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"WEATHER FEAR PREMIA TRADES: AN UPDATE"

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Weather Fear Premia Trades: An Update

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Ms. Hilary Till, the Contributing Editor of the *Global Commodities Applied Research Digest (GCARD)*, presenting at the J.P. Morgan Center for Commodities' Advisory Council meeting.

Introduction

In this article, we will review a class of trading strategies known as “weather fear premia” trades. We will describe them, arguing that they may comprise a type of risk premium and noting the extra diligence needed in their risk management. We note that both superior trade construction and an analysis of fundamentals are also critical for the successful implementation of these types of trades. We conclude with a cautionary note on a catastrophic trading blow-up that occurred in November 2018, illustrating the risk of such strategies.

Description of Weather Fear Premia Trades

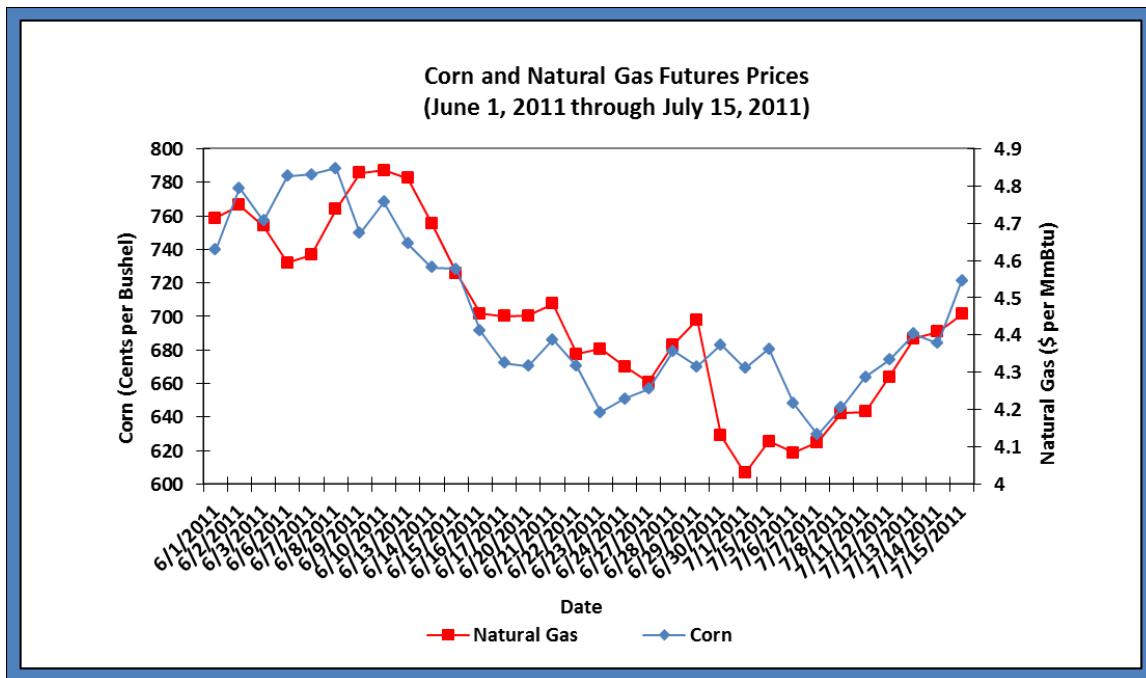
In Till and Eagleeye (2006), we described “weather fear premia” strategies. This early work noted that there were slight statistical edges in shorting certain futures contracts whose futures prices had built-in “weather fear premia” that would later subside if feared, but rare, weather events did not occur. For



this class of trades, a futures price is systematically too high, reflecting the uncertainty of an upcoming weather event. We say the price is too high when an analysis of historical data shows that it is generally profitable to be *short* the commodity futures contract during the relevant time period. And further that the systematic profits from the strategy are sufficiently high that they compensate for the infrequent large losses that occur when the feared, extreme weather event does in fact occur. In practice, futures traders do not take advantage of these opportunities by passively shorting a market; instead they exploit these slight statistical edges (a) through alternative trade constructions such as through futures calendar spreads in order to improve the return-to-risk of such strategies, and (b) only after taking into consideration a commodity market’s fundamental picture.

These trades can be found in the tropical, grain, and natural gas futures markets. Some of the relevant timeframes for these trades include the onset of the Brazilian winter and summer-time in the U.S. Midwest. In the case of the Brazilian winter, an extreme frost can damage Brazil’s coffee trees. In the case of the U.S. summer-time, an exceptional heat-wave can impair corn pollination prospects as well as stress the delivery of adequate natural gas supplies for peak air-conditioning demand. Given that corn and natural gas trades are heavily dependent on the outcome of weather in the U.S. Midwest, their prices can wax and wane at similar times during the summer. Figure 1 illustrates how both corn and natural gas prices had common reactions to the possibility of extreme heat in 2011.

Figure 1
Corn and Natural Gas Futures Prices during the Summer of 2011, Exhibiting Common Reactions to the Prospect of Extreme Heat

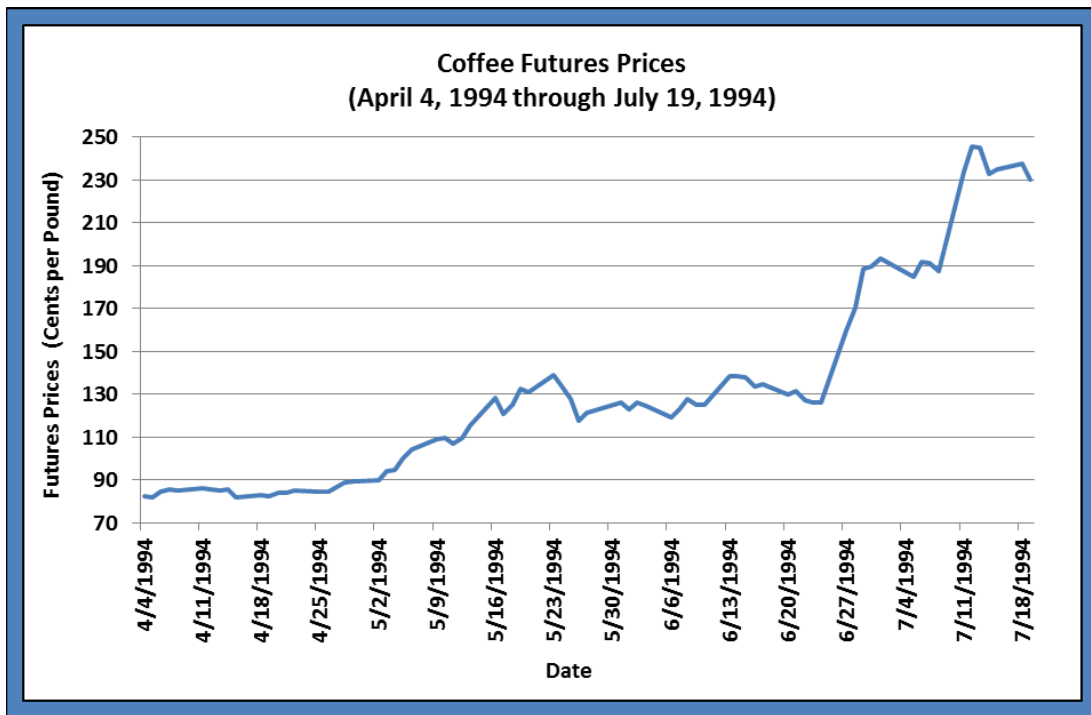


Source: Till (2016), Figure 3.



Till (2008) further described these opportunities as having short-option-like payoff profiles. While over long periods of time it has been profitable to be short weather-sensitive commodity markets around the time of their (respective) maximum weather uncertainty, these strategies can have very large one-off losses, which create classic short-option-like profiles. Therefore, such strategies should only be a fraction of one’s portfolio. For example, Figure 2 illustrates the risk of a *short* position in coffee if such a position were held during the Southern Hemisphere winter; in 1994 consecutive bouts of extreme weather did occur, as described by the derivatives trader, James Cordier, in an article entitled, “My Best Trade,” regarding profitably taking on *long* positions in this market (Cordier, 2005). Further in Neal (2008), Cordier stated, “The most memorable trade has to be long the coffee market in 1994. ... [F]orecasts called for a very cold winter for the southern growing regions of Brazil. Sure enough, freezing temp[erature]s invaded coffee fields not once but twice that year and prices tripled in a very short period of time. (Brazil’s coffee region has since migrated north.)”

Figure 2
Coffee Futures Prices during Extreme Brazilian Winter

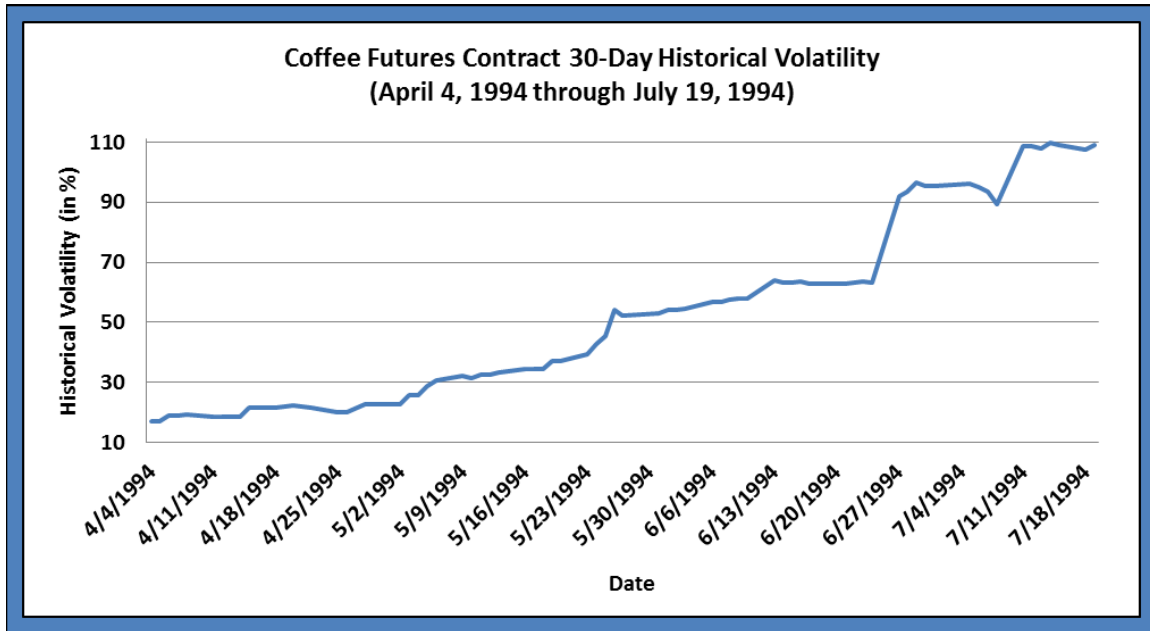


Source: Till and Eagleeye (2006), Exhibit 6-5.

Figure 3 on the next page further demonstrates how explosive the price change in coffee was during this time of unusual weather by showing the evolution of three-month historical volatility in this market.



Figure 3
Explosive Volatility in Coffee Futures Prices during Extreme Brazilian Winter



Source: Premia Research LLC.

A Type of Risk Premium

Chang (1985) defined the term, “risk premium,” as follows: this premium “generally refers to an average reward to investors for being willing to assume a risk position in a risk-averse financial world. The reward in this form should not be conditioned on any superior judgment or inside information.” Perhaps weather “fear” premia comprise a type of risk premium. Cochrane (2001) provided one possible explanation for why weather premia may exist in some commodity futures markets:

In really perfect capital markets, there should be no weather premium. Weather is pretty much a beta-zero risk relative to the rest of the market – there is no correlation between the weather and the S&P 500. ... Thus, investors should be willing to provide this weather insurance for a very small premium. But they don’t. It seems to me pretty analogous to the catastrophe insurance market. Catastrophe reinsurance itself, and the catastrophe enhanced bonds, have given quite high returns despite a zero beta risk. My own interpretation is that markets are quite a bit segmented.

Now the issue with all risk-premia strategies across asset classes is that they require active management. Whatever the asset class, a manager must decide how much to leverage the strategy, how many reserves to set aside in the event of a catastrophic event, and whether to give up any returns by hedging out some of the strategy’s extreme risks. This is analogous to the issues facing both commercial banks and insurance companies.



Active Management

As in all strategies that exploit structural phenomena, one can certainly choose to passively invest in weather-premium trades, expecting to earn a positive return over long periods of time. Alternatively, one can also create quantitative models, incorporating fundamental and technical data, so that one can judge if weather-sensitive futures contracts are especially over-valued, if at all, in a particular year. One would certainly do this in an actively managed commodity futures program. And in fact, hedge fund managers and asset managers alike have a higher expectation for trades and investments than merely earning a risk premium (Till, 2017). An actively managed position should have superior (entry-and-exit) timing, careful trade construction, and disciplined risk management rules and should not just passively involve entering into a trade that has a statistical expectation of profit.

Inventories are a crucial fundamental variable in the commodity markets and especially in weather-sensitive markets. If there is too little of a commodity, then that means there are inadequate inventories and therefore the only lever available to balance supply and demand is price, which must correspondingly increase. The inability of “the market as a whole to carry negative inventories,” as Deaton and Laroque (1992) explained, causes commodity markets to be prone to violent price spikes.

Corn

The Hightower Report (2002) described how to evaluate the corn futures market during the summer by evaluating both the inventory and technical positioning in the market:

July weather will be critical to [corn] yield potential. ... Given the tightness in world [inventory] numbers and the fact that speculators were still holding a net short position of over 28,000 contracts in the last Commitments-of-Traders Report with Options (as of June 4th) [along with] the threat of a significant reduction in yields (if hot and dry weather emerges in July), the upside potential in the market is explosive.

Natural Gas

Natural gas prices are also subject to the influence of its inventory situation, combined with weather outcomes (whether it is the potential of summer heatwaves or winter freezes.) *Dow Jones* (2005) reported how at the beginning of January 2005:

Natural gas futures prices on the New York Mercantile Exchange ... [experienced] a 5.8% drop as traders pointed to the confluence of near-record storage surpluses and increasingly mild temperature expectations as the source of the market’s weakness. ... “It’s going to just erase the whole winter premium because there’s no weather threat at all,” said ... [a futures broker].

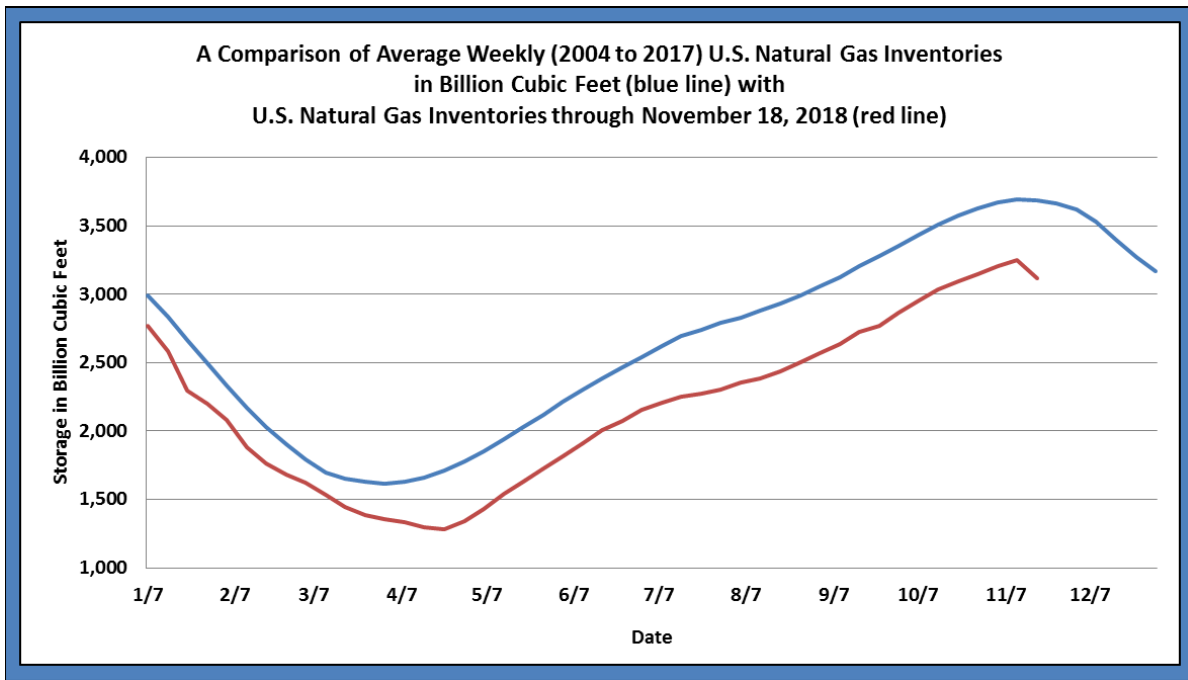
In mid-November 2018, Pirrong (2018a) warned against fading weather in the natural gas futures markets, after examining this market’s inventory situation. He particularly warned against taking bearish positions in a type of natural gas futures calendar spread known as the “widowmaker”: “[T]he



storage build in 2018 was well below historical averages ... Add in a dash of cold weather, and the widowmaker is back ...”

Figure 4 illustrates Pirrong’s fundamental observation.

Figure 4
U.S. Natural Gas Storage Builds in 2018 (through mid-November) have been below Average

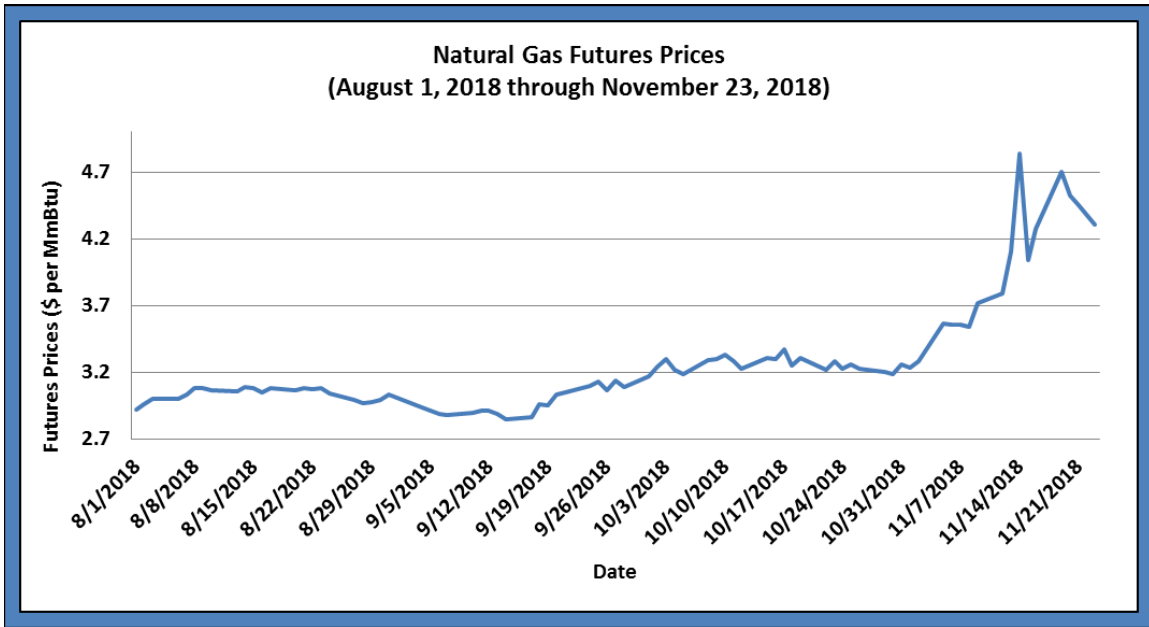


Source: Premia Research LLC.

And in fact, a cold snap did occur in mid-November 2018, sending natural gas futures prices and volatility spiraling upward, as shown on the next page in Figures 5 and 6 respectively.

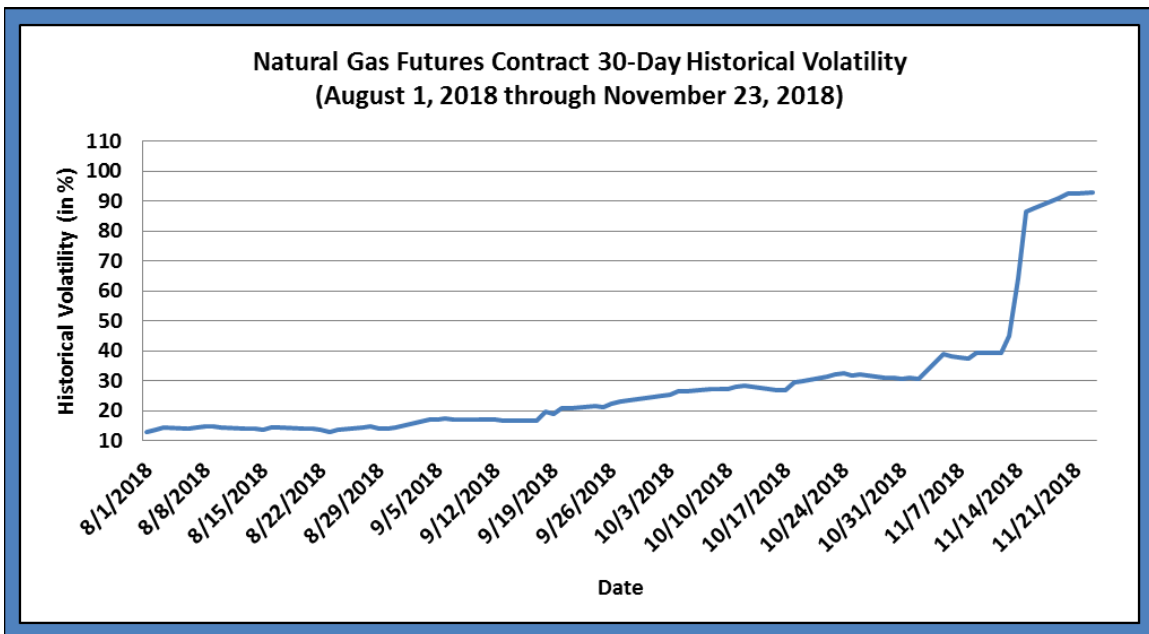


Figure 5
Natural Gas Futures Prices during a Cold Snap



Source: Premia Research LLC.

Figure 6
Explosive Volatility in Natural Gas Futures Prices during a Cold Snap



Source: Premia Research LLC.



The alert reader will note the similarities between the volatility graph for coffee in Figure 3 and the volatility graph for natural gas in Figure 6, indicating that natural gas' bout of volatility in November 2018 is not unprecedented for experienced traders specializing in weather-sensitive commodity futures markets.

Risk Management Case Study

Till (2008) described how natural gas seems to be at the center of a lot of trading debacles. Natural gas derivatives trading has offered hedge funds a potentially alluring combination of scalability and volatility, and also at times, pockets of predictability. This faith has continued unabated. Even in the aftermath of Amaranth sustaining the largest hedge-fund loss thus far in history in 2006, one of Amaranth's natural gas traders based in London was soon able to obtain a \$1-million signing bonus when joining another large-scale global macro hedge fund, according to Harris (2006). Further, by the spring of 2007, Amaranth's former head natural gas trader had apparently obtained close to \$1-billion in investor commitments for a new hedge fund headquartered in Calgary, Alberta, reported Herbst-Bayliss (2007). That said, a July 2007 U.S. regulatory action against the head trader himself (and not just against his former employer, Amaranth) appeared to put an end to these particular plans.

"Have I Lost All the Money in My Account Then?" Answer: "Yes"

What is the latest trading blow-up in the natural gas futures markets? According to press reports, James Cordier's Commodity Trading Advisor firm, OptionSellers.com, sustained catastrophic losses in November 2018 in the volatile energy markets, including in natural gas. Noted Banerji (2018), "A 2015 marketing document from OptionSellers.com reviewed by the *Wall Street Journal* encourage[d] investors to add option selling to their retirement strategies."

In the Yale University working paper by Goetzmann *et al.* (2002), the authors had warned investors about such strategies. The Yale professors show that "expected returns being held constant, high Sharpe ratio strategies are, by definition, strategies that generate modest profits punctuated by occasional crashes." As summarized in Till (2002), the experience of the Art Institute of Chicago's endowment provided evidence for the Yale professors' concern. One of the endowment's hedge fund managers noted in their marketing material that their fund had "the highest Sharpe ratio in the industry," according to Dugan *et al.* (2002). The hedge fund noted it would combine "cash holdings with stocks and riskier index options" in such a way that they "could guarantee profits of 1% to 2% a month in flat or rising markets. The fund ... could lose money only if the stocks to which the options were tied dropped more than 30%." This firm's funds were wiped out in late 2001. Unfortunately, as will be covered, apparently OptionSeller.com's investors sustained a worst result even than this.

Banerji (2018) explained that OptionSellers.com "specialized in selling options contracts to collect income ..." The firm was forced to liquidate its positions in mid-November "following wrong-way options bets on oil and natural gas prices." In an email to a client, "OptionSellers.com listed answers to frequently asked questions, including, 'Have I lost all the money in my account, then?' The answer given: 'Yes.'" Further, "[s]ome clients were left with a negative balance, meaning they are in debt to ...



OptionSeller.com’s clearing firm ...” The firm had 290 clients. According to one estimate in Malik *et al.* (2018), the “losses from the failure of the [strategy] ... could exceed \$150 million.”

Banerji (2018) further quoted from a client email sent by OptionSellers.com:

“Your account was caught in an extraordinary bout of volatility in the energy markets. In particular, natural gas prices experienced a parabolic move over the past 3 trading sessions. We had a short call position here that was on the wrong side of this. The magnitude of this move was so fast and intense that it overwhelmed all risk measures in place. It was like nothing we’ve ever seen.”

The final sentence of this explanation was not an obvious statement to make, given the principal’s past success in trading a market beset by extreme weather conditions: specifically, the coffee market during the Brazilian winter of 1994.

The founder of OptionSellers.com also referred to the market’s price action as a “rogue wave.” Pirrong (2018b) explained why he found this characterization unconvincing:

[T]he natural gas market was primed for a violent move: low inventories going into the heating season made the market vulnerable to a cold snap, which duly materialized and sent the market hurtling upwards. The low pressure system was clearly visible on the map, and the risk of big waves was clear ...

In addition to Pirrong’s fundamental analysis of the natural gas markets, one might also point out that “dramatic swings in implied volatility ... are [actually] inherent to the natural gas options market”, whereby this market’s implied volatilities periodically breach 90% (Till, 2008).

Pirrong (2018b) provided the following cautionary note to commodity investors: “Selling options is effectively selling insurance against large price moves. You are rewarded a risk premium, but this isn’t free money. It is the reward for suffering large losses periodically.”

Conclusion

We would conclude that if an investor decides to allocate to short options (or short options like) strategies such as weather fear premia trades, there are two lessons to keep in mind: (a) one should not employ a trade construction that has potentially unlimited losses; and (b) given the rare, but catastrophic, event risk inherent to such strategies that only a modest fraction of one’s portfolio should be devoted to these trades.

Endnotes

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assembled from sources believed to be reliable, but is not guaranteed by its author. Any (inadvertent) errors and omissions are the responsibility of Ms. Till alone.

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Hilary Till is also a principal of Premia Research LLC, which designs investment indices that are calculated by [S&P Dow Jones Indices](#). Prior to Premia, Ms. Till was the Chief of Derivatives Strategies at Putnam Investments where she oversaw the strategy development and execution of about \$90 billion annually in exchange-traded and over-the-counter derivatives; and before Putnam, Ms. Till was a Quantitative Analyst at the Harvard Management Company, the university’s endowment firm. Ms. Till’s additional academic affiliations include her membership in the North American Advisory Board of the London School of Economics and her position as a [Research Associate at the EDHEC-Risk Institute](#) (France.)

In Chicago, Ms. Till is a member of both the Federal Reserve Bank of Chicago’s Working Group on Financial Markets and the Advisory Board of DePaul University’s Arditti Center for Risk Management. She also has provided seminars (in Chicago) to staff from the Shanghai Futures Exchange, China Financial Futures Exchange, Zhengzhou Commodity Exchange, and the Dalian Commodity Exchange. In addition, Ms. Till is a board member of the International Association for Quantitative Finance (New York City).

Ms. Till has presented her analyses of commodity futures markets to the following institutions: the U.S. Commodity Futures Trading Commission, the International Energy Agency, and to the (then) U.K. Financial Services Authority. She has been a panel member at both the U.S. Energy Information Administration’s workshop on the “evolution of the petroleum market and [its] price dynamics” and the Bank of Canada’s joint roundtable with the International Energy Forum on “commodity cycles and their implications.” With [Joseph Eagleeye](#), she is also the co-editor of the bestselling Risk Book (London), [Intelligent Commodity Investing](#).

Ms. Till has a B.A. with General Honors in Statistics from the University of Chicago and an M.Sc. degree in Statistics from the London School of Economics (LSE). She studied at the LSE under a private fellowship administered by the Fulbright Commission.



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