Risky Business

The Energy Industry's Relationship with Risk

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In July 2018, OPEC boosted its output of crude oil by 70,000 bpd. As a result, U.S. crude futures fell 7%, Brent crude fell 6.5%, and subsequently two of the world's largest commodity hedge funds, both bullish on crude, posted double-digit percent losses.

Several additional energy trading shops have posted significant losses in 2018. Another exited physical energy trading, and yet another closed its doors earlier in the year. Another is in the process of closing operations, and yet another is closing its hedge fund.

Rather than being an unfortunate anomaly, 2018 has been only the latest in a series of difficult years for the energy industry. Let's look back a bit further.

From 2013 to 2015 the crude oil prompt month contract reacted to an oversupplied market and fell from a relatively stable range of $90-$110 to a low of $26, a 76% drop. Subsequently in 2016, US energy companies comprised seventeen of the year's twenty-five largest bankruptcy filings (Source: Haynes and Boone). Between January 2016 and March 2018, a total of 144 oil and gas producers filed for bankruptcy protection. Countless employees and families were affected.

Think back a few years farther, to 2008. Taking a cue from a plunging stock market, the Cushing, OK crude oil prompt contract fell 77% from a July 2008 high of $145/bbl to $34 in December 2008. Producers, marketers and hedge funds all suffered, including companies that had hedging programs in place. Numerous energy firms could not recover and went bankrupt.

Commodity markets have long been volatile: crude, natural gas and power contracts are among the most volatile on any exchange. But let's ask a few questions about the recent bankruptcies. If publicly traded energy firms have implemented risk management policies and processes, why are so many succumbing to price volatility? Is it possible that their policies or systems are not adequately managing their risk?

This article will initiate a series on risk. Our goal in writing this series is twofold: first, to keep risk on the forefront of the corporate mind, and second, to introduce the topic of risk to those unfamiliar with it. Reader feedback is encouraged, and our contact information is listed at the end of the paper.

The Risk Problem

Publicly-held firms are accountable to investor oversight regarding their risk policies and risk management systems. Further, government regulations hold firms accountable for the accuracy of their financial statements and often require internal controls. To comply with oversight, firms conduct both internal and external audits of their policies and systems. In the energy space, we suspect most risk policies are adequate, but that many risk management systems suffer from some shortcomings:

1. Many risk management systems update market data, trade positions or valuations only overnight, not in real-time through the day. This leaves traders and risk teams exposed to uncertainties through each trading day.
2. Many risk systems focus on reducing complex risk profiles down to a set of Value at Risk (VaR) numbers. VaR can be a misleading indicator of a portfolio's risk and is sometimes misunderstood.
3. Many risk systems do not perform extensive stress tests of portfolios.
4. Most commercial risk systems are of a *one size fits all* design. Such systems can be a cumbersome fit for firms that trade complex portfolios across multiple commodities.

It is important to point out that the larger and established commercial risk management systems are capable systems and likely do not suffer all of the noted shortcomings. However, these systems can be difficult to implement and maintain, and can be too expensive for smaller firms. That leaves a lot of organizations exposed to the noted shortcomings.

The present is an appropriate time to reacquaint ourselves with the limitations of existing risk management systems, reconsider risk policies, and refresh our knowledge of risk itself. This article begins that process by reviewing risk itself: what it is, how it is measured, and how it can be mitigated.

Defining Risk

Within the energy industry risk can be extremely complex, pervading every company, every transaction and every employee's career. But what exactly is risk?

With all due respect to Merriam-Webster, we'll offer our own definition of risk, targeted to a typical energy business. We'll start with the following, and then refine it.

> **Risk**
>
> Noun
>
> : the possibility of an unexpected event causing monetary loss, and the subsequent possibility that the owning entity could lose reputation or viability.

Our definition has an element of negativity to it: risk results in loss. That is a typical view, but it's worth noting that unexpected events can result in positive outcomes. You'll seldom hear a colleague say, "There's some risk that my project will complete ahead of time and under budget." But strictly speaking, a comment like that would be correct. Regardless, within our industry, participants generally agree that risk is the possibility of a negative outcome in the pursuit of a positive outcome.

Our definition also includes the word *possibility*. An important characteristic of risk is that it involves an element of uncertainty that can be measured. We might say something like, "There's a 25% probability that we won't hit our earnings target." Our definition also includes the word *causing*, which reflects that the risks we are referring to are the result of cause and effect. E.g., "When drilling our last well, we hit water rather than oil."

There are some risks that cannot be accurately measured. An example includes the risk that a meteorite will flatten your office. Such events are referred to as disasters. The probability of such events is typically not measurable, nor do these events necessarily result from cause and effect. As such, we will exclude disaster risks in this discussion.

Given the above, let's simplify our definition.

Risk

Noun

: the measurable probability that in the pursuit of an objective, an unexpected event causes loss of revenue, reputation or viability.

This is a reasonable definition of risk for those of us in the energy industry.

Types of Risk

While there are many types of risk, energy firms most commonly face the following types:

- Price risk: The possibility of monetary loss due to unexpected changes in commodity prices.
- Operational risk: The possibility of loss due to inadequate or failed policies, processes or systems.
- Counterparty or credit risk: The possibility of loss due to a counterparty defaulting on a debt or having their debt downgraded.
- Reputational risk: The possibility of loss resulting from damages to a firm's reputation.
- Government Policy and Regulatory Risk: The possibility that the rules that had been in place (and followed) for a long period of time change quickly with significant impact to performance.

It's a dangerous world, no? Risks are lurking around every corner. In fact, it gets worse: the above types of risk can amplify one another. A large market move could cause holdings or portfolios to plummet in value or trading systems to react inappropriately, causing financial losses and thus defaults on loan payments. If enough companies default at once, a business with many counterparties could suffer huge losses, and thus threats to their own reputation or viability. It has happened before: think back to the great recession of 2008.

Other risks important to energy businesses include macroeconomic risk, geopolitical risk, volatility risk, correlation risk, basis risk and liquidity risk. There are more. Books have been written on these topics, college courses teach the topics, and firms employ entire teams to monitor and manage their risks. We will address the various types of risk in future articles.

Measuring Risk

Risks can be measured. And once measured, risks can be mitigated. Let's look at a few measurement techniques.

You've probably seen terms like alpha, beta, VaR and vega (and many more) yet most people who don't work in the risk department could not recite their meanings. However, one simple measurement of risk will be familiar to many of our readers: *volatility*. Returning to Merriam-Webster, volatility is *a tendency to change quickly and unpredictably*. Within finance markets, for example, volatility is measured as the standard deviation of a security's returns:

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

where s is the standard deviation or volatility, N denotes the number of returns, and χ_i is the logarithmic return of the security's daily price series p_i, calculated as $\ln(p_i / p_{i-1})$. This same formula can be used to calculate the volatility of commodity prices, temperatures, corporate earnings, or any set of time series data.

Quoted standard deviations are typically annualized, meaning that S, as computed above, is multiplied by the square root of 365 (or ~250, if the price is determined only on business days). IBM stock, for example is currently at $146 and has an annualized volatility of 20%. An investor would thus expect the IBM stock price to be $146 +/- 20% one year from now[1]. Higher volatility translates into greater risk.

One interesting aspect of volatility warrants mention. Recall that risk is generally viewed as a loss. Volatility does not reflect that view: volatility represents profit and loss equally, e.g., IBM's stock price of $146 +/- 20% one year from now.

The volatility calculation may look complicated, but it is easily computed with most software programs. Volatility provides a simple though wildly incomplete measure of the risk of owning an asset over time, be that asset a stock, a barrel of oil or a megawatt of electricity. The following chart shows the Cushing Oklahoma prompt month crude oil contract (CME CL) annualized volatility for the time period 2001

[1] The volatility calculation in fact provides added specificity. One year from now, 68% of the expected outcomes for IBM stock will be within +/- one annualized volatility; 95% of the outcomes will be within +/- two annualized volatility, and 99.7% will be within +/- three annualized volatility.

through mid-August 2018, calculated with a trailing three-month window. Note the elevated level of volatility in '08 – '09, where at its peak, volatility reached 100%. That suggests that, given crude's price fluctuations at the time, crude could either double in price, or head toward zero.

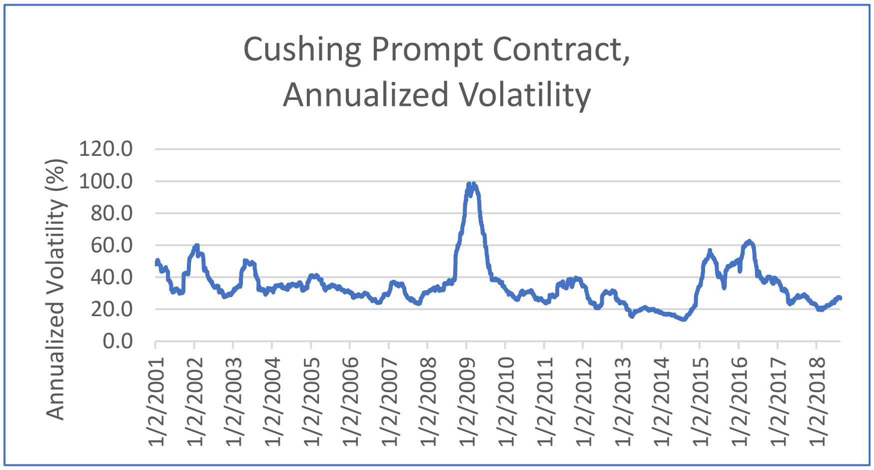

Figure 1. Cushing Prompt Month Contract Annualized Volatility

There's one problem with the above chart, a problem that limits its usefulness: you cannot see volatility until you've lived it. That is, the above chart shows only what happened in the past. We can see now that '08-09 volatility would reach 100%, but we could not see that until after it happened. The problem recalls an old saying, 'Hindsight is 20/20.' It is for this reason that we will be explaining other, more comprehensive risk measurement techniques in subsequent articles.

Mitigating Risk

Newfield Energy (NYSE:NFX) is an independent crude oil and natural gas exploration and production company headquartered in Houston, Texas. Founded in 1988, Newfield's annual revenue in 2017 was $1.8 billion. Newfield's risk management practices include commodity hedging programs, joint ventures, and advanced technologies. The firm understands risk. In fact, their 2017 annual report lists *thirty-five* identified risks to their business.

As an E&P, Newfield is exposed to price risk. Let's see how Newfield weathered the 2008 financial crisis. Recall that in '08-09 crude prices dropped from a high of $145/bbl to a low of $34. Risk management teams would refer to this as *tail risk*: the remote possibility of an outsized move in crude prices.

The $111/bbl drop in crude prices affected not only Newfield's production revenue, but also their reserve value. This took a toll on the firm's stock price. Newfield's stock price reached a high of $64 in May '08 and fell to $19.75 by October '08, as per the chart below.

Figure 2. NFX Stock Price, Nov. 1993 to August 2018
Source: Google Finance

During this time frame, Newfield's market cap fell from $8.3B to $2.2B. Newfield in '08 took a $1.2B loss to the value of their reserves and recorded a net loss of $373M for the year. A lot of firms could not survive an event like this, and many did not. But Newfield survived. Let's examine how.

Newfield had wisely implemented an oil-hedging program, which protected the firm from adverse commodity price movements. Over this same time period their hedging program recorded a $429M after-tax gain. Without the hedging program, the firm's 2008 financial results would have been far worse.

Newfield hedges commodity prices using a variety of derivatives, including swaps, collars and puts. The following table, published 2/15/2018, illustrates the hedging positions that Newfield owned earlier in the year, and their market view at the time. This table shows the expected impact of the program to pre-tax income, in $M, for crude prices ranging from $20/bbl to $80/bbl. Please note that crude was trading in a $50-$60/bbl range at the time this table was published. With crude now trading closer to $70/bbl, we can expect that Newfield's hedging positions have changed.

Period	$20	$30	$40	$50	$60	$70	$80
1Q 2018	$68	$60	$47	$5	($23)	($77)	($131)
2Q 2018	$178	$125	$72	$21	($26)	($79)	($131)
3Q 2018	$174	$125	$73	$28	($27)	($79)	($131)
4Q 2018	$100	$77	$50	$14	($21)	($67)	($112)
1Q 2019	$33	$33	$32	$2	($10)	($43)	($75)
2Q 2019	$31	$31	$30	$2	($9)	($40)	($70)
3Q 2019	$25	$25	$24	$2	($7)	($32)	($56)
4Q 2019	$17	$17	$17	$1	($5)	($22)	($40)

Figure 3. Newfield Oil Hedging Program. Source: Scotia Howard Weil

It is clear from the above table that Newfield is not going to sacrifice all their revenue should oil prices collapse again. As of 2/15/2018 Newfield hedged $520M should crude drop to $20 levels. And while they are willing to sacrifice some profitability at higher oil prices (likely to help pay for their hedging program), their view at the time appears to be that oil is unlikely to return to the highs of 2008 any time soon.

Newfield's risk management programs have allowed the company to weather several volatility storms, including the more recent 2013-2015 price collapse. Today, Newfield thrives and resides in the *Houston Chronicle's* list of "Top Work Places."

Embracing Risk

Energy is a risky business. Firms sometimes lose money; and worse, they sometimes lose viability. But it is important to recognize that in all industries, particularly in the energy industry, firms are rewarded for taking risk. As such, risk is both friend and foe.

There are two key lessons to learn from this article. The first is to know your risks and to ensure that you can measure and manage each so you will know exactly how your portfolio will perform under extreme duress. The second key lesson is this: ignore tail risk at your own peril. When we observe these two lessons, risk can be embraced for the opportunities it offers.

Conclusion

Take a moment of your time and consider your job, your portfolio, your co-workers' careers and your company. What is the biggest risk you face today? Secondly, make a guess as to the likelihood of that risk occurring. Perhaps your biggest risk is incurring business losses if crude oil prices drop to $20/bbl, and you estimate that the odds of it happening on any given day are one in five thousand. Five thousand business days equals 20 years, which means this could happen not only during the span of a career, but also over the course of the next several weeks. Are you prepared for such an event?

In subsequent articles we'll talk further about how to measure and mitigate risk in energy commodity markets. We'll talk more about VaR (Value at Risk) and its limitations, and after that we'll expand the discussion to more advanced measurement techniques. We welcome your feedback.

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