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Improbable events in commodities: How much do they matter?

Authors

Christopher Burton is a Managing Director at Credit Suisse Asset Management, based in New York. He is the Global Head of Commodities and the Senior Portfolio Manager for the Commodities team, responsible for managing institutional and retail client assets in both fund and separate account structures. Mr. Burton earned a B.S. in Economics with concentrations in Finance and Accounting from the University of Pennsylvania's Wharton School of Business. Mr. Burton holds the Chartered Financial Analyst (CFA) designation and has achieved Financial Risk Manager® Certification through the Global Association of Risk Professionals (GARP).

Scott Ikuss is a Vice President and Portfolio Manager at Credit Suisse Asset Management, based in New York. Mr. Ikuss acts as Portfolio Manager and Trader for the Commodities Team. He specializes in excess return strategies. Mr. Ikuss received a B.A. in Economics from Rutgers University.

Introduction

Commodity traders and fund managers at times underprice unlikely events. A mispricing can often persist until days, hours, or even minutes before the events occur. Why?

Time is a scarce resource; whether one is required to make a decision in a personal or professional capacity, there is only so much of it that can be devoted to evaluating evidence and arriving at a conclusion. This constraint is especially burdensome in the world of finance, where the opportunity set and available data border on limitless. As such, market participants tend to focus most of their attention on the most probable outcomes when making trading decisions. Further, the historical body of previously realized "most probable outcomes" can form generally accepted "rules" governing how asset prices should behave in absolute terms or in relation to each other. To be sure, there are good reasons why a particular set of outcomes for a particular asset (or group of assets) are the most probable. Often, these outcomes are driven by economic relationships such as price arbitrage or by assumptions that participants in a given market will behave like rational actors seeking to maximize economic benefit as the primary (if not the only) motivating factor. This is a reasonable base case! However, a portfolio manager or trader looking to generate returns only by evaluating a set of the "most probable outcomes" potentially leaves performance on the table. What's more, sometimes the least likely outcomes can have the highest costs. In many circumstances, the realization of improbable outcomes brings with it elevated volatility and trading opportunity. **As managers, we rely on the depth of our market research and our flexibility to opportunistically capitalize on such outcomes and avoid unintended risks. We do not intend to purport ourselves to be fortune tellers with the foresight to capitalize on all the opportunities discussed below. Rather, we present the notion that considering the improbable and having a flexible investment process can enhance decision-making and drive better portfolio outcomes…. Probably.**

The chilling reality of sub-zero oil

On April 20, 2020, the New York Mercantile Exchange (NYMEX) WTI Crude Oil futures contract for May 2020 delivery fell below $0 on the penultimate trading day, shocking the commodity industry and the general public. The period immediately preceding futures expiry is typically characterized by several attributes including low open interest, constrained liquidity, and exchange position limits. This leads to a reduced number of actively trading market participants and more price volatility. What made this time different, and what ultimately drove prices below zero, is that these typical features met a very atypical fundamental circumstance. Concerns about storage capacity reached such extreme levels that physical market participants were either unwilling or unable to step in and stop the decline in futures prices. Together, these factors formed a market situation that was viewed by many market participants as having such a low probability of happening that it didn't require consideration. Negative oil prices would break the "rules" that had been established as part of broad market thinking. A case could be made that market participants should have been more prepared as the potential situation had been foreshadowed by a CME Group advisory notice just 12 days prior, stating that it was "ready to handle the situation of negative underlying prices in major energy contracts,"[1] but such is the strength of the zeitgeist focusing on the "most probable" that the market was caught completely off-guard.

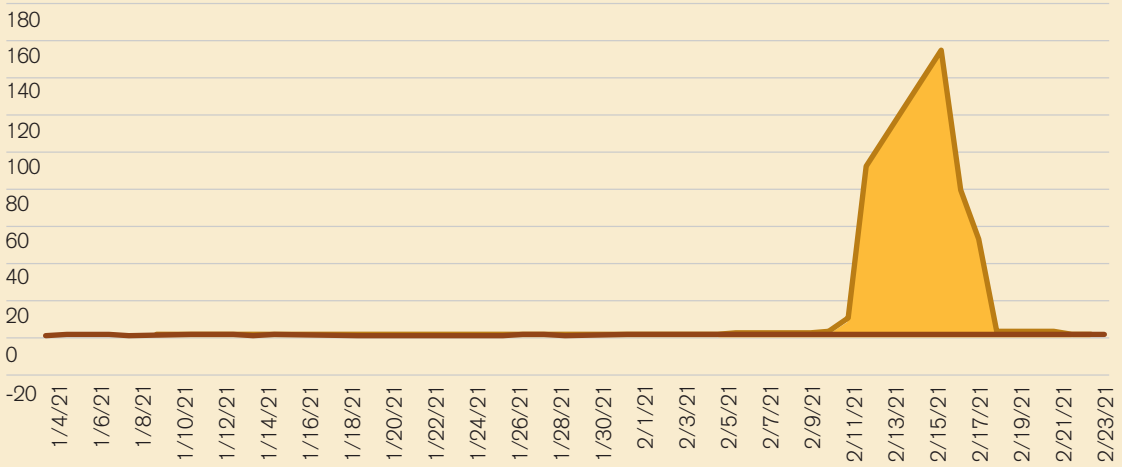
Prior to this incident, there had been historical precedents for negative commodity prices in the United States. However, these were typically affecting small quantities of commodities and were often caused by local transportation issues, which incentivized holders who couldn't store or dispose of the commodity to pay others to take it off their hands on short notice. For example, natural gas within the US Permian Basin has traded at both negative price levels and at steep premiums to the benchmark NYMEX Henry Hub Natural Gas futures, with spot prices even spiking 10 times higher than benchmark prices in extreme cases. Why didn't the market pay a passing glance at the idea of negative WTI Crude Oil before it became a reality? Simple. This outcome fell well outside the realm of the "most probable" for the WTI Crude Oil market, despite the fact that the situation had already been observed in the natural gas market!

Figure: Permian Basin Natural Gas spot versus NYMEX Natural Gas futures

US Dollars / MMbtu

Avg Jan 2021 Permian NG Spot Price: $2.49/MMbtu

2/16/2021 Permian NG Spot Price: $155/MMbtu



Spread, Permian NG spot - NYMEX NG futures (RHS) — Bloomberg Natural Gas Permian spot price (LHS)

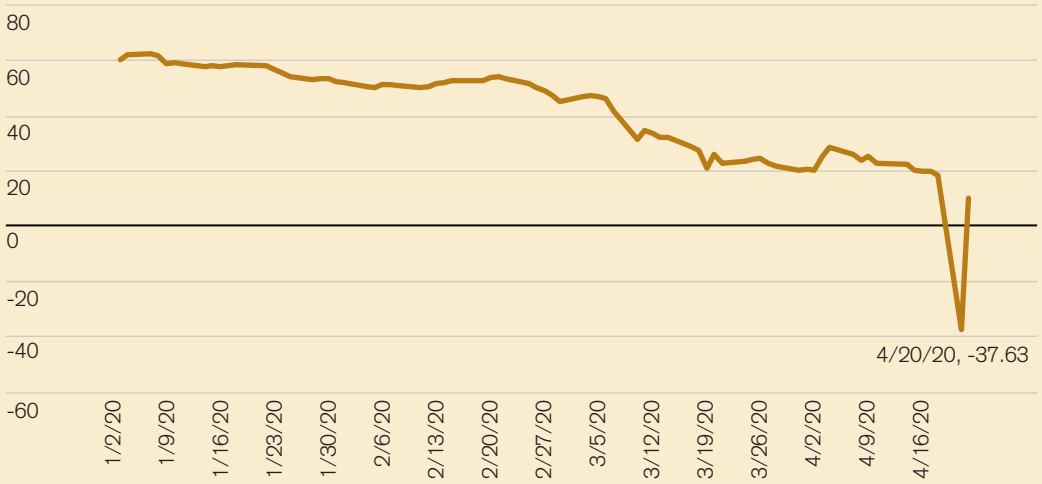
NYMEX Natural Gas futures, March 2021 Contract (LHS)

Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

1 CME Group, "CME Clearing Plan to Address the Potential of a Negative Underlying in Certain Energy Options Contracts," (April 2020)

On its face, there were many logical reasons for ignoring the possibility of negative prices. First, the WTI Crude Oil contract is one of the most liquid futures contracts in the world, with billions of dollars of notional value traded daily, and delivery linked to the storage hub of Cushing, Oklahoma. Commodity traders viewed negative prices as possible only briefly and in local settings, and WTI Crude Oil was not a local commodity which had minimal transportation available. Second, the commodities market is accustomed to having large physical participants ready and able to step in to buy or sell if the financial side of the market incentivizes them through pricing. This didn't happen in this instance, through a combination of lack of available storage and reduced logistical flexibility after new operating procedures were put in place during the COVID-19 pandemic. Lastly, and likely most importantly, WTI Crude Oil futures had never traded below zero before, to do so would break the "rules." This fact may have blinded market participants to the possibility of the circumstance occurring.

Figure: NYMEX WTI Crude Oil futures contract for May 2020 delivery
US Dollars / barrel



Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

The consequences of focusing only on the "most probable outcomes" and ignoring the least probable were widespread and varied in scope and duration. These consequences were not limited to simple lost performance. Operational impacts ranged from broken trading systems[2] to the rewriting of commodity index rules.[3] The financial impacts were felt by a wide range of commodity market participants across the globe, ranging from losses by retail Chinese investors seeking Crude Oil Treasure[4] to liquidation of well-known exchange-traded products.[5]

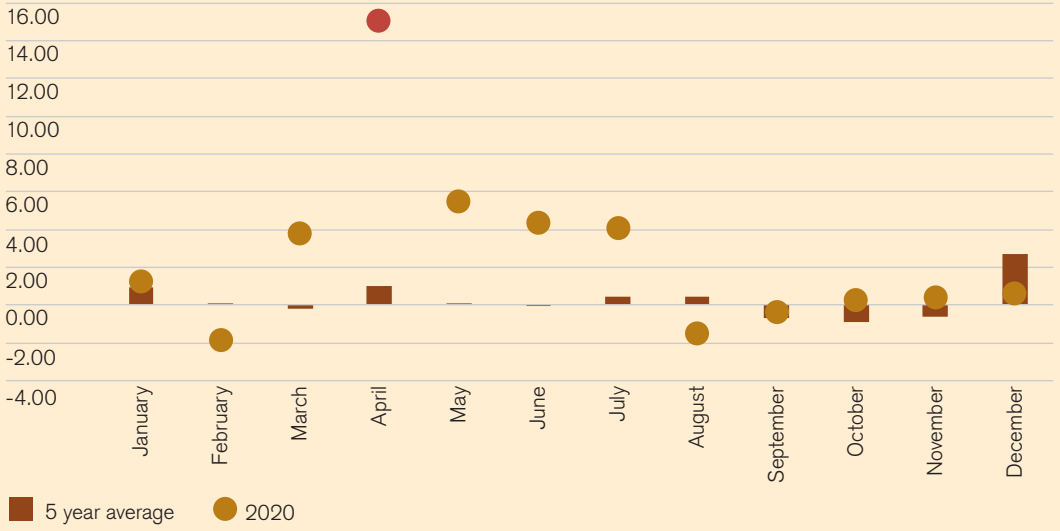
2 Commodity Futures Trading Commission Release, "CFTC Orders Interactive Brokers LLC to Pay a $1.75 Million Penalty for Supervision Failures," (September 2021)
3 S&P Dow Jones Indices, "Information Regarding Negative Futures Contract Prices and Index Levels in S&P Dow Jones Indices," (April 2020)
4 NY Times, "China's 'Crude Oil Treasure' Promised Riches. Now Investors Owe the Bank," (May 2020)
5 Barclays Bank, "Barclays Announces the Redemption of the iPath® Series B S&P GSCI® Crude oil Total Return Index ETNs", (April 2020)

All that glitters is… stuck in London

In March 2020, another event that broke the "rules" occurred in the gold market. Given that gold is easily transportable, storable, mostly immune to degradation (like the rotting or insect damage seen in crops), and has a very liquid physical and financial market, it would not seem like a prime candidate for an unprecedented market disruption. But those very reasons may be why market participants overlooked an "impossible" scenario.

There is high liquidity in the physical and financial gold hubs of New York and London. In March 2020, gold prices in London started to trade below prices in New York. Historically, when this occurred, an arbitrage trade would be to sell forward the gold at high New York prices, while taking delivery of the cheaper gold in London. The gold can then be moved from London to a refinery, often in Switzerland, to be adjusted to New York delivery standards, and finally transported to New York in time to deliver against the short forward prices. If the cost of this process is less than the discount in price for London gold, the trader can make a profit. However, due to the COVID-19 pandemic, in March 2020, certain Swiss gold refineries shut down and were unable to process the gold. Additionally, it was even difficult to find an airplane able to transport the gold across the Atlantic Ocean to New York to complete the arbitrage.

Figure: Monthly average of daily spread between London gold spot prices vs COMEX NY Gold futures prices
US Dollars / troy ounce



Note: 5 year average date range 1/1/15 - 12/31/19; Bloomberg ticker for London prices is GOLDLNPM and New York is GC1.
Source: Bloomberg LP; Credit Suisse Asset Management, LLC

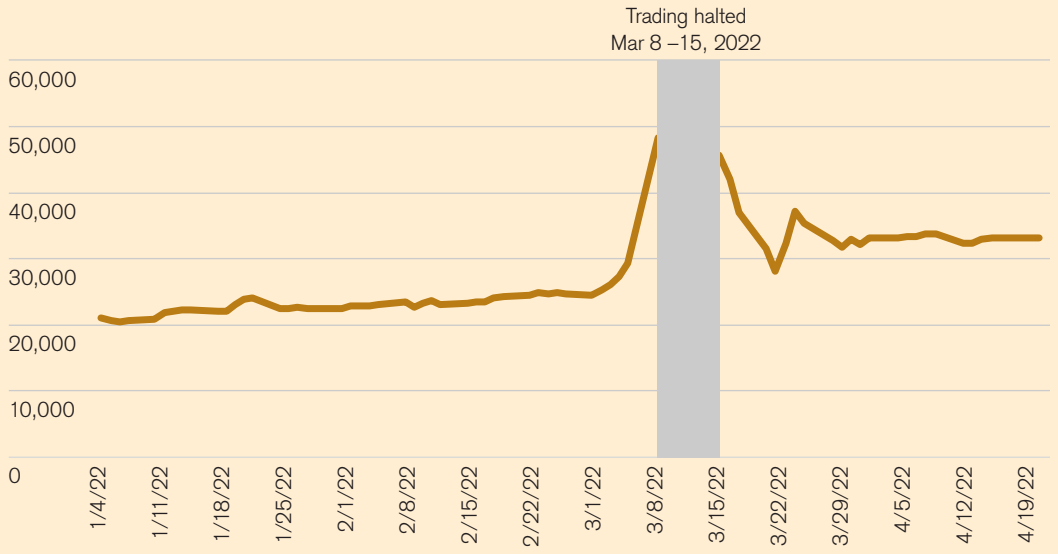
Here too, the tendency to focus only on the "most probable" proved costly. As a result of the canceled flights and shuttered refineries, not only were arbitrageurs unable to complete the arbitrage (with presumably some forced to unwind), but certain other traders lured in by the unusual deviation from historical norms also took losses. The impacts were not limited to speculators and arbitrageurs. The world's major bullion banks are located in London and are generally exposed to spot gold prices in London. These market participants hedge their risk by selling COMEX futures in New York as a normal course of business practice. This natural long spot/short futures position meant the bullion banks were also ensnared in the widening spread between the two previously tightly correlated assets.[6] Once again, an event which had never occurred in the past was perhaps viewed as "impossible," and surprised the industry enough to leave many experienced participants unprepared. Further, just as was seen in crude oil markets, consequences stretched beyond simply financial. As a result of this incident, the CME also announced physical delivery specifications for new future contracts to include the 400 troy ounce bars held by major bullion banks, eliminating the need for extra transport and refining.[7]

6 London Stock Exchange, HSBC Holding plc, Q1 2020 Pillar 3 Discl, (londonstockexchange.com)
7 CME Group/PR Newswire "CME Group to Launch New Gold Futures Contract with Expanded, Flexible Delivery in 100-ounce, 400-ounce or 1-kilo Bars," (March 2020)

Is nickel worth the squeeze?

In March 2022, many generally accepted "rules" proved to be anything but, when a massive short squeeze in nickel resulted in a historic spike in prices. A single market participant had amassed a large short position in nickel, expecting increased production to drive prices lower in the future. This participant was also uniquely positioned as a major producer of nickel, which drove conviction in the scale of production increase and, ultimately, the size of the trade. Russia's invasion of Ukraine had far-reaching impacts across many commodities, including nickel. Russia's actions introduced doubts about future global supply of battery grade nickel as Russia is a major producer and exporter. These fears, combined with market positioning, drove nickel prices up 250% in just 24 hours[8], creating a windfall for traders taking the long side and a disaster for shorts.

Figure: LME Nickel future, April 2022 contract
US Dollars / metric ton



Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

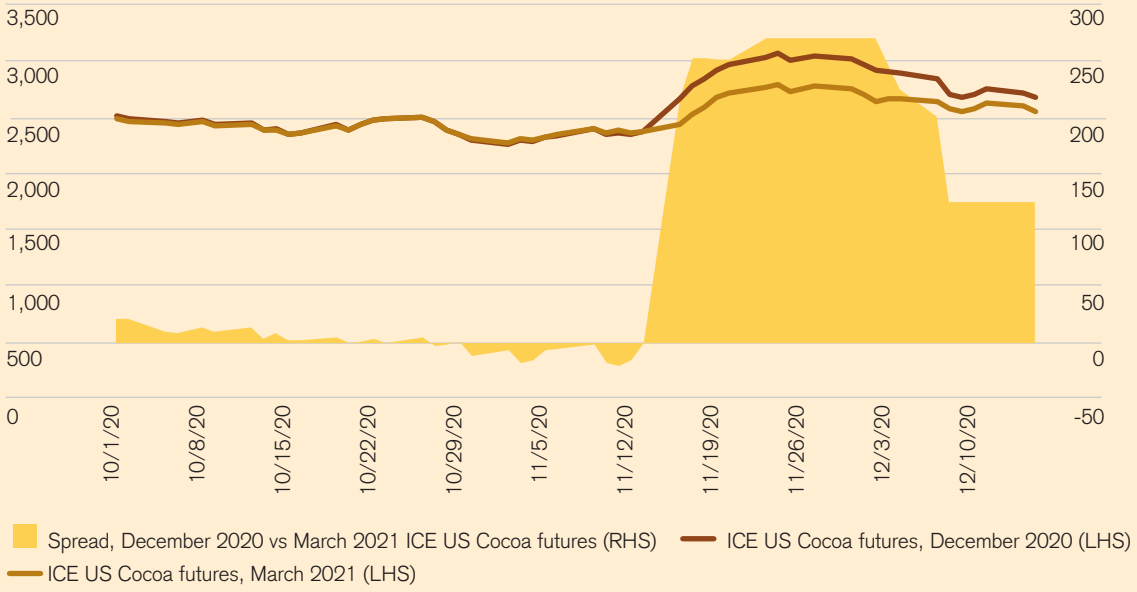
The breaking of pre-established "rules" started when the London Metal Exchange (LME) halted trading for the first time in three decades on March 8, 2022. Ultimately, the risks to the financial system and to counterparties in the metals markets were viewed as too great – further price spikes and associated margin calls could bankrupt a swathe of global firms. The LME decided to cancel billions of dollars of trades. Nickel trading was halted for a week, eventually reopening to a lower liquidity market as certain long-running market participants announced that they were halting LME trading due to uncertainty. Not only was that price spike viewed as "impossible," but reversing such a large number of trades was as well. By focusing on the "most probable," several major global financial firms were in difficult situations. Here too, consequences were not solely financial, as events in the nickel market caused the LME to impose daily trading limits for the first time in its history.

8 Businessweek, "The 18 Minutes of Trading Chaos That Broke the Nickel Market," (2022)

Spill the (cocoa) beans

In November 2020, a mysterious situation surfaced in the ICE Cocoa Futures market as a large buyer took physical delivery of several times more cocoa than typically allowed by the exchange.[9] That buyer was widely believed to be Hershey Co., and its actions in the futures markets were well and truly outside the scope of the "most probable." Typically, large physical consumers of cocoa conducted the majority of their business relating to physical procurement through private deals and intermediaries instead of through exchanges. However, a combination of factors made this procurement strategy less appealing than it had been historically, leaving chocolatiers searching for alternatives. First, the COVID-19 pandemic and associated lockdowns introduced questions about how far and how fast demand would recover for many commodities, including cocoa and finished chocolate confectionery products. Second, Ghana and the Ivory Coast, which produce more than half of cocoa globally, implemented a new cocoa export tax in late 2020 which amounted to approximately 15% of the futures price.[10] Facing input cost inflation from the new tax and the need to preserve margins given demand uncertainty, Hershey's procurement department broke from the "rules" and caught many traders by surprise when it moved to secure beans from the exchange, which were not subject to the new premium.

Figure: December 2020 vs March 2021 ICE US Cocoa Futures prices
US Dollars / metric ton



Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

9 Bloomberg, "Hershey Is Behind Big Cocoa Trade That Upended N.Y. Markets," (November 2020)
10 SkyQuest Technology Consulting - Globenewswire, "Global Chocolate Market to Worth 65.49 Billion," (November 2022)

As with the other examples, the unprecedented move had several consequences. On taking delivery, cocoa prices for the December 2020 contract rose by more than 30 percent in just a matter of days, compared to less than 20% gains for the March 2021 contracts, causing the steepest backwardation (which is when near maturity contracts are priced higher than later maturity contracts) in a decade.

As a separate but related unusual event in the cocoa market, for more than three decades prior to 2017, London cocoa futures were typically higher-priced than New York cocoa futures. Starting in 2017, this relationship mostly flipped to a New York premium, partly due to an influx of lower-quality Cameroon cocoa in London warehouses. This situation was temporarily exacerbated by the large physical delivery taken against the New York contract.

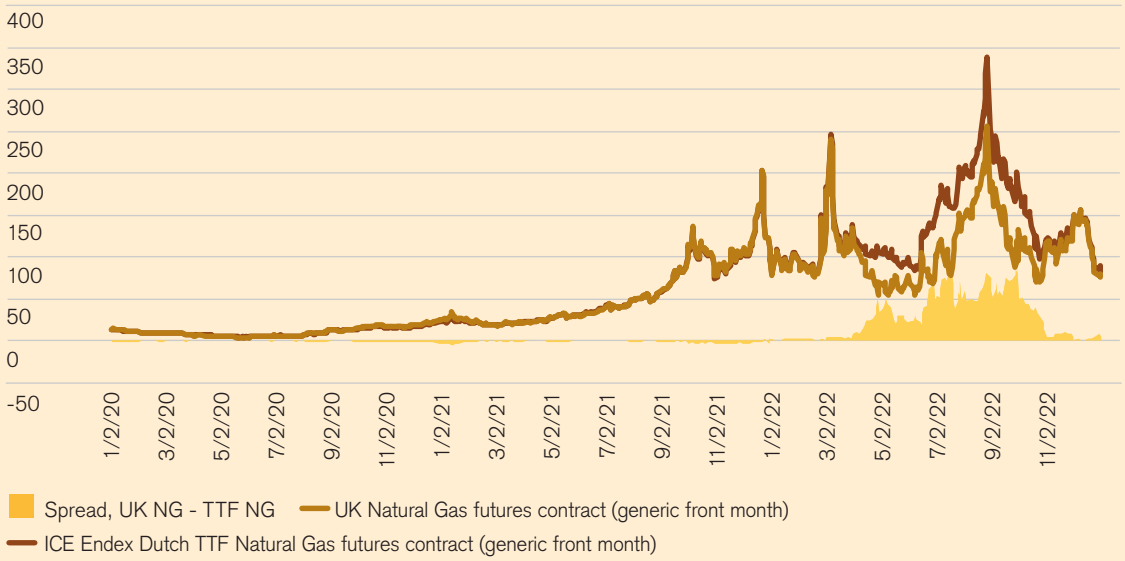
Relative value with a dash of sibling rivalry

Historical patterns also tend to create "rules" for traders, often with overconfidence. Some examples are "trading the range" (until it is no longer the range), "the trend is your friend" (except during high mean-reversion markets), and "buy the dip" (the US has not seen a lengthy equity bear market in decades, so there hasn't been much of a dip to speak of). There is, of course, a place for using historical data when trading, but it shouldn't create blinders against possibilities outside of these rules. Incorrectly assuming that historical patterns will persist could not only cause a trader to lose money during a regime change, but also cause traders to miss a potential opportunity to profit from that change. Examples of assuming historical relationships between assets will hold indefinitely and can be found across the entire opportunity set.

When European governments set energy policy goals to slowly move from fossil fuel-based sources to renewable sources, the "most probable outcome" almost certainly did not include a sharp and sudden reduction in Russian natural gas exports to Europe starting in 2021 and further deepening the following year. A fund manager or trader might be excused for not positioning a trade around that potential event in advance, but certainly should have been aware that Europe was dependent on natural gas imports, which could be reduced under certain scenarios, nefarious or not. The sudden divergence in local supply and demand conditions between the UK and Continental Europe caused natural gas prices in the two regions to rapidly diverge. Gas in the UK, as measured by National Balancing Point (NBP) futures, traded at a significant discount to gas in Europe, as measured by Dutch Title Transfer Facility (TTF) futures.[11] The close proximity of these two delivery points and high degree of product fungibility made a tight price spread the "most likely outcome." The base case strikes again! Consideration of the improbable might have included the evaluation of a scenario in which the volume of gas required by Europe exceeded transport logistics between the two locations, making arbitrage very difficult, if not impossible.

11 Spglobal.com, "European LNG sellers look away from UK amid wide discounts," (July 2022)

Figure: UK Natural Gas - TTF Natural Gas (front month futures prices)
US Dollars / megawatt hour

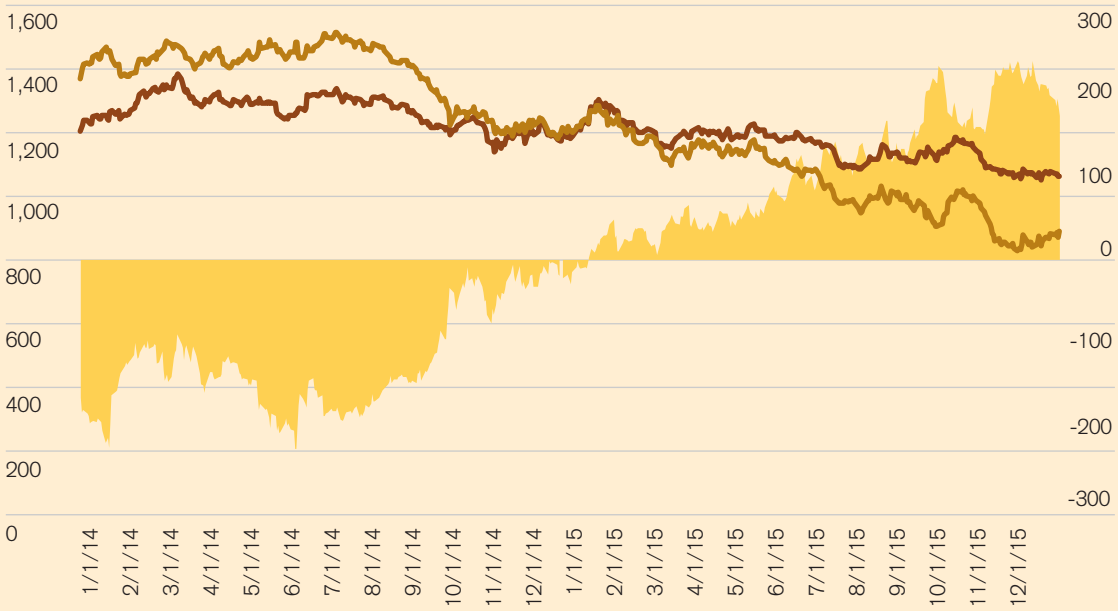


Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

For multiple decades leading up to 2014, platinum almost always traded at higher prices than gold, sometimes by a substantial amount. This premium was likely viewed as sustainable; it had sound economic and fundamental underpinnings, after all. Platinum's yearly mine supply is far below that of gold. In addition to demand from jewelry and investment sources, which are common between the two, platinum also has demand from industrial applications. However, starting in 2015, gold started trading higher than platinum, as strong investment demand for gold and reduced intensity of platinum usage in the automotive industry caused the relationship to reverse. (It is unclear if and when frequent traveler rewards programs or the music recording industry will reverse the prestige order of platinum versus gold status.)

12 Andrew Hecht, ETF.com, "Platinum: Rarer Than Gold, Looking to Shine," (January 2023)

Figure: Platinum - Gold spot price
US Dollars / troy ounce



Spread, Platinum - Gold spot price (RHS) — Platinum spot price (Bloomberg ticker: XPT Curncy) (LHS)
— Gold spot price (Bloomberg ticker: XAU Curncy) (LHS)

Source: Bloomberg, LP, Credit Suisse Asset Management, LLC

Broken supply chains lead to broken models

Imagine that there is a town that supplies a commodity to an entire region – Cookieville, which provides millions of delicious cookies weekly to Dessertland via train. Next, imagine that due to sudden flooding, the trains cannot export the cookies, and there is a week worth of inventory that will not be able to be shipped, depriving Dessertland residents of their favorite sweet, and forcing them to rely on their meager existing cookie supplies. Would cookie prices be expected to rise or fall amid this cookie shortage?

While this is a simplistic example, supply chain problems have occurred for millennia since the dawn of trade and transportation. Supply chain problems have also held the public spotlight in recent years, particularly since the emergence of COVID-19, initially due to bottlenecks in which human processing is involved at some point. Eventually, the supply chains were also stressed for a variety of other reasons, including production in certain industries based on demand forecasts which turned out to be wildly different from actual demand at certain points in time. Affected products included microprocessor chips, exercise equipment, and even certain types of toilet paper. Production can be adjusted, but not instantly.

Turning back to the cookie shortage example above, would prices be expected to rise or fall? The answer is the unhelpful "it depends." Cookie prices in Dessertland would rise because there was suddenly a supply shortage. But cookie prices in Cookieville would fall because there are excess inventories! In fact, if there was not enough storage for those excess cookies and they started to rot, cookie prices could drop below zero if residents were willing pay others to remove the cookies for them.

Some second-level effects could be for Cookieville production facilities to shut down to avoid increasing oversupply, reducing demand for flour and sugar as well. Dessertland physical traders would declare force majeure if they couldn't make cookie deliveries, and idle delivery trucks. Outside of markets, Dessertland media will focus on high prices, while Cookieville media will focus on low prices.

Cookie market participants may be amazed that this price move occurred, particularly if they were relying on common wisdom and historical data, without fully understanding the fundamentals. For example, quantitative traders may be surprised at the record divergence between Cookieville and Dessertland prices, assuming that there was a clearer linkage. For a trader who made a bullish futures bet on cookies, there would also be materially different outcomes depending on which location the futures were linked to. It should also have been obvious that relying solely on train transportation of perishable goods could lead to this result, but inevitably, there would be certain market participants unpleasantly surprised by this outcome. Overall, making assumptions purely based on historical data can be risky, particularly when the commodity is subject to material supply chain risk. In many instances, it is only a small portion of the market which may be making these assumptions, but having enough participants trading on incorrect assumptions provide opportunities for the rest of the market.

The COVID-19 era created supply chain problems in many areas of the global economy, and commodities were not exempt. As demonstrated by the gold and oil examples earlier, supply chain hiccups could be a catalyst for highly improbable events and unusual price moves. A key supply chain pattern that may often occur is in the processing stage, which caused retail consumer prices for both meat and lumber to soar during the COVID-19 pandemic. What is notable is that for beef and pork prices, this price spike also coincided with a drop in price for live cattle and hogs. With the contagious virus spreading through meat processing plants, the processing capacity to create wholesale meat cuts was reduced. Lower wholesale meat availability reduced supplies of meat at supermarkets, increasing retail prices. Livestock farmers, however, were experiencing a different environment altogether. Lower capacity utilization at processors meant lower demand for live animals, which drove down livestock prices even though prices for finished meat products were rising. A similar situation occurred in the lumber market. Sawmill processing utilization dropped, pushing up the price of lumber, despite having plenty of timber forests available as a raw material. With little carry cost for timber, in this case, the raw material price did not need to weaken. **A drop in processing capacity can increase the price of finished commodities and decrease the price of raw materials, even if historically these two prices have been positively correlated in the past.**

Where are there current opportunities to look outside the "most probable outcome" to hunt for potential trading ideas?

Even after numerous unusual situations within the commodity market over the past few years, the allure of the "most probable" remains seductive. Current market positioning seemingly still reflects the assumption that historical patterns will be maintained and that the old "rules" will be followed. What might be the next pattern or assumption to break—could it be any of the following hypothetical scenarios? What would be the downstream "impossible" price move that could result?

1. Increasing demand for lithium iron phosphate (LFP) batteries reducing what seems to be obvious nickel demand growth expectations.
2. Lack of crude oil refining capacity growth in Western countries increases reliance on imports of petroleum from other regions.
3. China does not actually slow aluminum production growth trajectory to reduce carbon emissions and instead increases production using more environmentally friendly power sources.
4. One country that is a dominant producer of a major commodity suddenly cuts off exports.
5. High prices and mended balance sheets cause natural resources firms to return to their old ways, drastically increasing capital investment levels or mergers and acquisitions activity at the expense of shareholder returns.

Conclusion

Technically, it is almost impossible to declare something impossible. In the WTI Crude Oil, gold, and nickel examples above, market experts might have assigned a de minimus probability to the events. However, the key here is that the odds were so low that many key trading and risk systems were not built to handle the possibility of these events occuring, so from that perspective, the events were deemed "impossible." If trading system software is not built to handle the possibility, it is not surprising that human traders also have a blind spot in this area.

We have highlighted many consequences of a failure to consider the unlikely, many of them negative. However, the irony of highly unlikely events is that, once they occur, the market may also flip from underpricing the probability of the event to overpricing it, as a new "rule" is added to the market rulebook. Witnessing crude oil prices fall below zero likely means the market is more prepared to face a similar circumstance in the future, which may, in turn, mean the event is less likely to occur as physical participants might be more willing to quickly buy at low prices and prevent such a drastic fall. A potential positive outcome is that this preparation might also ultimately strengthen the futures market infrastructure, as most market participants were bystanders during this period, due to strict position limits and low liquidity immediately preceding futures contract expiration. Traders may become more cautious in a similar situation going forward during a period where there could be a greater number of market participants involved. Extending this analysis across other commodities for events that could "never" happen may help identify potential risks and opportunities in the future.

Have we entered a new era of the improbable? Probably not. Commodities are particularly vulnerable to historically unusual events, including sudden shocks to supply and demand such as those that we witnessed during the COVID-19 pandemic. In addition, commodities markets are also highly reactive to longer-term shifts to technological improvements for producers, changes in consumer preferences, raw material substitutions, and evolutions to supply chains. Over the past few years, there have been events even in the most liquid commodities markets, such as gold and oil, which had no precedent and might have been considered "impossible" by experienced market participants right up until they occurred. Reliance on historical data might be helpful when trading commodities, but overreliance on most probable outcomes, focusing only on previous outcomes, or following the "rules" could result in strategies with hidden risks and create the potential for unforeseen losses. An approach that considers not only what has happened, but what could happen is likely to provide a wider and deeper opportunity set and understanding of potential risks.

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