A Matter Of Degrees

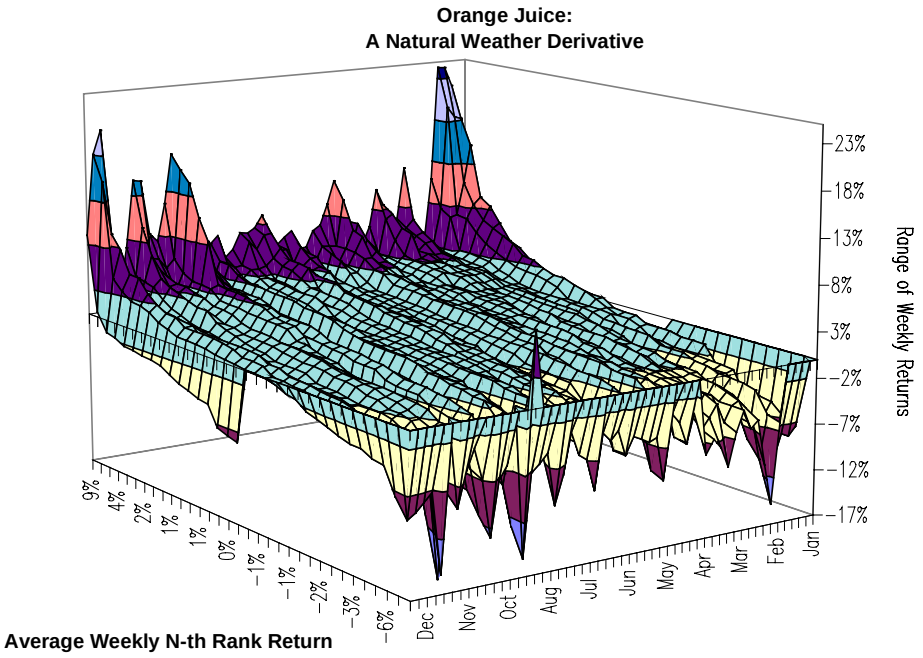
The three most important concepts in investment are, or were before the present bull market took hold, “diversify, diversify, diversify.” Yet this is a surprisingly difficult precept to adhere to for commodity futures traders.

Only a handful of separate and distinct factors drive markets. In financial futures, expected change in monetary policy is the dominant variable; it drives the level of short-term rates, the shape of the yield curve, and inflationary expectations. Economic growth rates drive demand for industrial materials such as base metals. These factors are produced by human behavior. Weather factors, which include temperature, precipitation, and singular events such as hurricanes and cold snaps, drive a host of markets, most notably agricultural and energy. Moreover, the tiresome bloviations of the global warming crowd notwithstanding, they are extrinsic to human behavior.

A Day Without Sunshine

We have been trading weather by proxy for years. The frozen concentrated orange juice (FCOJ) market has been one of the purest weather plays since supply disruptions almost always are functions of freezes, principally in Florida, but occasionally in Brazil. Oddly enough, freezes in navel orange growing zones such as California actually increase the juice supply as this damaged fruit is diverted from the whole-orange to the juice-orange market.

Unsurprisingly, the largest percentage swings in average weekly FCOJ futures, both up and down, have occurred during the U.S. winter months as players assess the potential frost damage to the crop. Sometimes traders can bet right on the weather and still lose in the FCOJ futures if the frost damage is minor. Similar conundrums occur in the heating oil market, both in terms of price and backwardation, (see “If The Sky’s Not The Limit, What Is?, *Futures*, May 1998) and in grain and cotton markets, where both adverse and favorable weather events may not produce the desired and predicted price movements.



Three questions arise. First, can we hedge the weather component of our underlying commodity risk directly; in the example above, should a grocery chain buy its freeze protection directly, instead of by proxy through FCOJ futures? Second, if we trade this weather component outright, will we be more certain of our total risk management than we will by trading the affected commodity directly? Finally, if the answers to the first two questions are affirmative, should we simply trade the weather?

Betting On Raindrops

An active OTC market for weather derivatives has emerged both as part of the ongoing convergence between capital markets and insurance markets (see "Poisson In The Wind," *Futures*, November 1998) and as a trading vehicle in its own right. This OTC market already has achieved astonishing complexity for exotic risks; you could probably hedge the risk of a cold day in hell if you were so inclined. The Chicago Mercantile Exchange has ratified this development by applying to the CFTC for permission to list contracts on the number of heating and cooling degree-days (HDD and CDD, respectively) in selected cities, including Atlanta, Chicago, Cincinnati, Dallas, New York, Philadelphia, Tucson, and Portland, Oregon. The CME hopes these contracts will become important for the weather market as the Eurodollar contract has been for the interest rate derivative market.

The contracts will be settled against the cumulative monthly HDD and CDD totals, the formulae for which are given below. For any given month with N days, the number of HDD will be the total of the positive daily deviations between 65° Fahrenheit and the average daily temperature, while the number of CDD will be the total of positive daily deviations between the average daily temperature and 65°.

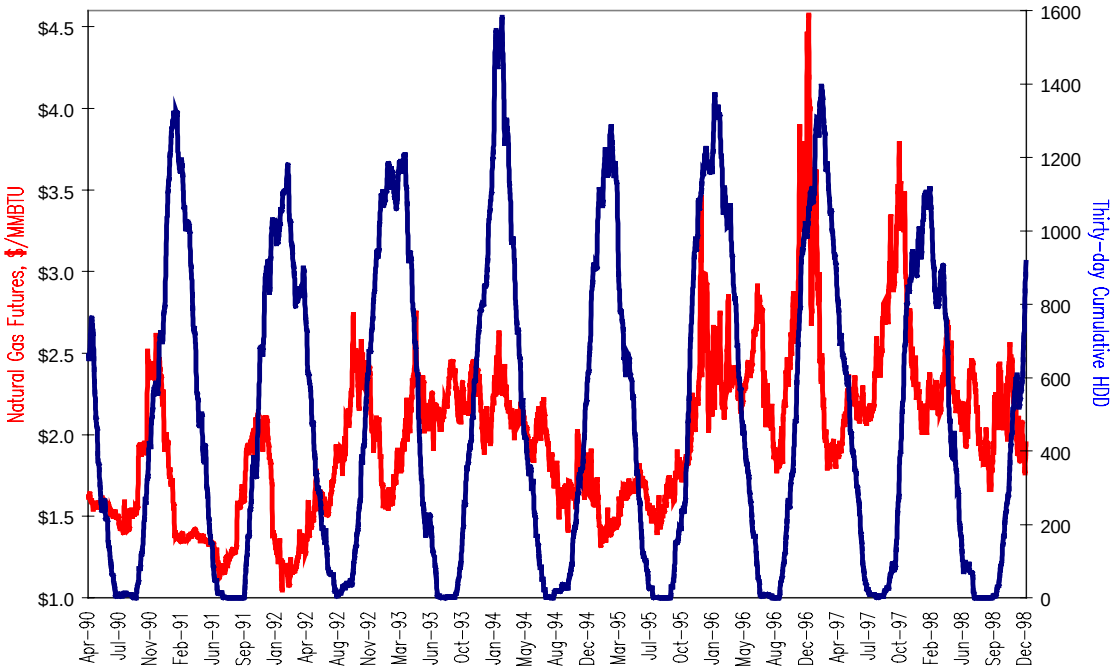
$$HDD = \sum_{i=1}^{N} \max(65^{o} - T_i, 0) \qquad CDD = \sum_{i=1}^{N} \max(T_i - 65^{o}, 0)$$

The non-negative nature of both data recall the intrinsic value calculations for options. The underlying asset, temperature, is bounded within reason; every city and region has an expected temperature range, although both Dallas summers and Chicago winters call these bounds into question. The effects of HDD and CDD are highly nonlinear as well; it takes exponentially more energy to either heat or cool a building at temperature extremes, meaning a degree-day is not a degree-day.

Hedging The Hedge

We now can begin to answer our three questions using the example of natural gas. We can compare natural gas prices at Henry Hub, the basis for the principal NYMEX contract, with a rolling 30-day total of HDD at Chicago as compiled by the Earth Satellite Corporation, which will be the official provider of weather data for the CME contracts.

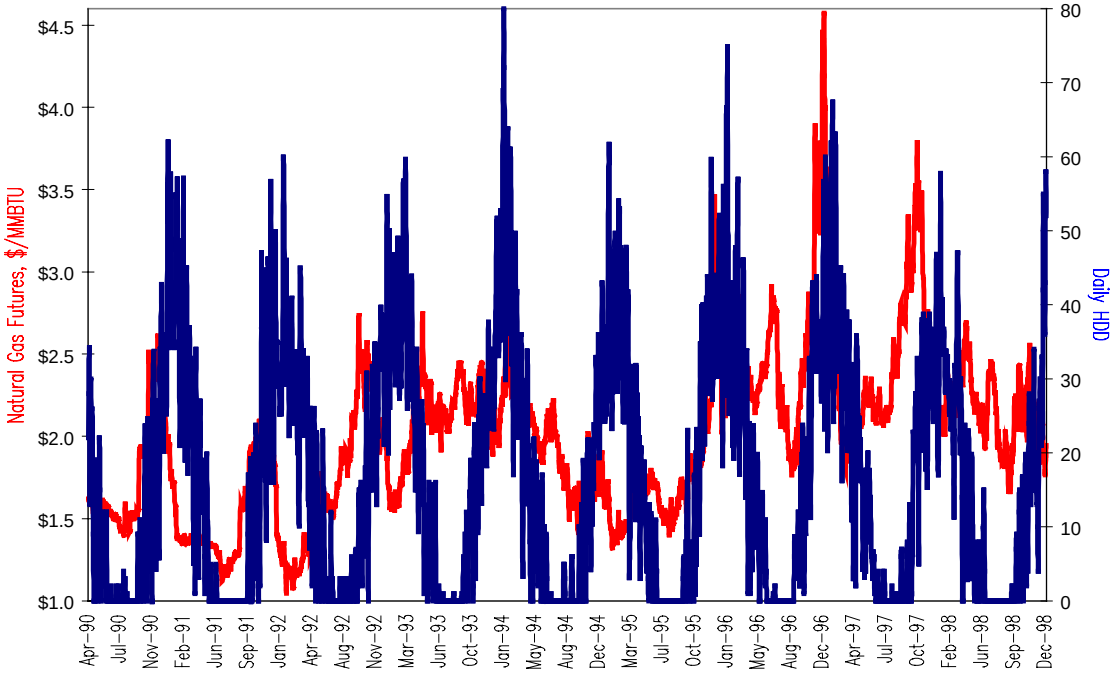
Chicago Heating Degree-days And Henry Hub Natural Gas Futures: Cumulative HDD



The annual natural gas price cycle exhibits rising prices in anticipation of winter heating demand and falling prices after summer electricity generation demand. We know it will get cold during the winter; we do not know, despite our best forecasts, what the total and peak-load heating demands will be. As a result, very cold winters such as 1993-94 produce only modest price responses, while more typical winters such as 1996-97 produce large price responses. In cases such as 1997-98, prices rise well in advance of the winter, and then collapse as the weather remains moderate, while 1998-99 saw a price decline prior to winter's onset.

The natural gas market exhibits a much tighter relationship with daily HDD data; this suggests the industry maintains a just-in-time inventory policy for peak loads and is able to pass the resulting higher costs on to its customers (see "It's A Gas," *Futures*, June 1997).

Chicago Heating Degree-Days And Henry Hub Natural Gas Futures:
Daily HDD



How could the natural gas industry – or an industry less able to pass higher costs on to its customers – use the new HDD futures? The major risk for natural gas utilities is overestimating its demand; unsold gas is expensive to transport and store. Demand shortfall should be a function of HDD, which means a utility could protect its demand projection by selling HDD futures, engaging in a degree-day swap, or buying puts on the HDD index. This would allow the utility to be more aggressive and proactive in its purchasing commitments instead of buying peak-load gas at the time of current demand.

A combination of natural gas futures and HDD futures will provide the industry with more complete risk management opportunities, as it allows for demand as well as price hedging. The quantitative tasks involved in modeling weather/commodity scenarios adequately are formidable, but hardly insurmountable. Weather protection should be bought separately, and not by proxy in natural gas futures. But weather protection alone will not suffice: The utility may be pleased with the financial results of its HDD hedge, but this will be of cold comfort indeed to its customers if no natural gas is available.

Blue Skies Ahead

Weather derivatives have massive potential; they should be the most important development in the risk management industry since the advent of financial futures in the 1970s. Little imagination should be required to see the potential for precipitation futures for agricultural commodities, or a combination of temperature and precipitation futures for industries such as tourism, construction, and retailing, all of which are affected by the ability of people to get out of the house and move around during the winter.

One of the requirements of any successful futures contract is active speculative interest, and weather futures should meet the test far better than many of the recent contract introductions have, since weather is part of our daily experience. A second requirement is two-sided commercial hedging interest, and this should be present as well. A third requirement, apparent on the face, is volatility of the underlying asset. It should be time to update Mark Twain on the weather: Everybody talks about it, and now they're trading it as well.