Managing extreme price volatility
How to reduce the impact of short-term changes in commodity prices using “out-of-the-money” call options

Sharp fluctuations in commodity prices are creating significant business challenges that can affect virtually everything from production costs and product pricing to earnings and credit availability. This extreme price volatility makes it hard to run a business and to plan and invest for the future. It can also undermine a company’s profitability and competitiveness, and in some cases it can even threaten a company’s survival.

In an earlier article (“Managing Rough Waters: How to steer a course to stability with commodity price volatility as the new norm”), we outlined the core elements of commodity price volatility and showed the impact that this volatility can have on a company’s earnings. We then presented a systematic approach that used multiple levers to address the range of volatility effects.

In this article, we focus on the increasingly common occurrence of extreme escalation in commodity prices over a relatively short timeframe (less than a year), and offer a specific strategy for handling them. Note that these extreme short-term price spikes are different than strategic shifts in commodity prices, which involve sustained price movements driven by fundamental changes in the supply/demand balance. This distinction is important because the methods used to address the different types of volatility vary significantly in terms of effectiveness, risk, and required execution capabilities.

Impact of price volatility
The earnings impact of extreme short-term price spikes can be significant. For example, a company with $6B in revenue and $2B in volatile spend could face annual spend volatility as high as $1.2B (60% of volatile spend)\(^1\). And while price spikes are by definition temporary, with prices typically returning to normal levels in less than a year, they can produce a lasting business impact — especially for companies that cannot pass cost increases through to their customers and must therefore take a margin hit. What’s more, even companies that are able to pass through some or all of the cost increases can still find themselves stuck with high-cost inventory when prices fall. In addition, companies that are unprepared to handle short-term price spikes may miss out on the market opportunities that arise during and after a period of significant price escalation.

Historical price behavior of commodities
Rapid and extreme price increases have occurred in several commodities over the past 15 years. During this period, a number of commodity groups — including energy (crude oil, natural gas), metals (copper, aluminum), industrials (rubber, cotton), and food (corn, coffee) — experienced sharp price increases of 30% to 60% over periods of three to six months. Moreover, the frequency and/or magnitude of extreme price changes have increased over the past 15 years (1997–2012) compared to the previous 15 years.
This is partly a result of strong growth in demand, coupled with the effects of globalization, which tend to amplify the speed and magnitude of price shocks. Figure 1 shows a summary of extreme price volatility events that have occurred over the past 20 years for a broad set of selected commodities. Companies that are major consumers of such commodities often think there is nothing they can do about these extreme short-term price shocks. In fact, we would argue that companies that don’t actively manage extreme commodity price volatility are essentially taking a “short” position — a commitment to buy the commodity at whatever price the market determines — which is equivalent to betting that prices will not rise. In other words, even if you do nothing, you are still committing to a course of action — whether you intend to or not.

And while it’s true that no one can predict the precise occurrence, magnitude, and duration of such events — and that futures markets don’t do a very good job of predicting them either — we believe they can be effectively managed.

Our earlier article explained why this environment of price volatility is likely to be the rule, rather than the exception. Which is why we believe business leaders should better understand what drives commodity price volatility, and take deliberate action to manage it more effectively.

### Drivers of short-term price volatility

Unpredictable events often drive extreme short-term increases in commodity prices. Rains, floods, drought, hurricanes, earthquakes and other natural disasters have the potential to disrupt commodity supplies by partially disabling or shutting down production capacity. In addition, business cycles and market speculation can sometimes drive extreme price spikes. Prices rise sharply during periods when demand temporarily exceeds production capacity and supply.

Political events, geopolitical tensions, trade policies, and government actions also affect commodity prices. For example, actions by the Chinese government have affected prices for rare earth metals, and actions by the influential government-linked industry group ITRO (International Tripartite Rubber Organization, controlled by the governments of Thailand, Indonesia, and Malaysia) have periodically impacted global rubber prices by restricting supply in order to create price support.

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**Figure 1: Examples of extreme price spikes in commodities over the past 20 years**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Est. global annual consumption</th>
<th># of extreme price increases from 1992–2012</th>
<th>Avg. duration of price increase (days)</th>
<th>Avg. price increase</th>
<th>Avg. annual price volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>Billion $^\text{a}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>836 MM tons</td>
<td>231</td>
<td>4</td>
<td>425</td>
<td>65%</td>
</tr>
<tr>
<td>Cotton</td>
<td>24 MM tons</td>
<td>77</td>
<td>2</td>
<td>353</td>
<td>80%</td>
</tr>
<tr>
<td>Copper</td>
<td>20 MM tons</td>
<td>174</td>
<td>3</td>
<td>279</td>
<td>41%</td>
</tr>
<tr>
<td>Coffee</td>
<td>8 MM tons</td>
<td>47</td>
<td>3</td>
<td>609</td>
<td>94%</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>28,000 MM barrels</td>
<td>2,800</td>
<td>4</td>
<td>550</td>
<td>128%</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>11,000$^{(2)}$ MM barrels</td>
<td>1,386</td>
<td>5</td>
<td>451</td>
<td>113%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>25$^{(3)}$ trillion cubic ft</td>
<td>88</td>
<td>5</td>
<td>157</td>
<td>139%</td>
</tr>
</tbody>
</table>

(1) Calculated using annual consumption and recent commodity prices  
(2) Number denotes consumption of all distillates (heating oil, diesel, fuel oil, etc.)  
(3) Number denotes U.S. consumption  
(4) Duration includes rise and subsequent drop in price  
(5) Average of annualized standard deviation of change in daily commodity priced from 1992 to 2012

Sources:  
1. International Grains Council  
2. International Cotton Advisory Committee  
3. Union Bank of Switzerland  
4. U.S. Department of Agriculture  
5. U.S. Energy Information Administration
Out-of-the-money call options can abate commodity risk

An innovative approach for taming extreme commodity price spikes

The framework in Figure 2, which we introduced in our earlier article, serves as an overall guide for holistically addressing the challenges of commodity price volatility.

This article focuses on using financial instruments to provide “insurance” against extreme short-term commodity price spikes — specifically, purchasing call options on the target commodity (or on a proxy commodity whose price movement closely tracks that of the target) to offset the impact of unexpected price increases.

Our recommended approach is to purchase call options that are “far out-of-the-money” and that won’t expire for several years (ideally 3–5 years, subject to availability for the targeted commodity). A company can set aside a small percentage of its commodity spend (about 1%-2%) to buy the options. Then, when an extreme event occurs — signaled by a sharp appreciation in option values or commodity prices — the company can liquidate its position in proportion to its raw material consumption, thus obtaining price protection. If an extreme event does not occur during the specified time horizon (say 24–36 months), the company can roll forward its position to help ensure it is consistently protected at least 2–3 years into the future.

Option sales are financial transactions and are usually settled in cash. The task of actually locating and obtaining the physical commodity is a separate issue that is generally handled through a purchase transaction with a supplier.

The approach outlined here can be broadly applied to situations where the target commodity has traded options that meet the requirements, or where suitable options are available for a different “proxy” commodity with price movements that are highly correlated to the target.

The proposed approach relies on the availability of appropriate financial instruments that can deliver the leverage needed to be effective — specifically, call options that are far enough out-of-the-money, with long enough expiry dates, to provide significant protection against sharp price spikes for a relatively low level of investment (about 1%-2% of spend annually). If the target commodity does not have traded options, or if the available options do not have long enough expiry dates or are not sufficiently out-of-the-money, a proxy may be needed. When choosing a proxy, it is important to find a financial instrument that is likely to remain highly correlated to the target commodity through the types of events that cause extreme price events. An analysis of historical commodity price movements can provide valuable insights when choosing proxies, while accounting for the fact that price movements between a commodity and a proxy can become disconnected, for example when a disruptive event leads to loss in production capacity for the target commodity (e.g., crude) while the proxy, which is upstream (e.g., HDPE) remains unaffected. In such cases the proxy can be rendered ineffective, at least temporarily.

Potential benefits of this approach
Buying call options as price insurance has three specific advantages:
• Call options on several major commodities are highly liquid and are available at a variety of strike prices and expiry dates.
• Call options can be purchased at a very small fraction of the cost of the underlying commodity and rise much faster than the commodity price. Thus, a small percentage of the actual commodity spend can be used to protect the entire commodity volume.
• Call options eliminate the challenges associated with physical storage, since there is no requirement to take delivery.

Detailed guidelines for buying and selling options
The following guidelines define a detailed approach for using call options to manage extreme short-term commodity price increases. In order to be effective, entry and exit discipline are important.

Buying rules. Establish clear buying rules that explicitly define initial purchase levels and how the option position will be built up.
• When making a decision to initiate a position, consider the commodity’s current price relative to its price history over the past few years. Depending on whether the current price high, average, or low (compared to the history for that commodity), a strategy should be formulated, for example whether to take a full position immediately (e.g., when the current price is low in the historical context) or employ a different approach.
• Understand the supply and demand fundamentals that will likely drive the commodity’s price over the next few years. Is there a clear direction for price pressure, either up or down? The presence of a clear direction of price pressure based on fundamentals, while not always the case, simplifies the decision on whether or not to initiate a position.
• A strategy for re-entry after the end of a price spike should be clearly defined to obtain a strong reset of coverage. Re-initiation of an insurance position should be executed once it is clear that the after-peak drop has ended, since price movements at the end of a price spike event can be quite sharp, with large swings in options prices.

Selling rules. Establish rigorous selling rules that enable managers to take quick and decisive action in the face of rapidly changing market conditions — without getting caught up in the heat of the moment. This is critical for cashing in on the value generated by call options, especially since their value tends to decline very quickly as prices decline at the end of price peaks.
• Identify indicators that signal the onset of an extreme price escalation. For example, this could be based on the rate of price change (e.g., a 30% increase over a 3-month period). The goal is to distinguish between a temporary price spike and a strategic, sustained price shift.
• Initially, option sales should be closely aligned with actual purchases of the target commodity.
• Clear rules should prompt a full sell-off of the position once it becomes clear the price spike has begun to subside; for example, when a flattening or lowering of the peak is observed over a relatively short period of perhaps a month or two. Define explicit triggers that enable options to be sold while the commodity price remains elevated — before it falls back to normal levels. With these types of extreme short-term price events, the tail-end price drop can happen very quickly, so the trigger could be a relatively small price reversal after a strong upward movement. The intent is to achieve a reasonably high probability that the selling period will encompass the peak, while avoiding the temptation to try and sell everything at the absolute highest price.

Accounting for changes in the market landscape.
Assess price movements in the context of the overall supply/demand landscape for the target commodity. This can generate progressively deeper insights into why price movements are occurring, and what actions to take — which will likely vary over time and from commodity to commodity. For example, it is critical to understand if a price change is truly a short-term spike, or if a strategic shift is emerging or underway.

Modeling real-world performance
The following examples show the impact of allocating roughly 1%-2% of annual commodity spend per year of coverage to purchase out-of-the-money call options as price insurance for five different commodities:
• Crude oil
• Heating oil
• High density polyethylene (HDPE)
• Corn
• Copper

In each example, we show the results obtained from modeling a sequence of actions based on historical call options prices, using the buying and selling rules described above. Important elements of each example include:
• Selection of the entry timeframe (timing for taking the initial position)
• Selection of call options to purchase (strike price, expiry date)
• Definition of conditions to sell
• Definition of conditions to roll over or extend the coverage — to help ensure you always have coverage at the point where a price spike is beginning to emerge and won’t have to buy new coverage after the market has become aware that a price spike is developing or imminent
• Definition of conditions to re-establish a position after a price spike has subsided

Overview of model results
Figure 3 summarizes the important data for all five examples. The results show significant competitive advantage for commodities for which far out of money options with long term expiry are available. Over duration of several years, the ROI on such commodities ranged from 200% to 500% at an investment level of about 1%-2% of spend per year of coverage. In addition, the competitive advantage in periods of extreme price increase range from 20% to 47% of annual commodity spend. Competitive advantage is smaller (6% to 20% of annual commodity spend) for other commodities where the optimal instruments (long term expiry, far out of money options) are not available. Overall, this approach represents a broadly effective method to protect against extreme short-term price increases (other commodities we analyzed showed similar results), and provides a degree of insurance that companies around the world should consider incorporating into their commodity management programs.

Examples A, D, and E (WTI crude, corn, and copper) use call options for the targeted commodity. Example B and C (heating oil and HDPE) use call options for a proxy commodity (WTI crude). The use of a proxy is an important concept for many companies, since not all commodities have traded options.

A close examination of the results in Figure 3 shows that target commodities that are downstream derivatives of a proxy commodity (e.g., heating oil and HDPE versus the proxy commodity they are derived from, crude oil) have the potential to generate greater ROI from call options for the proxy. This is because although the price of HDPE is well correlated with the price of crude oil, crude oil constitutes only a portion of the cost of HDPE. Also, producers of downstream commodities such as heating oil or HDPE are often unable to fully pass on cost increases to their customers. Thus, the relative price increase for crude oil tends to be higher than the relative price increase for its downstream derivatives.

<table>
<thead>
<tr>
<th>#</th>
<th>Commodity</th>
<th>Proxy employed</th>
<th>Total investment as a % of total spend</th>
<th>Savings as a % of annual spend in period of extreme price increase</th>
<th>Period of extreme price increase</th>
<th>Total savings as a % of total spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Copper</td>
<td>None</td>
<td>1.3% (2004–2012)</td>
<td>18%</td>
<td>03/2006–09/2008</td>
<td>3.4% (2004–2012)</td>
</tr>
</tbody>
</table>
**Detailed examples**

**Example A: Crude oil**

This example applies the proposed approach to crude oil (WTI) over the period from 2001 to 2012 (Figure 4), rolling forward the coverage periodically as appropriate, and selling the call options when the sell conditions were triggered. In 2008, the sale of options upon extreme price escalation effectively lowered the cost of the commodity by 30% compared to buying the commodity at the prevailing market price. Over the full period (2003 to 2011) the net estimated competitive advantage was 7.9%. In general the options were purchased 3–5 years from expiry, and sold at least 2 years from expiry — either as a rollover, or as the result of a sell trigger.

Important to this example is the availability of long-term options (with expiry several years away) with strike prices that are far out-of-the-money, allowing for significant leverage from a small investment (roughly 1%–2% of the commodity budget per year of coverage). Note that the true amount at risk can be limited by use of a sell-stop order that liquidates an option position if its value declines by a predefined amount, say 50%. Of course, the decision to liquidate a position (and thus lose the insurance coverage) should only be taken if there is a well-formed belief that prices will experience strong downward pressure (based on an understanding of the supply/demand fundamentals and any other relevant market activity).
Example B: Heating oil

Figure 5 illustrates the potential value of using a proxy to achieve improved insurance coverage, instead of being limited to the options available for the targeted commodity. This example establishes price protection for heating oil #2 using WTI crude options, not heating oil options. Using WTI crude as a proxy provided access to long-term options averaging 4–5 years expiry, compared to less than 24 months expiry for heating oil options. The resulting competitive advantage for 2008 were estimated at 35%, almost five times higher than the estimated 6.2% competitive advantage had a proxy not been used.

Savings during 2008 — NO options

Savings during 2008 — WTI as proxy

- a commodity’s price is strongly linked to a substitute material or product that derives from another commodity (e.g., natural rubber correlates well with Brent crude, due to its strong price linkage with synthetic rubber)

The opportunity to use a proxy can also arise when a company wants to obtain insurance for a portfolio of commodities, which may correlate to a small set of proxies. This is particularly relevant for a company that is exposed to a group of related products (e.g., a company that purchases a mix of plastics and chemical products and materials that are fundamentally linked to a combination of crude and natural gas). In these situations the commodity spend can be addressed as a portfolio without having to create and manage separate hedging positions for each individual chemical or material that the company is exposed to.

Proxies can be employed — with care
**Practical tips for using proxies**

Many major commodities are traded on public exchanges and various financial instruments (e.g., futures, swaps, calls/puts, spreads) are available to address price volatility. However, there are some cases where a desired commodity and its related financial instruments are not publically traded. Also, there are cases where a commodity is only traded through futures and other financial instruments such as options are not available. These commodities include natural rubber; chemicals such as carbon black, olefins, ethylene oxide, and propylene oxide; and plastics such as polyethylene and polypropylene.

For such commodities, a company can use a proxy whose price movements are highly correlated to the target commodity. Although a proxy introduces “basis risk”, in our opinion this risk is small compared to the potential benefits and can be readily managed by following a few simple rules:

- The proxy should be highly correlated (> 80%) to the target commodity over a long duration (10+ years). There needs to be a fundamental connection (competing product or substitute, input/output relationship) between the target commodity and the proxy that can explain the high correlation.

- Financial instruments for the proxy should be highly liquid and preferably traded on public exchanges.

- Ideally, the proxy should not introduce any additional basis risks such as currency risk.

- In instances where the financial instruments for a proxy are only available over-the-counter (OTC), companies should have an independent method to value them, and should establish relationships with multiple counterparties so the instruments can be sold when the time comes to cash out.

- Effectiveness of proxies should be tested using historical data to make sure the potential benefits are greater than the additional risk introduced by use of the proxy.

- If a proxy is used, the potential for dislocation between the proxy price and target commodity price should be analyzed and addressed, as appropriate, on a case-by-case basis.
Example C: High density polyethylene (HDPE)

In Figure 6 crude (WTI) is used as a proxy to manage price volatility for high density polyethylene (HDPE). Purchasing crude options produced a net benefit of 47% for 2008, and a net benefit of 9% for the entire period. An important reason for this strong performance is that the price increase for the proxy (crude) was stronger than for the target commodity (HDPE), leading to enhanced benefits during period of extreme price increase. This effect is driven by the fact that the cost structure of HDPE contains other less volatile elements, which causes the price of HDPE to rise less than the price of crude given the same price drivers. This phenomenon can enable companies to either spend less on price protection, or obtain greater coverage from the standard 1%–2% investment proposed.
Example D: Corn
The example in Figure 7 shows that effective price protection for corn could have been obtained by acquiring call options between 2006 and 2012, with 20% competitive advantage in 2008, and overall competitive advantage of 3.2% for the entire period. These results were achieved with options that expire roughly 30 months from the purchase date, which was the longest term available for corn. By contrast, crude oil had options that didn’t expire for roughly 60 months. The shorter duration of corn options limited the available leverage and required more frequent rollovers.
Example E: Copper

Figure 8 shows the important data for copper from 2001 to 2012. The results indicate a competitive advantage of 18% for 2006 (initial phase of the spike period), and a 3.4% net competitive advantage over the entire 12-year period. The results were achieved with options that had less than 24 months to expiry, which were the longest available. This required a frequent roll-forward sequence from 2006 onwards, which marginally reduced the value of our proposed approach. Despite the relatively short expiry options, the estimated benefits remain financially sound. That said, if a valid proxy is available with longer expiry dates, it should be seriously considered.

Close examination of Figure 8 shows that the price of copper sustained a high level from 2006 to 2008, which signifies a strategic shift rather than a temporary spike. The 18% competitive advantage achieved in 2006 would likely have been even greater had the price rise been temporary and abated after a few months (baseline would have been lower). This highlights the importance of implementing a broad-based response to volatility, beyond the short-term price insurance that is our focus here.
Why should companies consider purchasing call options to manage price volatility?

In our experience, many companies, for a variety of reasons, have not made a serious attempt or commitment to manage commodity price volatility. These reasons include:

- Bad experiences associated with limited forays into volatility management, without adequate preparation.
- Horror stories in the press about other companies.
- A belief that volatility cannot be consistently managed more effectively than simply buying the commodity at the prevailing market price.
- Concern about the level of risk involved while climbing the learning curve to effective commodity management.

However, a few companies have made serious efforts in this area and have achieved a meaningful competitive advantage over their peers. In fact, a recent study found that companies that hedge against price volatility, on average, perform significantly better financially than those that don’t.4

Companies that should be especially concerned about managing commodity price volatility include those with:

- Large concentrated spend in a few commodities or commodity groups.
- Lack of a natural hedge to counter their exposure (for example, not owning large reserves or sources of the commodity).
- Incomplete ability to pass costs through to their customers, particularly in the short term during periods of significant price change.
- Major forecasting, budgeting, and planning challenges.
- Earnings impacts that can be the difference between meeting or missing the market’s expectations.

Price insurance through the use of call options is an effective approach that can:

- Address extreme price spikes at relatively low cost and risk.
- Provide a simple way to start managing commodity price volatility, while creating visibility into future needs and a robust platform to build on.

Another benefit of this approach is that it can provide improved financial strength at the precise moment when other companies are most likely to be struggling, creating a significant opportunity for competitive advantage.

How to get started

A company should assess its exposure broadly, across its entire portfolio of commodities, rather than focusing on a few obvious commodities. This broad view may yield a proxy that has a closer correlation with the entire portfolio, instead of providing limited price protection for a single commodity. What’s more, by looking at its entire portfolio, a company may be able to reduce its transaction costs and increase its overall price protection thanks to economies of scale.

The next action item is to choose a maximum expenditure level for buying options as price insurance. This will likely require input from multiple functions such as finance, treasury, sales/marketing, and procurement. Once that’s done, the company can start looking at details such as available financial instruments, what volumes to buy, and duration of coverage. An important principle is to avoid buying insurance during extreme price events; in most cases, it’s preferred to wait until prices return to normal levels. At that point, the company can choose a strike price that is significantly higher than the spot price and slowly build up its coverage.

Using a small fraction of overall spend to buy call options as price insurance is the first step towards broader management of price volatility. The costs and risks associated with short-term price insurance are small, and the knowledge obtained by applying this approach can go a long way toward building world-class capabilities in commodity risk management.

Endnotes

1 Spend volatility is defined as annualized standard deviation of change daily commodity prices
2 China Consolidated Grip on Rare Earths, New York Times, September 15, 2011
3 Thailand, Indonesia, Malaysia agree moves to boost rubber, The Rubber Economist, August 15, 2012