Filled to the Brim

The Importance of Flexible and Innovative Storage in Commodities Markets

By William A. Reinsch and Patrick Saumell

Covid-19’s Impact on the Commodities Market

The Covid-19 pandemic has sent shocks through the world economy. Apart from exceptions in sectors like e-commerce and insurance, social distancing and stay-at-home orders have significantly lowered global demand. Energy and metal, which are hard commodities that must be mined or extracted, and agricultural products, which are soft commodities that are grown or raised, have not escaped this downturn, as shown by diminishing investment and falling prices in these markets. Crude oil prices reached a historic low in April, and the average price for this year is anticipated to be 43 percent lower than in 2019. Average metal prices for the year are expected to fall as well, although less dramatically than oil. Metal prices are projected to drop by 13 percent overall compared to 2019, with industrial metals being hit the hardest. Between January and April, agricultural prices also fell compared to 2019, with corn prices lowered by 19 percent, live cattle by 30 percent, and lean hogs by 45 percent.
With commodities’ historical high price volatility, traders and producers in these markets have experience handling a downturn. However, uncertainty around future vaccine availability and economic restriction’s duration has created doubt about when prices will return to 2019 levels. The prospect of a second wave and the recent growth of U.S. Covid-19 cases make it clear that little is certain about future global economic activity. These unknowns in the market interfere with two crucial and interrelated parts of the commodities trade: contango trade and storage.

Contango trade takes advantage of both spot prices and futures prices in the commodities market for sellers to make a risk-free profit. Spot trading, or the cash market, is the ability to pay and receive immediate delivery of goods. It is the more common transaction, and what occurs when you go shopping and can immediately leave with your purchase. Futures contracts are a unique financial instrument used to lock in a price for future delivery. In the oil market, a three-month futures contract allows a purchaser to hypothetically lock in a price during January for oil delivered in April, regardless of market activity. Contango refers to a situation when the futures price is higher than the spot price, allowing traders to arbitrage the market. Those engaging in this trade will purchase an asset at the lower spot price and then immediately sell it at the higher futures price, locking in revenue of the two prices’ difference. However, to execute these transactions, sellers need to have the appropriate storage capacity to hold the commodity until delivery. As a result, profit is dependent on storage costs.
Besides allowing traders to engage in contango trade, storage has an essential role in the commodities market. Fundamentally, storage allows a time gap between a commodity's extraction or cultivation and the next stage of production. This role stabilizes prices by making intermediate goods continuously available and smooths irregularities in production by holding inputs in reserve during manufacturing delays. Additionally, for some raw materials such as crude oil, storage is required to have continuous extraction. Storage capacity is also vital during a market downturn, such as the Covid-19 pandemic, because it enables producers to keep their intermediate goods stored until demand and prices rise.

Limited Storage and Its Consequences

Due to the severity of falling demand, storage capacity is quickly being filled as many commodities surpluses grow. Producers of hard and soft commodities extracted, mined, and cultivated their products to meet the expected demand for 2020, and many have still not wholly cut off production. The previously projected level of commodity supply and demand does not meet today’s reality of slowed production, lowered consumption, and disrupted supply chains, resulting in an oversupply for many energy products and metals and, to a lesser extent, some agricultural goods. These surpluses are concentrated mainly in inputs for industrial manufacturing and domestic products with disrupted shipping networks. On the other hand, imported commodities that still face average or higher demand, such as fruits, tree nuts, and specific meat cuts, could face shortages due to international supply chain limitations. Further, both the surpluses and shortages are amplified for upstream commodities due to the bullwhip effect. Caused by distorted information in supply chains, the bullwhip effect causes small changes in demand for final products to create more significant fluctuations in demand for inputs. This phenomenon is a crucial consideration for all commodities, which are predominantly used as intermediate goods.
The issue usually most relevant to surpluses is their impact on prices. When a market is oversupplied, producers are forced to reduce prices to sell their products and compete. However, the extreme supply glut driven by the pandemic has also made storage constraints an equally significant problem. Storage isn’t free and can be particularly costly for certain energy, chemical, and agricultural products. Storing these products can be difficult and expensive to scale up in the short term with relatively inelastic demand for storage. Storage is relatively price inelastic due to its few substitutes and its necessity. The oil sector has experienced the most notable storage-supply mismatch in the past few months. In the United States, the world’s largest crude oil producer, roughly 540,722k barrels of the available 622,268k barrels of working storage capacity, excluding the U.S. Strategic Petroleum Reserve, were occupied as of June 19.

Weekly U.S. Ending Stocks of Crude Oil (Excluding SPR)

Thousands of Barrels


The capacity in liquid natural gas (LNG) storage also elucidates this problem. As of March, 177,400k barrels out of the total working capacity of 485,636k barrels were occupied. This amount is significant for the offseason of LNG use, as the five-year average for March was only 141,213k barrels. Additionally, in Europe, inventories are 54 percent full, which is 45 percent higher than the average of the last 10 years. Companies are actively trying to get out of natural gas purchases and storage. In early March, the Chinese National Petroleum Corporation issued a force majeure, a provision that allows parties to get out of a contract given an event out of their control, to cancel natural gas imports. While capacity on metals storage is less closely tracked, there have also been surpluses in industrial metals such as copper, aluminum, zinc, tin, and iron, forcing producers and sellers to find additional storage.

The irony of the situation is that, unlike the commodities that have slashed prices due to surpluses and demand shocks, storage prices have risen significantly. In March, fuel storage rates roughly doubled for oil tanks in Europe and the United States. Prices for floating storage subsequently rose. On land, in Cushing, Oklahoma, a key storage point for U.S. crude oil, rates increased by more than 200 percent to 50 cents per month for each barrel. For U.S. warehouse storage, rent per square foot rose to $7.86 during the first three months of 2020, a 4.8 percent increase from early 2019. As industrial warehouse space faces even more demand during 2020’s second quarter, this figure will likely rise. A specific example can be seen in the recent sale of a Fort Lauderdale cold storage warehouse. Since its purchase in 2016, the facility’s value rose by roughly 75 percent and sold at $4.5 million in June 2020. The demand for cold storage already outpaced supply before the demand shocks, but the pandemic has greatly increased the value of these warehouses.
In North America, these storage shortages have led crude oil producers to take the extreme measure of shutting down oil wells. In May, Texland Petroleum LP shut off all of its 1,211 oil wells, ceasing production for the first time since its business opened in 1973. Shutting down these operations is risky and expensive, and there is no guarantee that the wells will be as productive when restarted. Additionally, in oil markets, the unthinkable happened in April. The spot price and the futures price per barrel became negative. In West Texas Intermediate (WTI) crude, the futures price went negative for May contracts that closed the next day, as sellers were willing to pay $4.47 per barrel to get rid of the contract and avoid storing the future shipment. Additionally, on the same day, the spot price of WTI crude dropped to −$36.98 per barrel. This drop was an aberration and not reflective of actual market conditions, given that the spot price rose to $13.64 two days later, but it reflects the panic that storage constraints caused in the WTI crude market. Interestingly though, the surplus in metals has not had as significant an impact on the market. Outside of mines closed by lockdown orders, metal production has been able to stay open throughout the pandemic. Additionally, the price of these metals has dropped, but the futures price and spot price have remained above zero. A critical factor that has caused these two separate outcomes is the different storage flexibilities in each sector.

**INFLEXIBLE AND FLEXIBLE STORAGE FOR COMMODITIES**

Different commodities have different storage requirements. Some commodities’ storage is more expensive and has additional constraints, making it inflexible. Other commodities’ storage can be quickly adapted and is less costly to expand.

Many of these inflexible characteristics are associated with hard commodities in the energy sector and some soft agricultural commodities. As a result of these characteristics, it is not economical for a firm
to expand storage to meet demand. This constraint prevents industries from continuing to produce at pre-
Covid-19 rates and storing away surplus commodities to be sold when prices rise.

Commodities with flexible storage do not share this issue. Industrial metal commodities such as copper, aluminum, zinc, tin, and iron have relatively few storage requirements. Metals like aluminum that do not rust can even be stored outside if necessary. As a result, investors have taken to stockpiling these metals to earn a return using contango trade. As of mid-June, investors could make a 2 percent annualized return from storing aluminum. Additionally, companies on the London Metal Exchange (LME) have expanded their capacity to handle the growing surplus. Since early March, the LME warehouse operators have increased storage capacity by 4.5 percent to create an additional 180,000 square meters of space. Following this, the Metro International Trade Services (MITS) that operates metal warehouses has not seen a significant change in pricing. MITS Managing Director Ben Dunn believes regardless of changes in demand, "space [will] be found to house metal."

**Why It Matters and What Should Be Done**

In times of crisis, such as the Covid-19 pandemic, adaptability is essential for industries to preserve market share and remain profitable. While many sectors are achieving this within their production and marketing, innovation for certain storage types has remained limited. This deficiency hurts individual companies but can be devastating to emerging markets that rely on commodities with inflexible storage to drive growth. Many of these developing economies have not diversified into more resilient industries, such as e-commerce, that are currently benefiting from significant consumption and shifting consumer behavior. This lack of diversification makes these countries overly dependent on commodities’ market conditions and limits sustained, job-intensive, and inclusive growth. As a result of space deficiencies, these commodity-driven economies must face high costs to develop additional storage or reduce production. Regardless of their choice, the resulting revenue loss will strain public finances and risk driving away foreign investors. On top of the harm from demand shocks and lower prices, storage constraints also limit commodity-driven economies and businesses’ ability to recoup their losses by storing until prices rise or selling to third parties that engage in the contango trade.

![Petroleum as Percentage of Total Merchandise Exports, Top 20 Producers](image)

The loss caused by inflexible storage to emerging economies and businesses is also a big problem for employees in these industries. After shutting down production in May, the previously mentioned Texland Petroleum LP needed to apply for loans through the Small Business Administration’s Paycheck Protection Program to “keep its 73 employees on the payroll.” As of May 2019, the U.S. oil and gas extraction sector had 141,320 employees, of which roughly 47,000 handled maintenance, extraction, and transportation. These employees will be directly impacted by slowed production and face a severe risk of unemployment. Additionally, for emerging economies, some of the top producers of petroleum are highly dependent on the product, indicating that it supports a large population of their workforce. In countries such as Saudi Arabia, Iran, Iraq, and Kuwait, where oil was more than 50 percent of the total merchandise exports in 2017, even slowing down production can significantly harm the workforce.

The situation for many commodities has improved marginally since April, with the Chinese industrial sector starting up again and demanding inputs. However, there is still significant uncertainty about the future of Covid-19. On June 9, Dr. Anthony Fauci, the United States’ top infectious-disease official, advised states to shut down again, given the virus’s resurgence. This announcement follows the seven-day average for new U.S. cases rising by more than 7,100 to 52,280. Additionally, the WHO Director-General Tedros Adhanom Ghebreyesus warned that the “pandemic is still accelerating,” with the total of global cases doubling in the past six weeks to roughly 12 million. This resurgence and the possibility of a new second wave create uncertainty about future demand for commodity inputs. If industrial production shuts down again, crude oil and other commodities with inflexible storage could face futures prices below zero. These sector’s resilience is highly dependent on whether they continue to slow down commodities’ production.

While it is unlikely that the same flexible storage available to metals will be possible for the entire commodities market, innovation in how specific commodities are stored could allow industries to reduce

space constraints. Inspiration can be taken from the oil industry’s effort to store its product on the open sea. In the last few months, traders chartered vessels to engage in the practice of floating storage. However, innovation still has a long way to go. Accessing additional floating storage has become expensive, with shipping rates growing by 300 percent in March. Even after this crisis is over, commodities producers could prepare for future demand shocks by investing in the cost-effectiveness, adaptability, and scaling of traditional storage. While it may seem like a misuse of capital compared to more immediate gains, this due diligence would ensure that storage space is available during the next inevitable demand shock.

Part of this problem is the lack of research and development (R&D) addressing storage constraints in traditional warehouses. A literature review that compares the body of research with warehouse managers and consultant’s input found that the studies lack applicability to the industries’ most significant problems. The research highlights minor operational issues but has failed to tackle the most critical trends, like the increasing volatility of demand. An exception, however, is the significant R&D devoted to e-commerce’s impact on warehouses. Companies like Deloitte have addressed how to transform warehouses into distribution centers to take advantage of newer digital systems. This research is vital for companies to respond to e-commerce’s requirements for speed and adaptability in supply chains. However, it still provides little assistance in addressing the pandemic’s most significant issue of inflexible storage. A potential solution to this lack of R&D is for more companies to take advantage of the U.S. federal research and experimentation tax credit introduced in 1981. This tax credit was created to incentivize private research by covering wages for qualified services, supplies, contract research expenses to third parties, and basic research payments. It was previously used in the warehouse industry by Federal Express in the 1990s to invest in package tracking and internal software and, more recently, by large warehousing companies to develop software-based warehouse management systems.

While progress has been limited in developing flexible storage for energy commodities, the push towards renewables has led to a greater focus on developing improved electricity storage. This trend could be expedited with the pandemic highlighting the problems of storing oil and gas. In early 2020, the Department of Energy’s (DOE) Office of Electricity announced the Energy Storage Grand Challenge to help fund projects on grid storage and high capacity batteries. Supporting this project, the Department of Energy released a report on the Potential Benefits from High-Power, High-Capacity Batteries. This report describes the opportunities from “increasing the resilience of the U.S. electrical power system and helping to integrate higher levels of variable renewable energy” with input from the DOE, industry, and other grid stakeholders. Analyzing the energy sector over the long term, the report highlights the benefits of flexible bidirectional high-capacity batteries that allow the ability to store and supply energy. There are two main ways to utilize this bidirectional technology to increase the flexibility of energy storage: the distributed approach and the centralized approach. The distributed or decentralized approach spreads smaller batteries throughout the grid to provide more flexibility for consumers. The centralized approach installs larger batteries that provide utility-scale services. For either method, transitioning the global energy sector to rely on these high-capacity batteries would reduce the need for traditional energy commodities as variable renewables like solar and wind power became more feasible. At this point, the oil and natural gas sector’s current storage level would be more than enough, but it would come at the cost of significant market share.

Further innovation has come from the cold storage industry. With the high demand for cold storage, facilities are costly, and smaller companies struggle to attain the capital to expand. However, the rise of advanced automation and technology allows these companies to cut down on labor expenses and make their warehouses more cost-effective. A technique that has been especially important for enabling facilities
to maximize space has been mobile racking, allowing facilities to increase the number of multi-level storage units. Additionally, new facilities use in-floor heating to prevent damage to the facility and internal storage areas to allow for different temperatures zones. While the widespread global adoption of these technologies is a few years off, innovation in this sector will increase the flexibility to store a larger number of agricultural commodities at different temperature points. These developments will make the current constraints on luxury products such as wagyu beef more manageable and encourage companies to invest in additional cold storage.

Despite the adoption of these new technologies on the horizon, some commodities will have to contend with inflexible storage for at least another 10 to 20 years. The uncertainty surrounding the pandemic and tension in the global trade regime highlights the need to have flexible and innovative storage to weather unpredictable demand shocks. Moving forward through the 2020s, we will see if this crisis has imparted lasting lessons for individual businesses and governments to invest in improving energy and agricultural storage or if the next shock will bring commodity futures prices below zero again.

William A. Reinsch holds the Scholl Chair in International Business at the Center for Strategic and International Studies (CSIS) in Washington, D.C. Patrick Saumell is an intern with the CSIS Scholl Chair.

This report is made possible by general support to CSIS. No direct sponsorship contributed to this report.

This report is produced by the Center for Strategic and International Studies (CSIS), a private, tax-exempt institution focusing on international public policy issues. Its research is nonpartisan and nonproprietary. CSIS does not take specific policy positions. Accordingly, all views, positions, and conclusions expressed in this publication should be understood to be solely those of the author(s).

© 2020 by the Center for Strategic and International Studies. All right reserved.