1QBit

CME Market Sentiment Meter Historical Market Analyses:

Natural Gas
2014 North American Cold Wave

The CME Market Sentiment Meter (MSM) assigns market states from futures and options settlement data. There are four possible market states: Complacent, Balanced, Anxious, and Conflicted. This series of application notes provides detailed examples on how to use MSM by exploring economic events.

Executive Summary

From late 2013 through early 2014 there were severe cold fronts across North America, during which time natural gas futures (NG[1]) prices spiked, peaking in February of 2014. The Market Sentiment Meter (MSM) indicated Complacent and Balanced states before the cold period. As the cold wave became more severe, the MSM indicated Anxious states, which preceded an upward movement in settlement price.

During and following the price spike, the MSM indicated Balanced states. This was indicative of options traders not expecting the gas shortage would persist beyond March, in line with previous years' supply and demand cycles.

1 NYMEX Henry Hub Natural Gas Futures (NG)

- NG is a physically delivered contract at Henry Hub in Louisiana.
- NG is a global price benchmark for trading natural gas.
- NG has a deep, liquid market with 400K contracts traded daily and 1.4M of open interest.
- NG price is volatile compared to other commodities and is highly susceptible to disruptions in supply.
- Weather events can deeply affect the supply and demand for NG.

2 2014 North American Cold Wave

There were a series of abnormal weather conditions across North America from November, 2013 to March, 2014. This was in part due to the breakdown of the polar vortex in November, which allowed for extended periods of cold air travelling down into the United States.

The settlement price NG (most active expiry) hovered steadily between 3.45 and 3.95 USD/MMBtu from September to November, 2013. The MSM indicated Complacent and Balanced states during this period (Fig. 1).

In early December, the polar vortex weakened and led to an abnormally cold trend in the Eastern and Central United States. Over 150 daily precipitation records and close to 100 daily snowfall records were broken across the the north-eastern, south-eastern, and south-central US.

[1] The CME DataMine product codes are used in this work. See Appendix C.

Written by Aaron He. Revised by series editor Anish Verma.

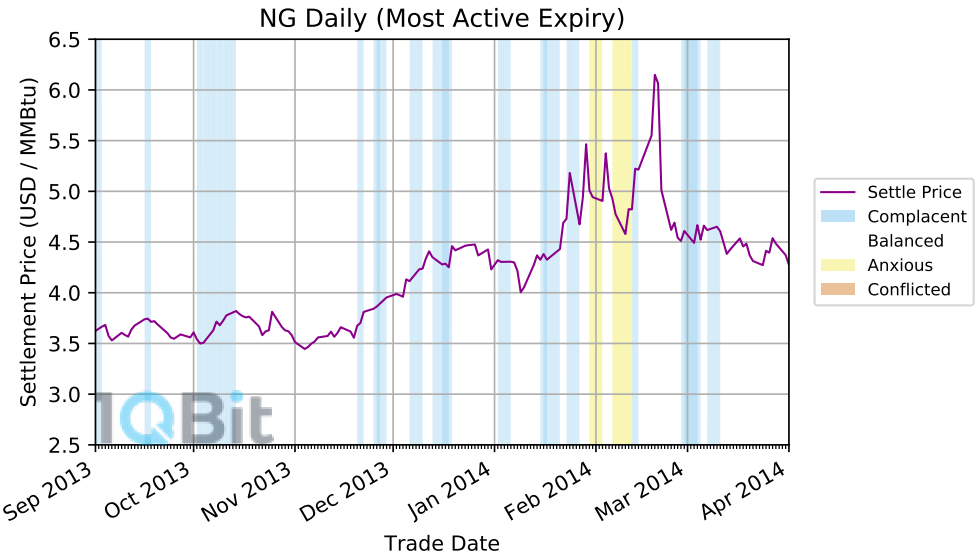

Figure 1: **2013–2014 Daily Settlement Prices for NG** (most active expiry) (purple line). Regions where the MSM is Complacent (blue), Balanced (white), Anxious (yellow), and Conflicted (red) are highlighted.

As storms moved east, temperature decreased resulting in increased demand for heating in early winter. The price of NG rose from 3.99 USD/MMBtu in early December to 4.48 USD/MMBtu in late December. However, NG usually sees a seasonal increase in winter. The MSM market state remained in the low-risk Complacent and Balanced states.

On January 20, 2014, a fast-moving blizzard moved through the north-east, bringing severe temperatures, and lasted until January 24. During these five days, the price of NG rose from 4.43 USD/MMBtu to 5.18 USD/MMBtu.

From January 27 to January 31, a rare winter storm hit the eastern and south-eastern US, extending to the Gulf Coast, which rarely receives frozen precipitation.

The consumption of natural gas reached its peak in January, breaking at-the-time recent records (Fig. 2). The price of NG rose during this time. The MSM indicated an Anxious market state on January 31 (Fig. 3), which is associated with a wider risk-return curve than that of the Balanced market state, indicating greater risk than was encountered before the cold front.

From January 29 to February, severe winter storms affected most of the US. During these early-February winter storms NG was volatile, and the market state became Anxious again on February 7 after being Balanced for a week.

From February 11 to February 24, there were blackouts lasting up to two weeks without power due to these storms. The MSM shifted from indicating Balanced to Anxious market

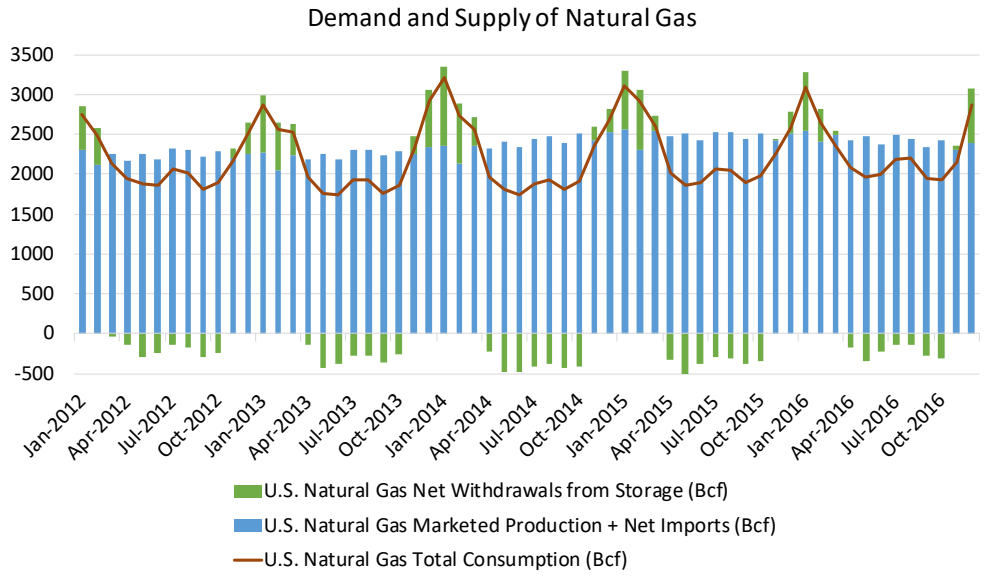

Figure 2: **Supply and Demand of Natural Gas.** Charted here is the supply and demand for natural gas in the US, quantified by US marketed production and net imports(blue bars), US net withdrawals (green bars), and US total consumption (brown line). There is a rise in consumption each year during the winter months, due to an increased demand for heating.

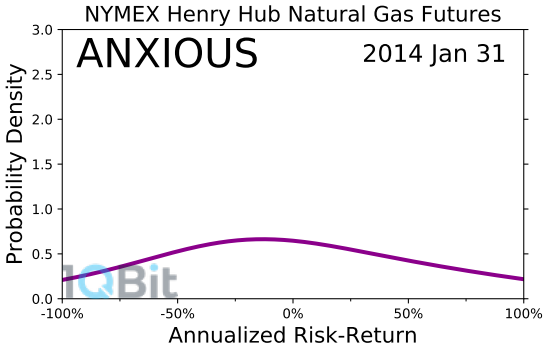

Figure 3: **One day in January, 2014.** The MSM indicated wide risk–return distributions at the end of January, 2014, characterized by the Anxious market state, as shown here.

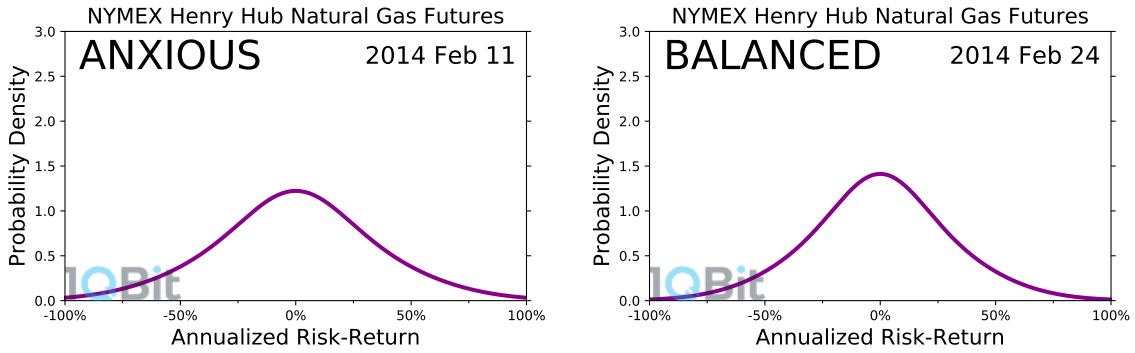

Figure 4: **Two days in February, 2014.** Left: An example of an Anxious market state indicated by the MSM following the start of a major winter storm. This preceded a large upward price movement in NG. Right: The Balanced market state following the end of the storm. The price of NG settled back to pre-storm levels.

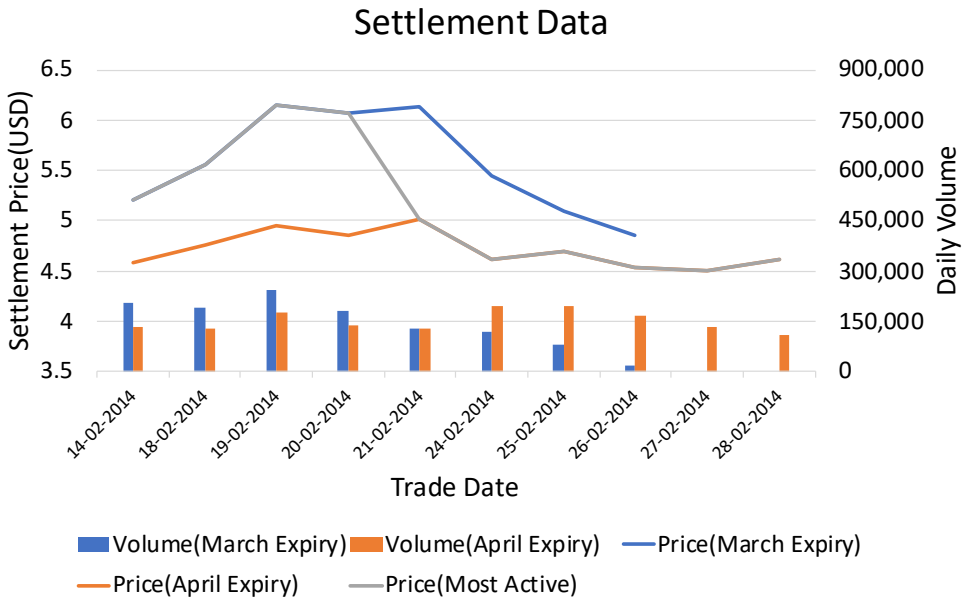

Figure 5: **Settlement Data of March and April Expiry Contracts.** The settlement data for the March expiry (blue) and the April expiry (orange) contracts are charted for the last two weeks of February, 2014. The most active settlement price for NG is represented by the grey line, lining up with the diminishing of the price spike.

states (Fig. 4). The characteristic wideness of the distribution indicates higher implied volatility when compared to a Balanced or a Complacent market state.

NG rose to 6.15 USD/MMBtu on February 19 before dropping steadily back to 4.62 USD/MMBtu on February 24. The most active expiry shifted from the March contract to the April contract. In Fig. 4, the daily settlement price and volume of both contracts show where the shift took place. Before February 21, the volumes of the March expiry remained higher than that of the April expiry. Thus, when the transition took place on February 21,

the price of the most active contract for NG fell, resulting in the appearance of a spike. After the short-term rise and fall, the MSM went back to indicating Complacent and Balanced market states.

In summary:

- Natural gas futures prices see a seasonal increase in price as demand for heating and electricity during the winter season. This demand is highly susceptible to sudden weather events.
- The MSM indicated Balanced and Complacent market states early in the final quarter of 2013 before a sudden severe cold period.
- Once the cold front hit, the MSM indicated a shift to Anxious market states which preceded an upward price move.
- The large price movement was short in duration but intense in magnitude.
- Following the sharp rise and fall, the MSM returned to Balanced and Complacent states, which was a mark of the end of the large volatility in settlement price.
- This was indicative of options traders not expecting the gas shortage to persist beyond March, in line with previous years' supply and demand cycles, as reflected in the settlement data for February.

APPENDIX

A About the Historical Market Analyses

This series of application notes describes notable historical events and times and how they affected market prices and trends. Each event considered is tailored to a specific product which is covered by the MSM product line. For each historical narrative, an analysis is provided making use of the data and features available through the MSM in order to gain an economic and financial insight into each situation.

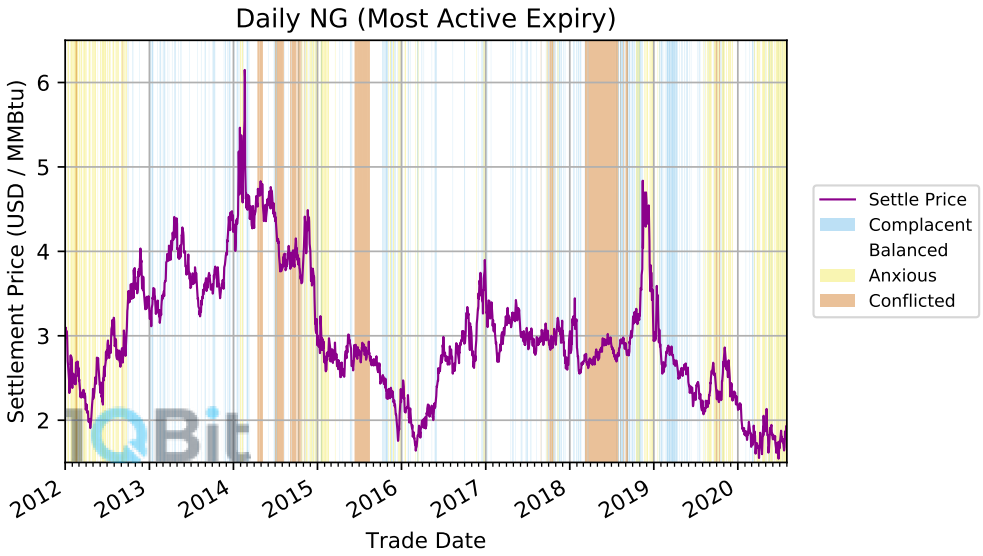

Figure 6: **2012–2020 Daily settlement price for NG** (most active expiry) (blue line). The shading indicates the market state. Regions where the MSM is Complacent (blue), Balanced (white), Anxious (yellow), and Conflicted (red) are highlighted.

B Market Sentiment Meter Market States

The CME Market Sentiment Meter models risk by allowing there to be multiple "schools of thought" for price movement. There are four possible "market states": **Complacent**, **Balanced**, **Anxious**, and **Conflicted**. Graphical representations of the market states are found in Figs. 6–7. These are represented in a single Mixture Distribution. The Mixture Distribution represents the expected price movement over the next twelve months, so that its standard deviation can be directly compared to an annualized volatility. However, the Mixture Distribution may change daily, evolving over time as new information arises. This may indicate a large price move. The model works best for events in which the timing is known but the outcome is uncertain.

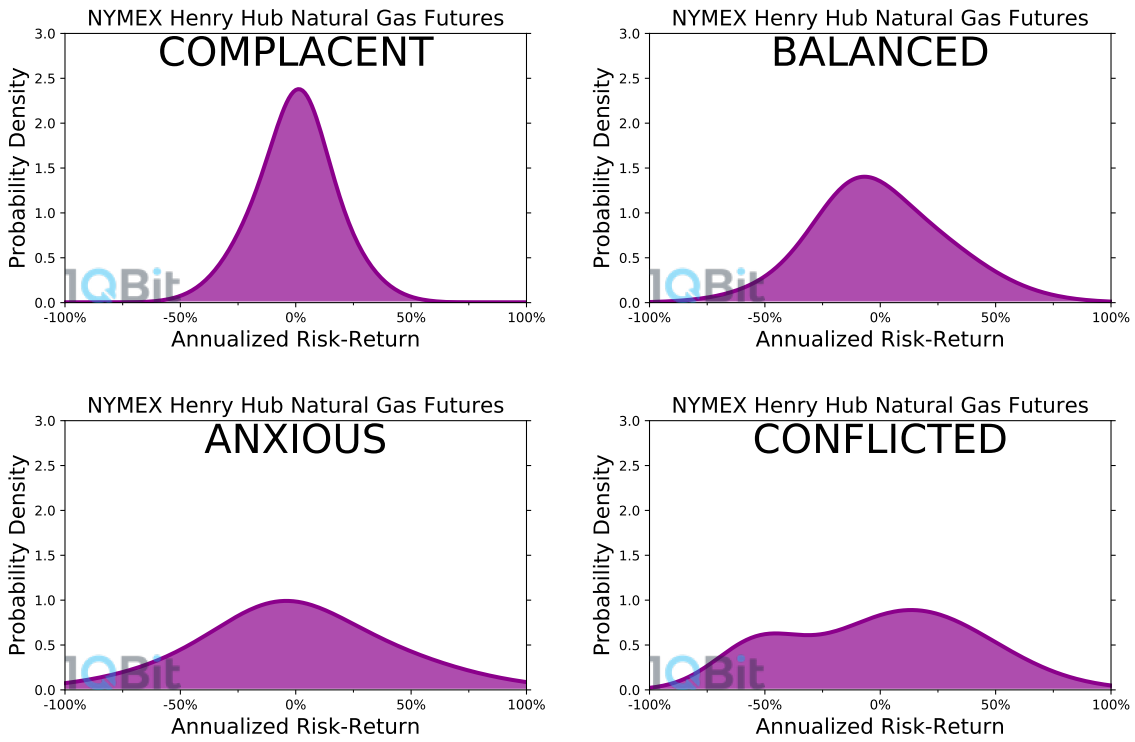

Figure 7: **MSM Market States.** Graphical representations of the risk–return curves for the four market states within the MSM: Complacent; Balanced; Anxious; and Conflicted states.

The **Complacent** market state is a "calm" state indicating that market participants have few concerns. Conceptually, it is when the schools of thought do not differ significantly, resulting in a tall and narrow distribution. The narrow width of the curve is a direct result of a small standard deviation, and generally indicates that there is only a small chance of a large price move.

The **Balanced** market state is the most common state. This distribution has a larger standard deviation than the Complacent state, indicating a larger difference in the schools of thought when compared to the Complacent state.

In the **Anxious** market state, the schools of thought are diverging, and result in a much broader risk–return curve. Indeed, the differing schools of thought can also skew the distribution and move the mean off centre, yielding information about the direction of a potential price move.

Most unique to the MSM model is the **Conflicted** market state. The defining feature of this, graphically, is the bi-modal nature of the distribution. For this situation, the schools of thought differ significantly and subsequently result in a large volatility.

C CME DataMine Product Codes

Throughout the Historical Market Analyses, CME DataMine product codes are used to refer to the various products. For convenience, tabulated below is a list of CME DataMine product codes currently available through the Market Sentiment Meter.

DataMine Code	Futures Product Name
C	CBOT Corn
CL	NYMEX WTI Crude Oil
EC	CME Euro FX (USD per EUR)
ES	CME E-Mini S&P 500
GC	COMEX Gold
NG	NYMEX Henry Hub Natural Gas
S	CBOT Soybean
TYF	CBOT US Treasury 10-Year Note