amaranth

Value Matters

- Amaranth had engaged in natural gas calendar-spread trading on a vast scale …
- … in which the fund was long winter-delivery contracts and short non-winter-month contracts in the 2006 through at least 2010 maturities.
- They had entered into these positions at exceedingly wide levels for these spreads.

V. Postscript on Amaranth

Scenario Analysis

- As of the end of August 2006, it was apparent that up to -36% could have been lost under *normal* conditions.*

Scenario Analysis if Winter vs. Non-Winter Spreads Reverted to Past Spread Relationships

Number of Contracts	Spread Symbol	Natural Gas Spread	8/31/06 Level
(105,620)	NGV-X	October-November	-2.18
59,543	NGH-J	March-April	2.14

Date	NGV-X	NGH-J	Losses due to V-X	Losses due to H-J	Total Losses	Portfolio Loss
8/31/2000	-0.058	0.26	$ (2,241,256,400)	$ (1,119,408,400)	$ (3,360,664,800)	*-36.5%*
8/31/2001	-0.33	0.09	$ (1,953,970,000)	$ (1,220,631,500)	$ (3,174,601,500)	*-34.5%*
8/31/2002	-0.33	0.113	$ (1,953,970,000)	$ (1,206,936,610)	$ (3,160,906,610)	*-34.4%*
8/31/2003	-0.25	0.44	$ (2,038,466,000)	$ (1,012,231,000)	$ (3,050,697,000)	*-33.2%*
8/30/2004	-0.643	0.57	$ (1,623,379,400)	$ (934,825,100)	$ (2,558,204,500)	*-27.8%*
8/31/2005	-0.185	2.24	$ (2,107,119,000)	$ 59,543,000	$ (2,047,576,000)	*-22.3%*

- This was two weeks before the fund's implosion.

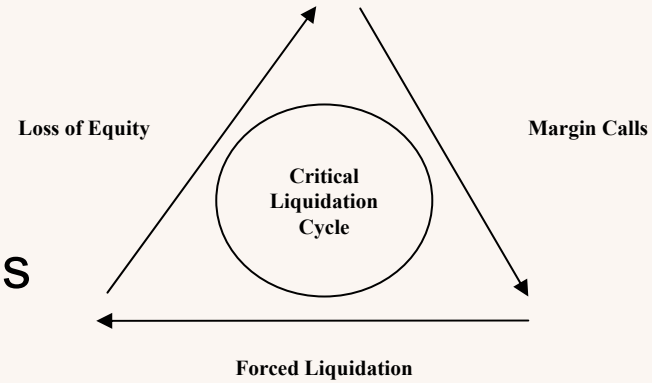
[Note: This analysis uses the Senate report's documented positions for Amaranth as of 8/31/06. We simplify our scenario analysis by choosing two spreads that, in combination, were 93% correlated to Amaranth's documented natural-gas book.]*

Source: Till (2008a).

V. Postscript on Amaranth

Critical Liquidation Cycle

- Severe liquidation scenarios have been formally modeled for highly-leveraged funds. For example, this scenario was modeled as being short a barrier option by de Souza and Smirnov (2004).



- This framework appears to be quite appropriate for the Amaranth case.

VI. Conclusion

- There are a number of futures strategies that earn their returns due to taking on risky positions in a risk-averse world.
- The returns are not due to inefficiencies in the marketplace.
- That said, there is a very important active component to a futures program that earns a return due to bearing risk ...

Source: Till (2008c).

VI. Conclusion

- … it is the program's risk management methodology.

- An investment manager must decide:
  - How much to leverage the strategy;
  - How to balance long-options-like trades with short-options-like trades;
  - How to avoid inadvertent concentration risk; and
  - Whether to give up any of its returns to hedge out the strategy's extreme risks.

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