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The *Global Commodities Applied Research Digest* (*GCARD*) is produced by the J.P. Morgan Center for Commodities (JPMCC) at the University of Colorado Denver Business School. The aim of the *GCARD* is to serve the JPMCC's applied research mission by informing commodity industry practitioners on innovative research that will either directly impact their businesses or will impact public policy in the near future. The digest is published twice per year and has been made possible by a generous grant from the CME Group Foundation.

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The *GCARD's* Contributing Editor is Hilary Till, M.Sc. (Statistics), Solich Scholar at the JPMCC and member of the JPMCC's Research Council. The *GCARD's* Editorial Assistant is Katherine Farren, CAIA, and the *GCARD's* Publication Consultant is Barbara Mack, MPA, of Pingry Hill Enterprises.

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The J. P. Morgan Center for Commodities' Advisory Council primarily consists of members of the business community who provide guidance and financial support for the activities of the JPMCC, including unique opportunities for students. With the support of the Advisory Council, the JPMCC aims to become a global leader in commodities education and applied research. The JPMCC is grateful for the Advisory Council's staunch support of its activities!

The JPMCC is honored to have a distinguished Research Council that is responsible for shaping the applied research agenda of the Center. Accordingly, the *GCARD*, in part, draws from insightful presentations and discussions that occur at the Center's semiannual Research Council meetings. The JPMCC's Research Council members are listed on the next page.

Professor Nikos Nomikos (left), Ph.D., Cass Business School (U.K.), speaking with Mr. Steffen Hammer (right) of Robert Bosch GmbH (Germany) at the J.P. Morgan Center for Commodities' (JPMCC's) Research Council meeting on September 30, 2016. On Professor Nomikos' right are Dr. Ajeyo Banerjee, Ph.D., Executive and Faculty Director of the JPMCC at the University of Colorado Denver Business School and Professor Vince Kaminski (seated), Ph.D., Rice University. Professors Nomikos and Kaminski are both members of the JPMCC's Research Council.

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TABLE OF CONTENTS
Vol. 2, No. 1: Spring 2017

Welcome Letter

Contributing Editor's Letter

Research Council Corner

Gold may see some extra volatility in 2017 as several driving forces are converging. Gold bears no interest, so in a rising rates environment its value may be challenged. Improved risk management and technological enhancements may also play a role in the continued expansion of production, even if prices fall. Central banks have been buying gold for the last few years, but will they continue? And China appears to be decelerating further, and it has been a big buyer of gold. Taking each of these factors into consideration, this could be quite a volatile year for the shiny metal.

Financial markets in general, and energy finance markets in particular, are highly informative. The challenge is always in interpreting what exactly the message is from the markets. We address this issue in the crude oil markets with an examination of the level of spot prices and the implied volatility of crude oil futures prices. Professor Ronn's Encana Distinguished Lecture at the JPMCC on March 9, 2017 was closely related to this topic.

Contributing Editor's Collection

This collection of three articles by the Contributing Editor covers the commodity derivatives markets from a broadly conceptual perspective. Specifically, this set of articles reviews (a) the potentially persistent sources of return in the commodity futures markets; (b) the differing risk-management priorities for commercial versus speculative commodity enterprises; and (c) the economic role of commodity market participants.

Contributing Editor's Collection (Continued)

This digest article describes potentially persistent sources of return in the commodity futures markets due to (1) hedge pressure, (2) scarcity, and (3) weather-fear premia. But the article also notes that active commodity futures strategies can be limited in scalability and can potentially lose their potency due to structural breaks or popularization.

Risk management in commodity futures trading takes two different forms, depending on whether trading is done for a commercial or a purely speculative enterprise. For commercial enterprises, the most important aspects of risk management are in (a) adhering to regulatory rules and laws, and in (b) establishing strict operational policies and procedures over every facet of risk-taking activity. In contrast, for a purely speculative participant, the emphasis is almost entirely on market risk-management.

The terms, "hedging" and "speculation," are not precise. What futures markets accomplish is the specialization of risk-taking rather than the elimination of risk. In addition, this paper discusses how there is some empirical evidence to support the theory that speculative involvement actually reduces price volatility. This article also explains that even when commodity futures markets are viewed as "hedging" markets, there is still a vital role for speculators because there will not always be an even balance of short hedgers and long hedgers at any one time: speculators are needed to balance the market.

Research Digest Articles

As summarized by Ana-Maria Fuertes, Ph.D., Professor in Finance and Econometrics, Cass Business School, City, University of London, U.K. and Member of the GCARD's Editorial Advisory Board

This digest article summarizes a research paper by the following three co-authors: Charoula Daskalaki, Ph.D., University of Piraeus, Greece; George Skiadopoulos, Ph.D., University of Piraeus, Greece, and Queen Mary, University of London; and Nikolas Topaloglou, Ph.D., Athens University of Economics and Business, Greece. Their paper revisits the question of whether it is worthwhile for investors to include commodities in equity and bond portfolios. In studying this question, the authors use a statistical methodology that circumvents the need to make assumptions on investor preferences and the distribution of asset returns. The authors find in both in-sample and out-of-sample tests that commodities provide diversification benefits, especially, for second- and third-generation commodity indices. Of note, the authors of this research article were recipients of one of the JPMCC's Commodities Research Fellowship Awards, which, in turn, were generously funded by the CME Group Foundation.

Research Digest Articles (Continued)

This digest article summarizes a research paper by the following three co-authors: Adrian Fernandez-Perez, Ph.D., Auckland University of Technology, New Zealand; Ana-Maria Fuertes, Ph.D., Cass Business School, City, University of London, U.K.; and Joëlle Miffre, Ph.D., EDHEC Business School, Nice, France. Their article investigates the nexus between idiosyncratic volatility and returns in commodity futures markets. The authors find that the seemingly abnormal performance of active strategies that systematically exploit idiosyncratic volatility turns out to be a fallacy associated with the use of an inappropriate benchmark. Instead, suitable benchmarks reveal that idiosyncratic volatility cannot be a specifically rewarded risk factor since it can be diversified away.

Reports on the Research Council Meetings

As discussed at the JPMCC's September 2016 Research Council meeting, recent developments in battery technology have given rise to energy storage devices targeting not just wholesale or grid support operations, but residential buyers as well. While several manufacturers compete in this space, it is Tesla, with its Powerwall, that has commanded the majority of media attention. Billed as a complement to residential rooftop solar installations, the Powerwall offers homeowners the allure of some measure of energy independence, reliability, and cost savings, all with not-too-subtle intimations that use of this storage technology is associated with superior environmental stewardship. This paper examines the Powerwall product, and by implication its competitors, in the context of today's electricity markets to consider the validity of these claims and the prospect of retail electricity storage significantly impacting the electric market.

Reports on the Research Council Meetings (Continued)

Editorial Advisory Board Commentaries

(Continued on next page)

Editorial Advisory Board Commentaries
(Continued)

the sector much stronger than seen in decades. This article discusses the current situation for American shale producers as they emerge from one of the most dramatic oil price collapses in modern history.

This digest article examines whether gold can hedge an investor's inflation risk over the long term. Though many studies do find that a long-run equilibrium relationship exists between gold and inflation in various countries, these results may not be relevant for the outcomes that real investors would have experienced. Accordingly, this article examines the results of saving an ounce of gold a year for a U.S. dollar-based investor over various 25- to 40-year timeframes during a 200-year period. Perhaps somewhat surprisingly, in the majority of cases, saving in gold would not have compensated these investors for inflation when they came to draw down their funds. The paper concludes that there may be good reasons for an investor to hold gold, including portfolio diversification benefits and acting as a safe haven during major market crashes, but reliable inflation hedging properties does not appear to be one of them.

In the power markets, prices can move rapidly at quite inopportune times. This article highlights one such event in the Texas power market and describes what led to and contributed to this extreme market price move, followed by what happened as the market went into settlement. The article concludes with lessons learned on how to manage the price risk around such an event.

Industry Commentary

The Liquefied Natural Gas (LNG) industry is going through the largest increase in LNG capacity ever, equivalent to twice the LNG export capacity of Qatar. These new supplies are arriving in a market environment significantly different in terms of supply, demand and prices from what the industry anticipated when investment decisions were taken. Slower than expected LNG demand growth is forcing sellers to look for new, riskier markets. But a potential market squeeze beyond 2020 is currently the greatest worry of investors and buyers alike, as very few projects have been sanctioned since mid-2015. Buyers have become more demanding about what they are ready to accept in terms of contractual conditions.

(Continued on next page)

Industry Commentary (Continued)

Their demands focus on three different aspects: pricing mechanisms, flexibility and final destination clauses. Sellers have become increasingly worried on how far negotiations could be pushed and that the sanctity of long-term contacts could become under threat.

Commodity Education Perspective

By Andy Hecht, Subject Matter Expert, "Foundations for Commodities" Professional Education Program, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

This brief article outlines the changes in the political and economic landscape that one might expect with the new U.S. administration. The article also argues that the changing regulatory environment twinned with the potential for energy independence could lead to vast changes in the commodity markets. The article concludes with exploring the growing potential for some commodity merchant businesses to return to the shores of the U.S. over the months and years ahead.

Interview

In the Spring 2017 issue of the *GCARD*, we are honored to interview Dr. Vince Kaminski, Ph.D., Professor in the Practice of Energy Management, Rice University and an inaugural member of the JPMCC's Research Council. In this issue's interview, Professor Kaminski discusses his motivation for joining the Research Council and the value that the JPMCC can bring to commodity market participants. He also elaborates on his metaphor of comparing the various parts of the commodity complex to a Rubik's Cube, which he had proposed at the JPMCC's April 2015 Research Council meeting. In addition, Dr. Kaminski generously summarizes his September 2016 Research Council presentation on the involvement of financial institutions in the commodity markets. Dr. Kaminski's interview also includes how he came to specialize in the commodity markets, and he offers advice to students and young professionals whom are interested in potential careers in the commodity markets. His interview also covers his newly published and updated reference textbook, Managing Energy Price Risk, which is now in its 4th Edition at Risk Books, and he concludes with suggestions on what topics should be covered in future issues of the *GCARD*.

International Commodities Symposium

August 10-11, 2017

By Ajeyo Banerjee, Ph.D., CMA, Executive & Faculty Director, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

The "New Directions in Commodities Research" conference is an international commodities symposium, which is being organized at the J.P. Morgan Center for Commodities, University of Colorado Denver on August 10-11, 2017.

(Continued on next page)

International Commodities Symposium
(Continued)

The symposium will bring together global thought-leaders in commodities to discuss new research related to commodities. The conference organizers are Ajeyo Banerjee, Ph.D., Associate Professor of Finance and Risk Management, Executive & Faculty Director, JPMCC and Graham Davis, Ph.D., Professor of Economics, Colorado School of Mines and Member of the JPMCC's Research Council. The technical committee for the symposium is drawn from the membership of the JPMCC's Research Council. The symposium is being sponsored by the CME Group Foundation and by the Payne Institute for Earth Resources. Presentations from the symposium will be covered in the Fall 2017 issue of the *GCARD*.

Welcome Letter

Rohan Christie-David, Ph.D.
Dean and Professor of Finance, University of Colorado Denver Business School

Rohan Christie-David, Ph.D., Dean of the University of Colorado Denver Business School and Professor of Finance, welcoming JPMCC Research Council members to their September 30, 2016 meeting in the Center's CoBank Lecture Hall.

Dear Reader,

As the new dean at the University of Colorado Denver Business School, I am delighted to welcome you to the third issue of the J.P. Morgan Center for Commodities' *Global Commodities Applied Research Digest (GCARD)*. This biannual publication is generously sponsored by the CME Group Foundation with the purpose of highlighting key findings of applied research on topical commodity issues that affect the business community.

As the only center of its kind in the world, the University's J.P. Morgan Center for Commodities (JPMCC) played a major role in my decision to come to Denver: I immediately grasped the JPMCC's potential. Given Denver's location, history and local expertise in the commodities trade, it was natural for a commodities center to be established here. Our further goal, however, is to build the JPMCC into a global leader in commodities education and thought leadership. Future issues of the *GCARD*, under my leadership, will document our progress toward that goal.

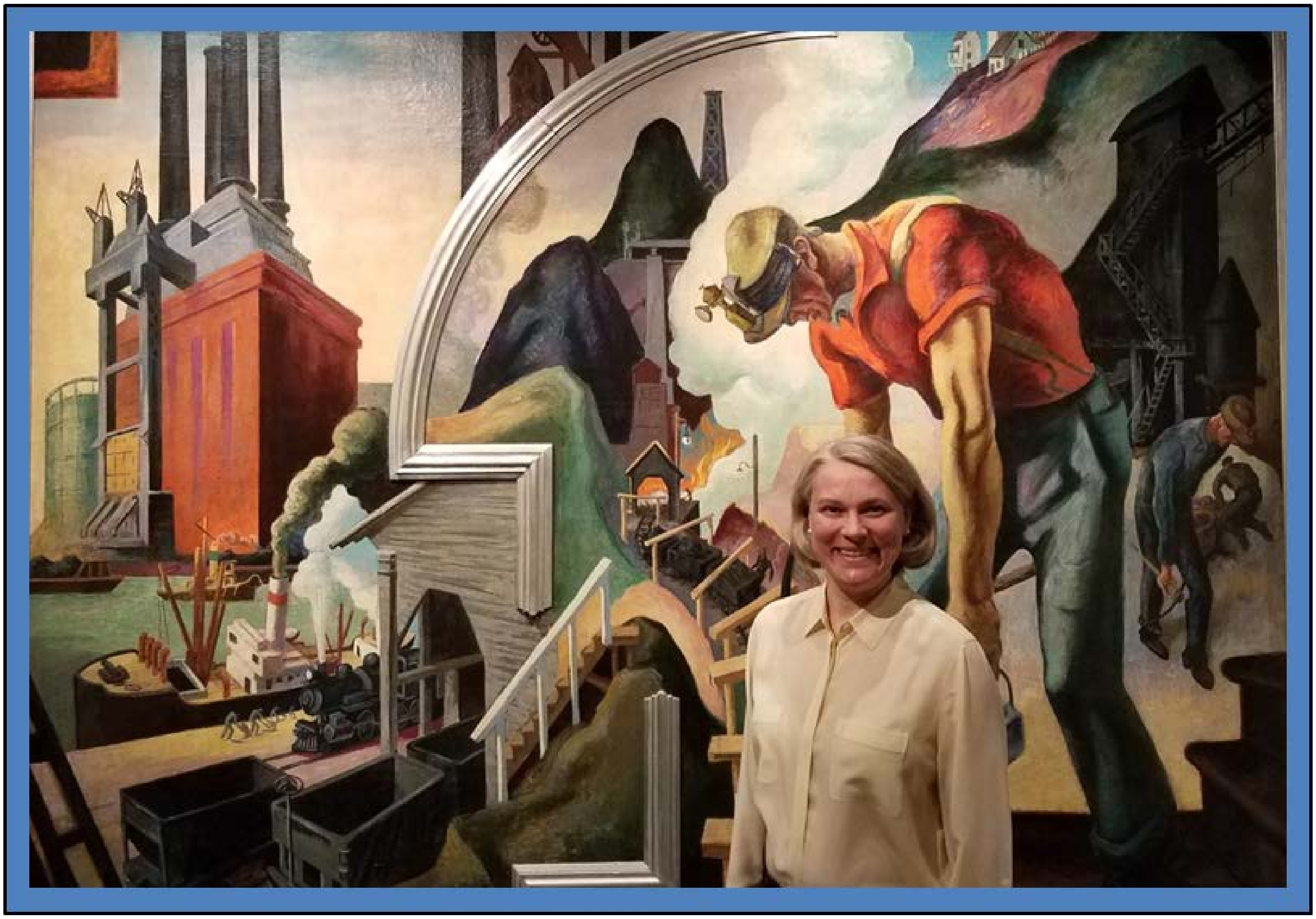
In the meantime, I invite you to browse the J.P. Morgan Center for Commodities' website, www.business.ucdenver.edu/commodities. If you have any questions or would like more information about the JPMCC, please contact the Center's Program Manager at commodities.center@ucdenver.edu.

Sincerely,

Rohan Christie-David, Ph.D.

Contributing Editor's Letter

By Hilary Till
Solich Scholar, J.P. Morgan Center for Commodities (JPMCC), University of Colorado Denver Business School; and Contributing Editor, *Global Commodities Applied Research Digest (GCARD)*



Hilary Till, M.Sc. (Statistics), Solich Scholar, J.P. Morgan Center for Commodities at the University of Colorado Denver Business School, standing in front of the artwork that is the basis of the *GCARD*'s Spring 2017 cover. This commodity-themed artwork is located at The Metropolitan Museum of Art in New York City and is from Thomas Hart Benton's 1930-1931 set of panels entitled, "America Today." Ms. Till is also the Contributing Editor of the *GCARD*.

Dear Reader,

My colleagues and I are pleased to present this comprehensive view of the commodity markets to you. We have brought together timely insights from the J.P. Morgan Center for Commodities' (JPMCC's) Research Council and also from the *GCARD*'s Editorial Advisory Board, which collectively illustrate the JPMCC's deep bench of commodity expertise.

During the December 4, 2015 Research Council meeting, **Thorvin Anderson, CFA**, (left), Content Director, "Foundations for Commodities" Professional Education Program, JPMCC, in discussion with Professor Graham Davis (middle), Colorado School of Mines, and Dr. Robert Vigfusson (right), Chief, Trade and Quantitative Studies Section, International Finance, Board of Governors of the Federal Reserve System (Washington, D.C.) All are members of the JPMCC's Research Council. Mr. Anderson contributed the article, "Small-Scale Electricity Storage: Future or Folly?", to this issue of the *GCARD*. Mr. Anderson's article, in turn, is based on his September 30, 2016 presentation to the JPMCC's Research Council. In addition to his multifaceted role at the JPMCC, Mr. Anderson is also the president of Razor Commodity Advisors, LLC.

This issue of the *GCARD* is divided into the following eight sections: (1) the Research Council Corner, (2) the Contributing Editor's Collection, (3) the Research Digest Articles section, (4) the Reports on the Research Council Meetings, (5) the Editorial Advisory Board Commentaries, (6) an Industry Commentary, (7) a Commodity Education Perspective, and (8) an Interview with a Thought Leader in Commodities. Each of these sections is summarized below. Of note is that the JPMCC's Research Council meetings are exclusive events, so I am delighted that three of the presenters from the September 30, 2016 meeting agreed to make their presentations available to a much wider audience through articles in the "Reports on the Research Council Meetings" section of the Spring 2017 *GCARD*. We have also included a concluding section on the JPMCC's upcoming "New Directions in Commodities Research" conference, which is being co-organized by Ajeyo Banerjee, Ph.D., Associate Professor of Finance and Risk Management, Executive & Faculty Director, JPMCC and by Graham Davis, Ph.D., Professor of Economics, Colorado School of Mines and member of the JPMCC's Research Council.

During the JPMCC's September 30, 2016 Research Council meeting, **Professor Nikos Nomikos** (left), Cass Business School, City, University of London (U.K.), in discussion with Professor Lutz Kilian (right), University of Michigan, Ann Arbor. Both are members of the JPMCC's Research Council. Professor Kilian will be a keynote speaker at the JPMCC's international commodity symposium, "New Directions in Commodity Research," in August 2017. Professor Nomikos contributed the article, "Asset Valuation and Market Expectations in Dry Bulk Shipping," to this issue of the *GCARD*. Professor Nomikos' article, in turn, is based on his September 30, 2016 presentation to the JPMCC's Research Council.

In this issue's **Research Council Corner**, our authors separately discuss the prospects for gold volatility and the interpretation of the current state of the oil market from price indicators. In the former case, Dr. Bluford Putnam of the CME Group discusses the fundamental factors that will likely impact gold prices this year. In the latter case, Professor Ehud Ronn of the University of Texas at Austin reviews both the level of spot oil prices and the implied volatility of crude oil futures prices over time and describes the varying "message from [the] markets." Both Dr. Putnam and Professor Ronn are members of the JPMCC's Research Council.

The **Contributing Editor's Collection** of digest articles covers the commodity derivatives markets from a broadly conceptual perspective, but also includes concrete examples from the live cattle, gasoline, coffee, grain, natural gas, and crude oil markets.

In the **Research Digest Articles** section, Professor Ana-Maria Fuertes of Cass Business School, City, University of London (U.K.) summarizes two scholarly papers. Professor Fuertes is also an Editorial Advisory Board member of the *GCARD*. Dr. Fuertes provides accessible interpretations of two theoretical papers, which cover (1) the diversification benefits of commodities, and (2) the question of whether idiosyncratic volatility is a specifically rewarded risk factor in the commodity futures markets. The authors of the commodity diversification paper, in turn, were recipients of one of the JPMCC's 2016 Commodities Research Fellowship Awards.

Mr. Steffen Hammer, Vice President, Corporate Purchasing, of Robert Bosch GmbH (Germany) presenting at the JPMCC's September 30, 2016 Research Council meeting. Mr. Hammer's colleague at the Bosch Group, **Sven Streitmayer**, is a member of the JPMCC's Research Council. Mr. Streitmayer contributed the article, "Emerging Challenges for Commodity Risk Managers from an Industrial Consumer's Standpoint," to this issue of the *GCARD*. Mr. Streitmayer's article, in turn, is based on the similarly themed September 30, 2016 Bosch Group presentation to the JPMCC's Research Council.

The **Reports on the Research Council Meetings** section includes the following three articles from Research Council members who presented at the Council's September 30, 2016 meeting: (1) an exposition on the economic viability of small-scale electricity-storage technology, (2) an overview on dry-bulk shipping economics, and (3) a discussion of risk-management insights from a large-scale industrial commodity consumer. This section's authors are respectively as follows: (1) Mr. Thorvin Anderson, CFA, of the JPMCC, (2) Professor Nikos Nomikos of Cass Business School, City, University of

London (U.K.), and (3) Mr. Sven Streitmayer of Robert Bosch GmbH (Germany). Dr. Ajeyo Banerjee, Executive & Faculty Director, JPMCC, had organized the September 30, 2016 Research Council meeting, and I gratefully acknowledge that Dr. Banerjee recruited this section's authors to share their respective expertise for this issue of the *GCARD*.

In the **Editorial Advisory Board (EAB) Commentaries**, four EAB members have contributed articles on the following topics: (1) futures trading strategies, (2) shale oil, (3) gold, and (4) the Texas power markets. Briefly summarizing each article, both myself and EAB member, Joseph Eagleeye, discuss the most common strategies employed by futures traders, namely: trend-following and calendar-spread trading. Ms. Ebele Kemery of J.P. Morgan Asset Management covers the current prospects for the highly resilient American shale oil industry while Dr. Fergal O'Connor of the University of York (U.K.) examines whether gold has been a reliable inflation hedge for U.S. dollar-based investors over lengthy periods of time. The concluding article of this section is by Peter O'Neill, CFA, of Uniper Global Commodities North America, E.ON. Mr. O'Neill reviews the lessons learned from a time of extreme price moves in the Texas power markets during the summer of 2015.

The **Industry Commentary** article covers the dramatic changes in the Liquefied Natural Gas markets. Anne-Sophie Corbeau of KAPSARC (Saudi Arabia) discusses the consequences of the largest increase in LNG capacity ever.

A Subject Matter Expert from the JPMCC's Professional Education program provides a **Commodity Education Perspective**. Specifically, Andy Hecht prepares readers and students for the vast changes to come in the commodity markets due to (1) the new presidential administration, and (2) the potential for energy independence in the U.S.

In this issue's **Interview with a Thought Leader in Commodities**, we have the immense privilege of interviewing Professor Vince Kaminski of Rice University and an inaugural member of the JPMCC's Research Council. Professor Kaminski describes the value that the JPMCC can potentially bring to commodity market participants, and he also summarizes his September 30, 2016 Research Council presentation on the involvement of financial institutions in the commodity markets.

As you read through this issue of the *GCARD*, we hope you will share our enthusiasm for the commodity markets in its many complex manifestations. As always, we welcome your feedback regarding new topics and markets that we should cover in future issues of the *GCARD*!

Best Regards,

Hilary.Till@ucdenver.edu

Contributing Editor, *Global Commodities Applied Research Digest*; and
Solich Scholar, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

Gold Market Dynamics Shifting Gears

Bluford Putnam, Ph.D.
Chief Economist, CME Group; and Member of the J.P. Morgan Center for Commodities' (JPMCC's) Research Council at the University of Colorado Denver Business School

Dr. Bluford Putnam, Chief Economist at the CME Group, presenting at the inaugural meeting of the J.P. Morgan Center for Commodities' (JPMCC's) Research Council on April 18, 2015.

Gold price dynamics look set to shift gears. The drivers of the new volatility patterns are likely to include (1) rising U.S. inflation leading to an increased pace of removal of monetary accommodation by the U.S. Federal Reserve (Fed), (2) expanded risk management activities by mining companies coupled with the impact of efficiencies in mining leading to more production, (3) central bank buying of gold, which some see as a contrarian indicator, and (4) continued deceleration in the debt-ridden economy of China, which is a large buyer of gold along with India. We will tackle these fundamental forces one at a time before summarizing the implications of our research into the shifting price dynamics of the gold market. First, though, let's take a quick review of the historical price action.

Over the last few years, the gold price has been stuck in a relatively wide trading range pivoting above and below $1200/ounce. (See Figure 1 on the next page.) Despite the trading range pattern, gold has had some exceptionally volatile days, and not always related to any specific news or surprises. For example, on Tuesday, October 4, 2016, the gold price precipitously dropped by $44/ounce, yet the catalyst was not so clear. There were some relatively minor Fed-related speeches suggesting a rate hike was coming in December, and higher rates are not good for gold which bears no interest. There was the U.S. Vice-Presidential debate, which was not likely to have mattered for the price of gold. And, interestingly, technical indicators had been signaling the potential for a breakdown in the gold price. Whatever the reason, trading in gold futures and options was intense in the Asian time zone even before U.S. traders woke up. October 4, 2016 was the highest volume day for gold options in 2016 on CME Group exchanges with 147,514 contracts traded, although it was well below the all-time record for gold options set on April 15, 2013. Still, options trading in the CME gold contracts on October 4 was 3.7 times the 2016 average daily volume, and the trading displayed deep liquidity in the Asian time zone.

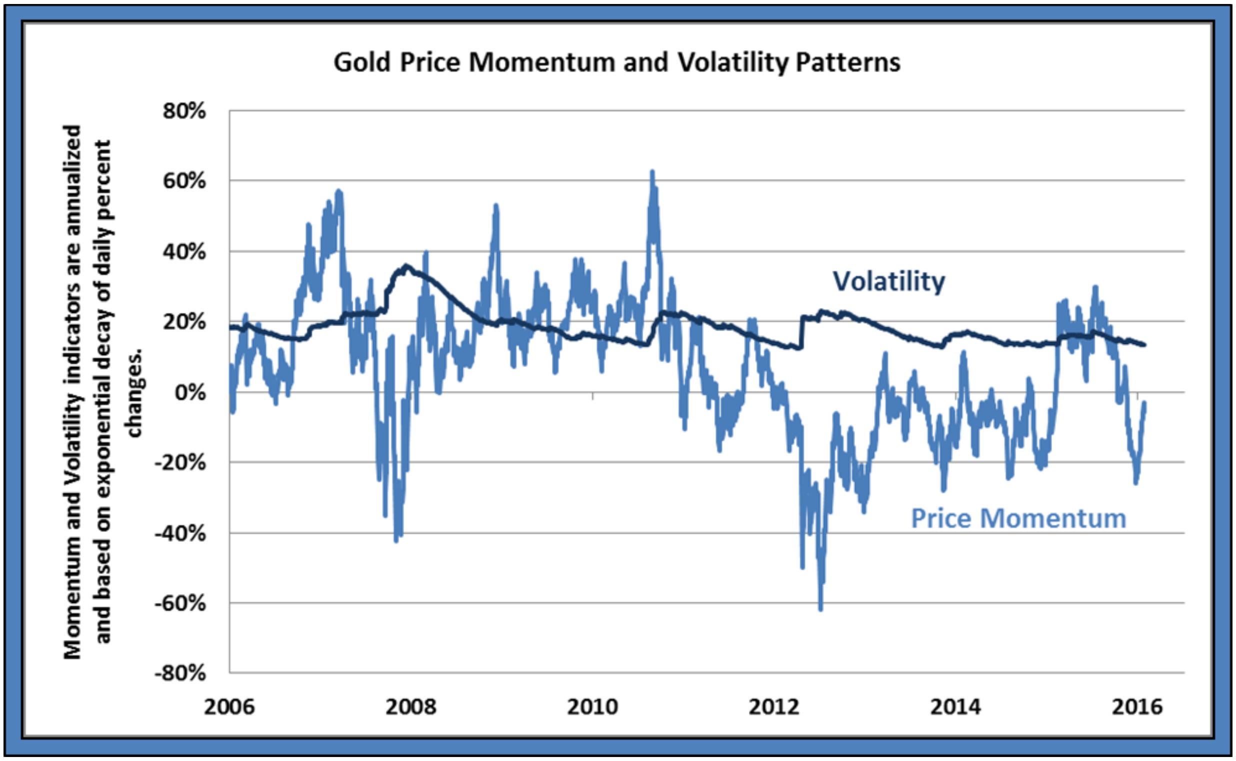
Figure 1

Source: Bloomberg Professional (GOLDS).

The main takeaway for studying the volatility patterns of the last few years is that the intraday futures and options trading dynamics suggest that market participants are much more nervous and uncertain about the how the price of gold may evolve than the observed standard deviation of daily price percent changes would suggest. At the close of 2016, gold market volatility as measured by an exponentially decaying time series process was sitting between 13% and 15% (annualized standard deviation), which is relatively calm by historical comparisons. In addition, and reflecting the trading range characterization of the market, the price momentum indicators were reading just slightly negative and very close to neutral. (See Figure 2 on the next page.)

The lack of a persistent trend and the relatively benign historically measured volatility, however, may be hiding the potential for surprise and change, if a few of the scenarios discussed below come to fruition. So, let's examine the four drivers that could change the gold price dynamics.

Figure 2



Source: Gold price data from Bloomberg Professional (GOLDS) and Momentum and Volatility indicators calculated by CME Group Economics.

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1. Removal of Monetary Accommodation

Short-term U.S. interest rates matter to the price of gold in no small part because gold bears no interest and is often held in investment portfolios as a diversifying element, given the perceived lack of correlation between gold and equity indexes. So, if U.S. interest rates are rising, then the cost of holding gold rises for diversification purposes in a broad portfolio.

The Fed made its first rate increase since the financial panic of 2008 in December 2015, and provided forward guidance that four more rate increases might follow in 2016. As it happened, the Fed reached November 2016 without having made another move. And when it decided to raise its target range for the federal funds rate at its December 2016 Federal Open Market Committee (FOMC) meeting, it only provided forward guidance for two or three rate rises in 2017. Not unsurprisingly, the Fed had lost some credibility concerning its forward guidance in 2016, despite always carefully noting that its future decisions would be data dependent.

For 2017, the Fed will, no doubt, remain data dependent, but under one scenario that may gain ground, the inflation data could be a trigger for a more rapid pace of raising rates. U.S. inflation has been held back in recent years by the weakness in commodity prices, and that weakness was reversed in commodities as diverse as oil, copper, and iron ore during 2016. Working through the economy with a lag, a case can be made that inflation may well rise faster than the Fed expects and move clearly above the Fed's long-term inflation target of 2% as 2017 progresses. If so, this would suggest as many as four rate rises in 2017, and such a development could lead to an adverse impact on the price of gold.

2. Risk Management and Efficiencies in Mining

Economists often build statistical models that ignore changes in the underlying structure of markets. That is, say, for the gold market, one might run statistical studies involving inflation, interest rates, production output, growth of China, central bank purchases or sales, and other fundamentals. What are often missing from the list of explanatory factors, however, are two very important trends in the commodity world – not just in the gold market.

First, producers of oil, natural gas, gold, silver, copper, corn, soybeans, and many other energy, metals, and agricultural products are constantly improving the efficiency of production and lowering marginal costs. Sometimes the effects of technological improvements appear on the scene in a burst of activity such as happened a decade ago with the extraction of oil and natural gas by hydraulic fracking in the United States. What often goes unnoticed, however, is that lower marginal production costs and greater efficiencies are constantly evolving, even if at an uneven pace. The long-run implication is for more production at price levels that might have been seen as prohibitively high only a few years prior.

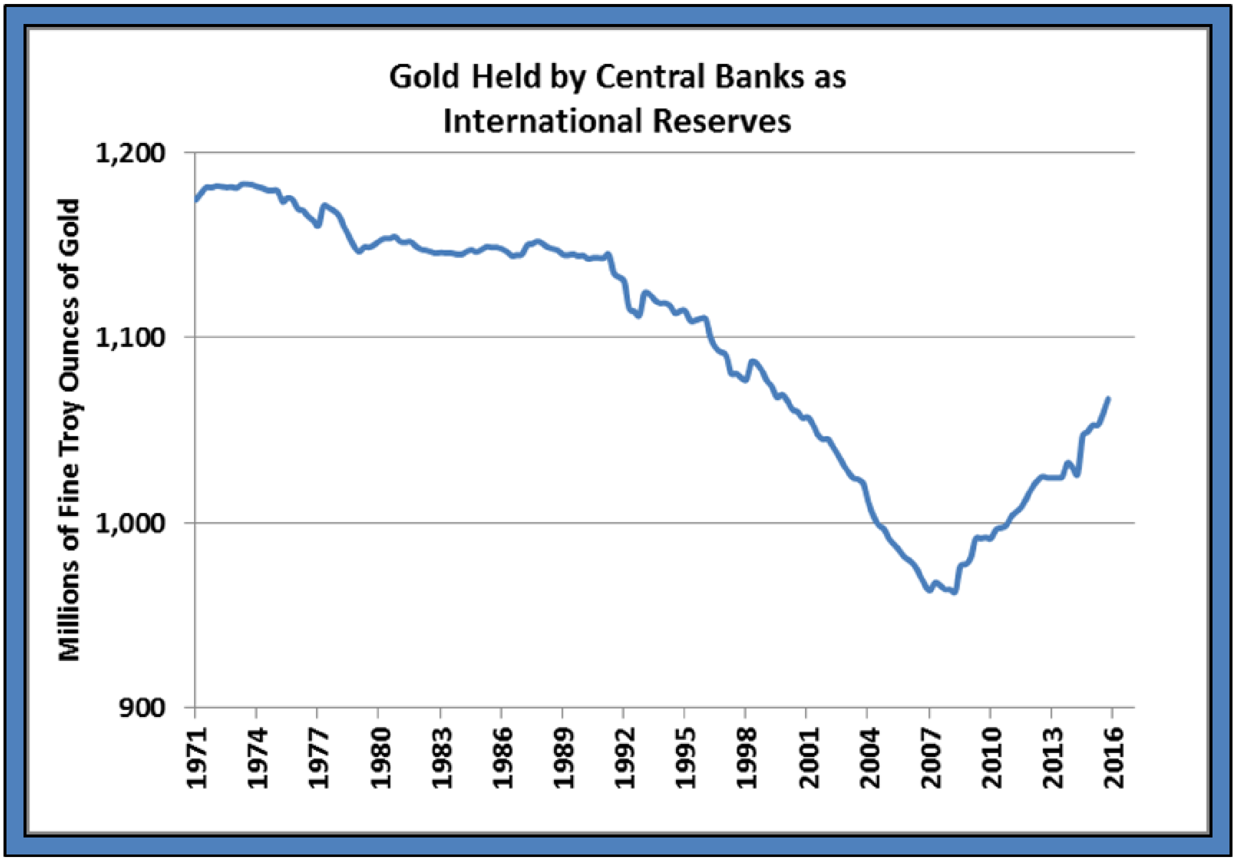
Second, producers of energy, metals, and agriculture are increasingly active in the futures and options markets to manage their risks. Trading in options, in particularly, has seen strong gains in recent years.

When we couple these two trends together, one realizes that the production response to a given price change may be very different than 5, 10, or 20 years ago. Marginal production costs are lower and the sophistication and ability of companies to manage and hedge their price risks has increased. The longer-term trend is for greater production than might have been previously expected in weaker price environments.

3. Central Bank Buying

Central banks typically have significant holdings of gold in their foreign reserve portfolios. Central banks were net sellers of gold through the 1990s and all the way until the financial crisis of 2007-2008. Since 2009, central banks have been net buyers of gold. (See Figure 3 on the next page.) That said, central banks are not known for their market-timing adeptness. A price break to the downside for gold might well temper their buying enthusiasm, leading to a sharper down trend as this source of demand is removed.

Figure 3



Source: IMF Data on Central Bank Holdings of Gold, provided by the Bloomberg Professional (001.046).

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4. China Deceleration

China and India are big importers of gold. India's economy is doing well; however, China's is decelerating. Moreover, the deceleration of China's economy has been accompanied by a weakening of the Chinese yuan relative to the U.S. dollar. China has actively resisted the currency weakness by selling foreign reserves to keep the currency from depreciating at a faster rate than otherwise. (See Figure 4 on the next page.) China has also rapidly expanded debt as a way to stimulate the economy and cushion the pace of deceleration. There are growing fears among China-watchers that the debt level has gotten precipitously high and the efficacy of using ever more debt to provide economic stimulus is waning.

Figure 4

Source: Bloomberg Professional (WIRACHIN).

The China deceleration scenario cuts two ways for gold. China may buy less gold for jewelry. But China may also increase its purchases of gold for portfolio hedging purposes. What we do know is that the trading of gold futures and options in Asian hours has expanded rapidly in the past two years, and we take this as a potential precursor of volatility to come.

Concluding Remarks

When we put these four factors together – rising US interest rates, lower costs of extraction, central bank buying, and China deceleration – at first glance we may see a mixed picture. The natural tensions among these factors, however, suggest that any move in the gold price, up or down, may come in a burst of activity and may come with significant volatility. The first two drivers point to the possibility of lower gold prices if (a) the Fed surprises with a faster pace of rate hikes and (b) mining companies expand output more than expected at current prices, given their ability to produce at lower marginal costs and to hedge their anticipated output. The other two factors – central bank buying and China deceleration – have the ability to cause even more volatility. If the price of gold were to drop, central banks might abruptly stop their purchases, removing a source of demand. And if the Chinese economy hits a downdraft, the net fall in gold imports could be a big surprise and quite material for the market.

While these are only "what if" scenarios, collectively they suggest that the current volatility regime in the gold market may be the calm before the storm.

Endnotes

All examples in this report are hypothetical interpretations of situations and are used for explanation purposes only. The views in this report reflect solely those of the author and not necessarily those of CME Group or its affiliated institutions. This report and the information herein should not be considered investment advice or the results of actual market experience.

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Dr. Bluford (Blu) Putnam is Managing Director and Chief Economist of CME Group. He manages the Strategic Intelligence & Analytics team, which includes both data science and management analytics. As Chief Economist, Dr. Putnam is responsible for leading the economic analysis on global financial markets by identifying emerging trends, evaluating economic factors and forecasting their impact on CME Group and the company's business strategy. He also serves as CME Group's spokesperson on global economic conditions and manages external research initiatives.

Prior to joining CME Group, Dr. Putnam gained experience in the financial services industry with concentrations in central banking, investment research and portfolio management. He most recently served as Managing Partner for Bayesian Edge Technology & Solutions, Ltd., a financial risk management and portfolio advisory service he founded in 2000. He also has served as President of CDC Investment Management Corporation and was Managing Director and Chief Investment Officer for Equities and Asset Allocation at the Bankers Trust Company in New York. His background also includes economist positions with Kleinwort Benson, Ltd., Morgan Stanley & Company, Chase Manhattan Bank and the Federal Reserve Bank of New York. Dr. Putnam holds a bachelor's degree in liberal arts from Florida Presbyterian College (later renamed Eckerd College) and a Ph.D. in economics from Tulane University.

Dr. Putnam has authored five books on international finance, as well as many articles that have been published in academic journals, including the *American Economic Review*, *Journal of Finance*, and *Review of Financial Economics* among others.

Dr. Putnam is also a member of the J.P. Morgan Center for Commodities' Research Council at the University of Colorado Denver Business School.

Crude Oil Contracts: The "Message from Markets"

Ehud I. Ronn, Ph.D.
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Professor Ehud Ronn (standing), McCombs School of Business, University of Texas at Austin, in discussion with Professor Vince Kaminski, Rice University, at the September 30, 2016 JPMCC Research Council meeting. Both are members of the JPMCC's Research Council.

Overview

One of the most oft-cited, and frequently hotly debated, questions in financial markets pertains to the question of what it is markets are "telling us": What is it about the level of prices, and their volatility, that conveys the message of the current state of the oil markets.

To address the "Message from Markets," this paper considers two important indicators:

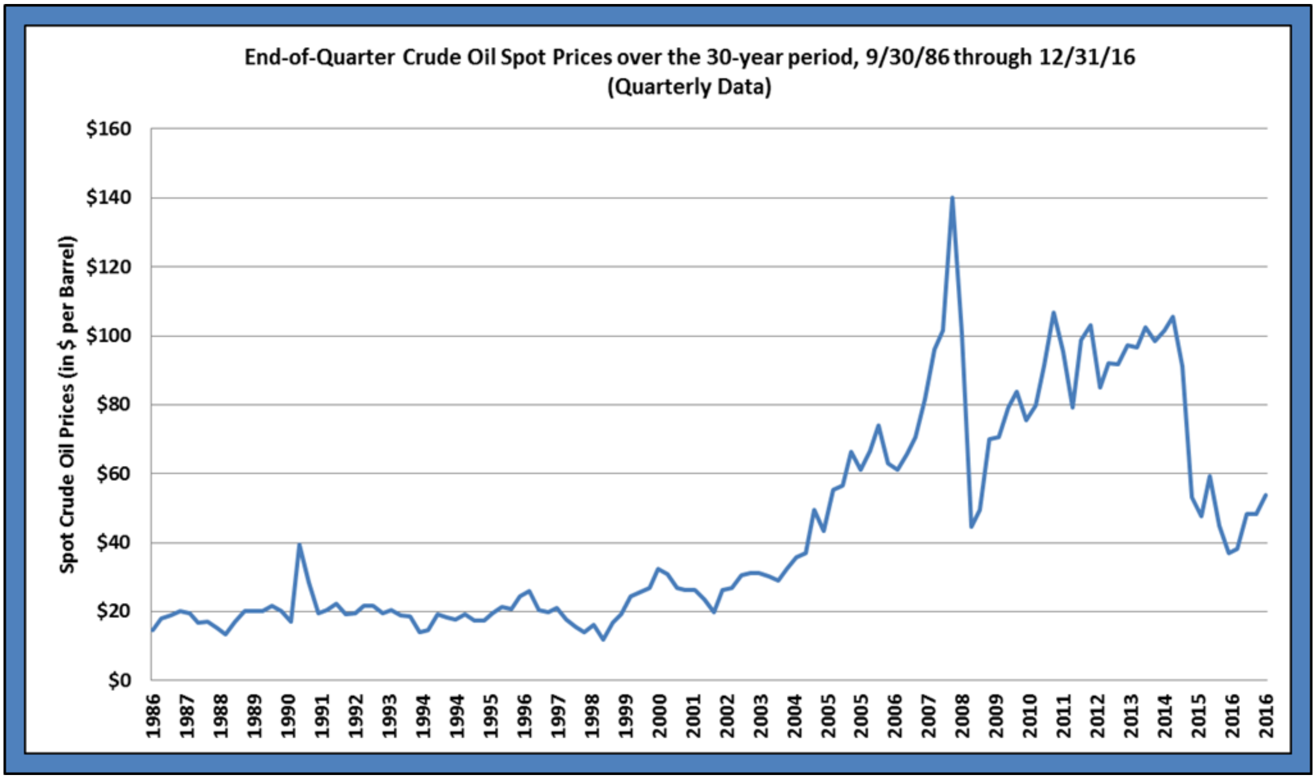
1. The *Level* of Crude Oil Spot prices (a.k.a., the crude oil "prompt-month" prices), and

2. *Volatility* — not the historical, but rather the "priced," or so-called "implied," volatility — of Crude Oil Futures Prices.

The Level of Crude Oil Spot Prices

The "spot price of crude" is defined to be the price of the "prompt-month" futures contract, that is, the futures contract closest to maturity. As the nearby contract matures and ceases trading, on or about the third week of the calendar month,[1] the next maturity futures contract takes over the role of the prompt-month contract. When we splice together the prices of these prompt-month contracts, we obtain Figure 1, which depicts end-of-quarter crude oil spot prices over the 30-year period, 9/30/86 through 12/31/16.[2] Over the first part of this period, through 2002, prices remained remarkably stable in the $20 ± $5/barrel range — the exception being the price spike to circa-$40 surrounding "Persian Gulf I" in the Aug. 1990 – Feb. 1991 period.[3]

Figure 1



Source of Data: The Bloomberg.

Beginning in 2002, prices began a dramatic increase, driven primarily by the voracious demand of the developing economies such as China and India. This particular run reached its apogee as prices rose to the $140-level at the beginning of July 2008. Then, with the onset of the worldwide recession, prices collapsed to the mid-$30 range. Subsequent to the 2009 end of the "Great Recession," prices recovered to the $100 mark before the precipitous decline in 2014 to sub-$30 levels before then appreciating again to their current $50s.

As important, if not more so, than the demand side, oil prices are dramatically impacted by supply-side concerns, geopolitical and meteorological in nature. The geopolitical concerns are found in several regions of global unrest. As is well-known, geopolitical uncertainty in at least three distinct areas of the Middle East evokes supply concerns: the eastern Mediterranean, Iraq and Iran. Outside the Middle East, supply concerns arise due to domestic unrest in the oil-producing areas of Nigeria. Finally, current relations between the United States and one of its Latin American providers, Venezuela, are occasionally sources of concern.

With the growing importance of onshore oil production using hydraulic fracturing ("fracking") in the continental U.S., the importance of meteorological phenomena such as hurricanes in the Gulf of Mexico (and, for that matter, El Niño in the Pacific Ocean) may have diminished in its ability to impact crude oil prices.

Crude Oil Futures Options' Implied Volatilities

One of the most interesting message-from-markets indicators is that of a metric inferred from option prices — the implied volatility that can be extracted from option prices using the famed Black-Scholes (1973) and Black (1976) option pricing models. After defining implied volatility, to lend perspective to the analysis we will first consider implied volatility ("implied vol") in the equity market, then make the transition to the crude oil futures market.

<u>Definition of Implied Volatility</u>

The key to the seminal contribution of the Black-Scholes-Merton option pricing model is the identification of the parameters which determine option prices.[4] Specifically, for an option on a stock index or a futures contract such as crude oil futures, the Black futures-option model (the latter is a variant of the stock-based Black-Scholes model) provides the value of an option (c) given the inputs of: futures contract price (F), strike price (K), risk-free rate (r), time to expiration (T) and prospective volatility (σ) over the remaining time to the option's expiration. It is important to note that of all these parameters, all are observable (the time to expiration and the strike price are *contractual*) save the future volatility σ.

Econometricians have devised numerous ways of estimating prospective volatility using recently-observed returns on the underlying asset (stock or futures). These volatilities are then substituted into the Black-Scholes model to obtain the option's fair market value.

In contrast to using such historically-based volatility estimates, implied vol changes the question: instead of asking,

> "What is the value of the option?"

the question posed is:

> "Given the option's observable market price, and assuming the market is using the Black-Scholes model to price options, what volatility number is the 'market' using?"

Table 1 provides a useful contrast of implied vol relative to its better-known historical-volatility counterpart:

Table 1
Contrasting Implied vs. Historical Volatilities

Descriptor	Historical	Implied
Method of Calculation	Standard Deviation of Rates of Return	Inferred from Option Prices using the Black-Scholes Model
Data Period for Calculation	*Past* History [−t, 0]	*Forward*- Looking [0, T], where T is the maturity date of the option
Bias, due to a Risk Premium, as a measure of volatility	None	Typically perceived as an *upward* -biased measure of future volatility

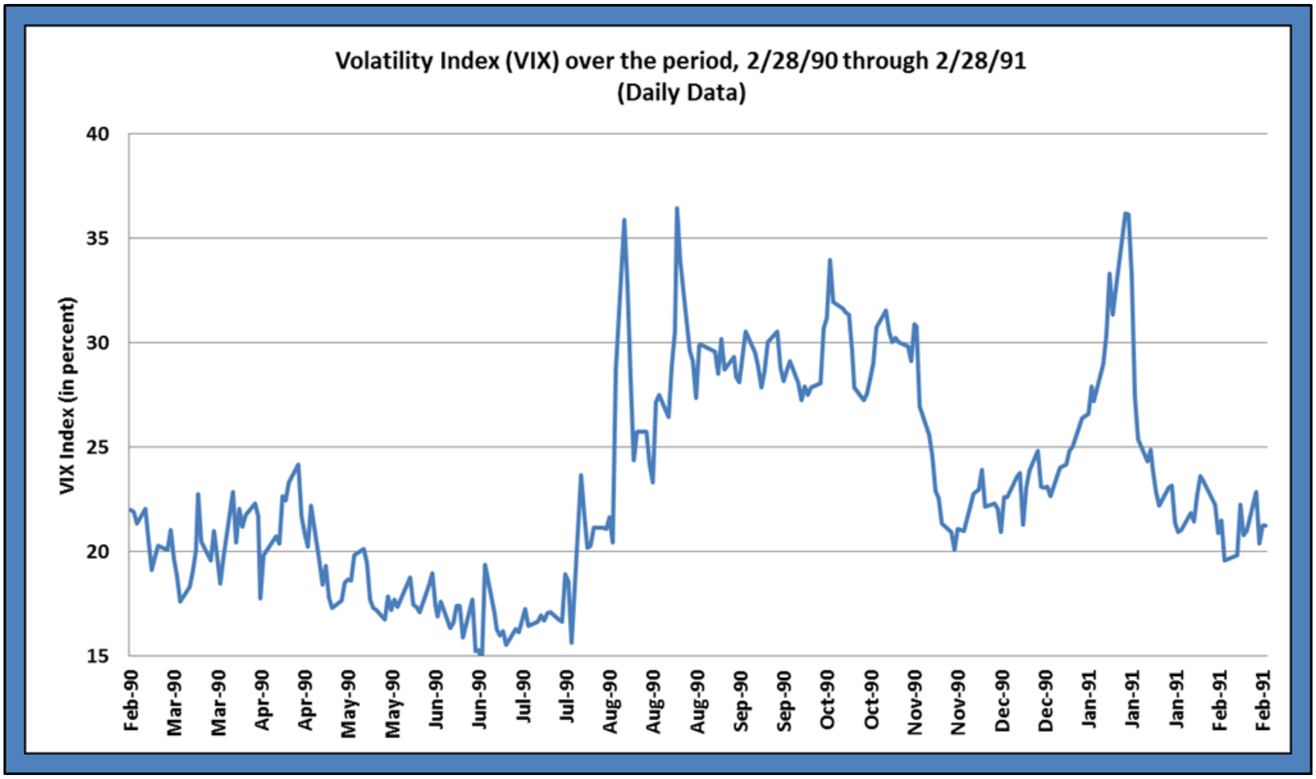
VIX — The Implied Volatility of the S&P 500 Index

The time-series of VIX, the 30-day implied volatility of the S&P 500 Index, is a subject which also fully merits an in-depth analysis of its own. Our purpose here, however, is simply to describe VIX, interpret its value and exemplify its application. Consider the following quotes from the CBOE's http://www.cboe.com/micro/vix/faq.aspx#1:

> "1. What exactly is VIX?
>
> In 1993, the Chicago Board Options Exchange (CBOE) introduced the CBOE Volatility Index, VIX, and it quickly became the benchmark for stock market volatility. It is widely followed and has been cited in hundreds of news articles in the *Wall Street Journal*, *Barron's* and other leading financial publications. Since volatility often signifies financial turmoil, VIX is often referred to as the 'investor fear gauge'. VIX measures market expectation of near term volatility conveyed by stock index option prices.
>
> 2. Why is VIX called the 'investor fear gauge'?
>
> VIX is based on real-time option prices, which reflect investors' consensus view of future expected stock market volatility. Historically, during periods of financial stress, which are often accompanied by steep market declines, option prices — and VIX — tend to rise. The greater the fear, the higher the VIX level. As investor fear subsides, option prices tend to decline, which in turn causes VIX to decline."

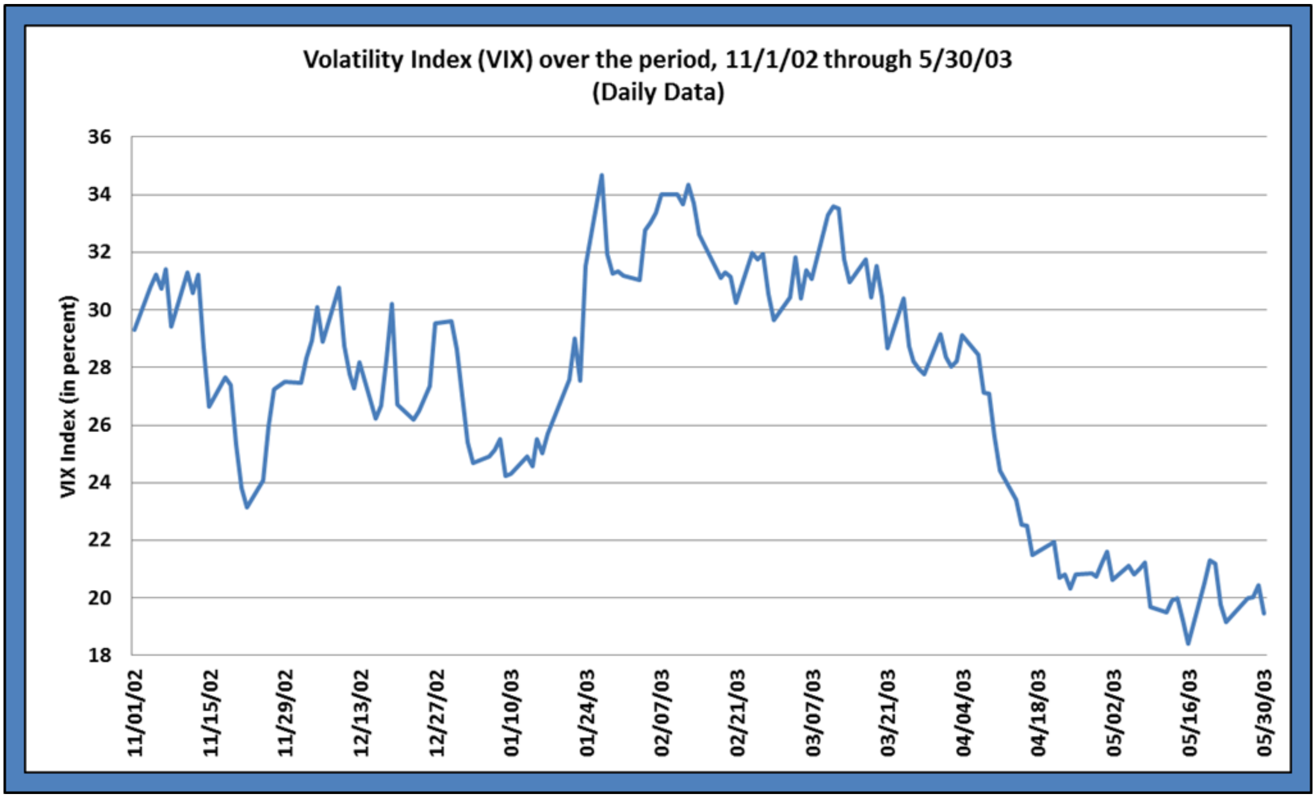
Figures 2 and 3 graph VIX over the two periods, 2/28/90 – 2/28/91 and 11/1/02 – 5/30/03, which span the two Persian Gulf conflicts.[5] VIX's high-water marks in these two periods are 36.47% on 8/23/90 and 34.69% on 1/27/03. Using VIX as the measure of investor uncertainty/nervousness, investors (through VIX) assessed both conflicts as presenting equal risks to the U. S. economy. Although political scientists may take issue with this characterization, I thus infer from VIX a quantitative measure by which to measure any crisis, be it geopolitical, economic or financial.

Figure 2



Source of Data: The Bloomberg.

Figure 3



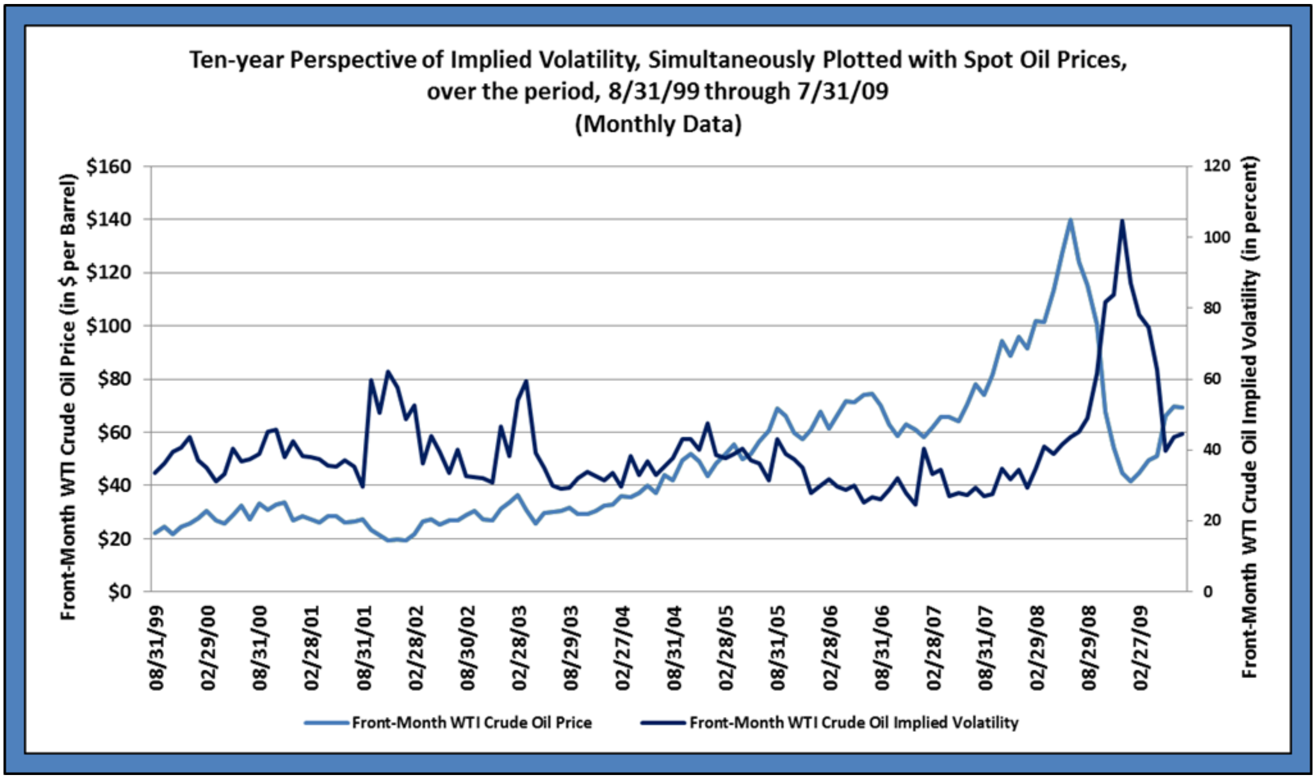
Source of Data: The Bloomberg.

Implied Volatility on Crude Oil Futures Contracts

In light of the previously-described stock market-based VIX, and its interpretation in terms of an intertemporally-comparable measure of nervousness and uncertainty, consider now the implied volatility on crude oil futures contracts. Analogous to VIX, we will in the following graphs for the most part focus on the short-term implied vol, that inferred from the option on the prompt-month crude oil futures contract:

1. Figure 4 presents a 10-year perspective (8/31/99 – 7/31/09) of implied vol simultaneously plotted with spot oil prices. The price series is depicted in dollars/barrel along the left axis; the implied vol is graphed in percentage points on the right axis. In general, non-crisis vols are in the admittedly-wide range of 20% to 40%, with recognizable crises taking the vol into higher, occasionally significantly higher, ranges.

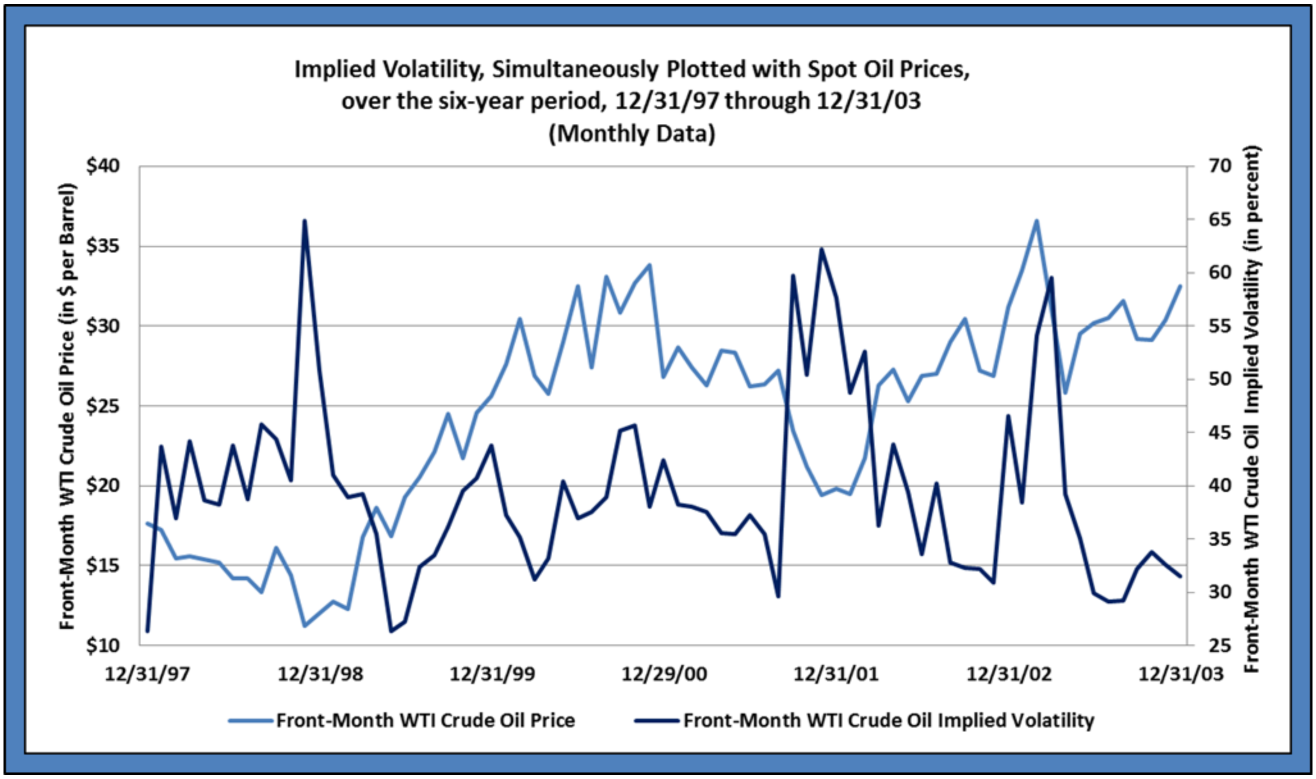
Figure 4



Source of Data: The Bloomberg.

2. Figure 5 considers these two price series over the six-year period, 12/31/97 – 12/31/03. We discern three major crisis periods over this time: the aftermath of the Asian financial crisis in 1998, the period of 9/11/01, and "Persian Gulf II" in the spring of 2003. The early and late-1970s accustomed us to thinking of oil-related crises as primarily *supply-driven*, wherein the correlation between increasing prices and higher implied vols is positive.[6] In fact, we see that two of the three most-recent episodes were in fact demand-driven: the 1998 episode is the aftermath of the Asian financial crisis, which reduced Far Eastern oil demand. In the immediate aftermath of 9/11, markets were concerned the U.S. economy would be pushed into recession or depression. In these two events, the correlation between prices and vols is negative.

Figure 5

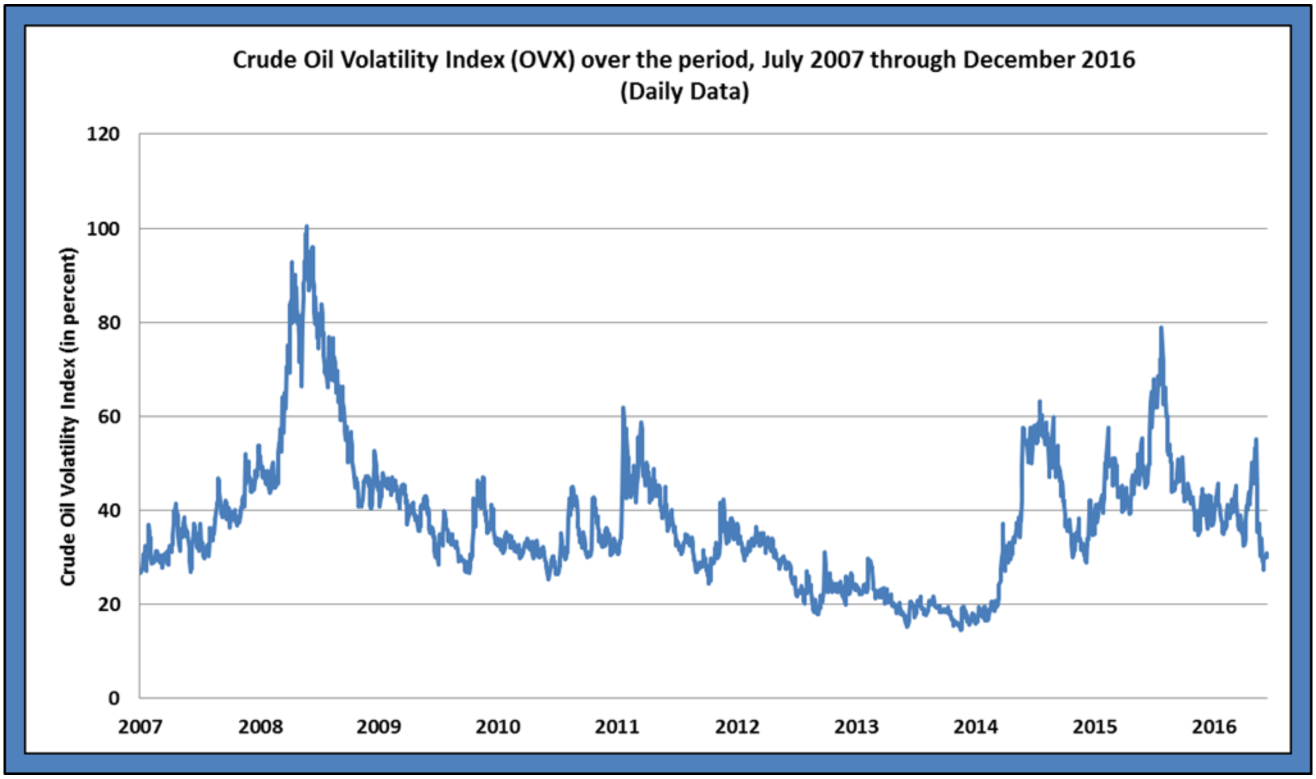


Source of Data: The Bloomberg.

The spring of 2003 is the traditional supply-driven crisis: "Persian Gulf II" raised concerns supplies of oil from the Persian Gulf would be curtailed, driving both prices and vols higher.

3. Figure 6 brings us to the present. Turning our attention to data frequency shorter than one-month, we can now use the available OVX index, initiated in May 2007, to graph the relevant crude oil implied vol on a daily, rather than monthly, granularity. As prices climbed ever-higher in June 2008 and the effects of the recession were becoming more apparent, oil vols exceeded the 40% level. As prices crashed and financial ramifications of the recession hit our financial markets, vols spiked to a peak over 100%. The observed negative correlation between prices and vols is, again, a manifestation of *demand-side* effects, clearly driven by recessionary conditions.

Figure 6



Source of Data: The Bloomberg.

Crude oil vols spiked both in 2011 — with the onset of the so-called "Arab Spring" — as well as in 2014 with the sharp decline in oil prices. As we close out this report at the end of 2016, OVX has subsided to a reasonably-moderate level of 30% (the equity VIX is at 14%).

Informationally-Efficient Financial Markets

In their well-known textbook, Principles of Corporate Finance, Brealey, Myers and Allen write:

> "If [financial markets are] efficient, prices impound all available information. Therefore, if we can only learn to read the entrails, security prices can tell us a lot about the future."

Financial markets in general, and energy finance markets in particular, are highly informative. The challenge is always in what the three authors termed "reading the entrails" — that is, what is the "Message from the Markets"? In this paper, we have attempted to address that question by considering crude oil commodity markets, specifically, the level of spot prices and the implied volatility of crude oil futures prices.

Endnotes

1 Per NYMEX specifications,"[t]rading terminates at the close of business on the third business day prior to the 25th calendar day of the month preceding the delivery month."

2 The frequency, or "granularity," of the data is not a matter of indifference. When plotting quarterly data, intra-quarter monthly, weekly, daily and intra-daily prices are lost. These latter prices will of course portray higher highs and lower lows than the end-of-quarter prices.

3 I have used the terms, "Persian Gulf I" and "Persian Gulf II," as shorthand for periods of hostilities in and around Iraq. To clarify, "Persian Gulf I" refers to Operations Desert Shield/Desert Storm (1990 – 1991), whereas "Persian Gulf II" refers to Operation Iraqi Freedom (2003).

4 The pioneers of the option pricing model were awarded the Nobel Prize in Economic Science in 1997.

5 I submit the term "investor nervousness/uncertainty index" is more appropriate, as "fear" may denote an element of irrationality.

6 Econometricians might challenge the implicit assumption of oil prices as log-normally distributed. (To explain, saying that oil prices follow the log-normal distribution is another way of saying that oil-price *returns* follow the normal distribution.) In my view, the observed volatility changes are too large to be driven by purely statistical effects.

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Prior to joining the University of Texas in July 1988, Dr. Ronn was a faculty member at the University of California, Berkeley, and the University of Chicago. Dr. Ronn was the founding director of the University of Texas at Austin's Center for Energy Finance Education and Research over the years 1997 – 2009. In Fall 2011, Dr. Ronn was a visiting professor of finance at Dartmouth College and Fordham University.

During 1991 – '93, Dr. Ronn served as Vice President, Trading Research Group at Merrill Lynch & Co. From January 2010 to February 2011, Dr. Ronn served as Commodity Market Modeling practice area manager at Morgan Stanley & Co.

From May 1998 to June 2001, Dr. Ronn was a principal of the Law and Economics Consulting Group. From June 2001 to July 2002, Dr. Ronn was appointed Senior Advisor at PA Consulting Group. Since 1993, he has served as a consultant to government agencies, an insurance company, investment banks, risk advisory firms and energy-derivative software vendors in the interest-rate and energy-commodity arenas.

In November 2004, Dr. Ronn was selected by *Energy Risk* to be included in the "Energy Risk Hall of Fame."

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Contributing Editor's Collection

Hilary Till
Solich Scholar, J.P. Morgan Center for Commodities, University of Colorado Denver Business School; and Contributing Editor, *Global Commodities Applied Research Digest*

In this issue of the *GCARD*, the Contributing Editor covers the commodity derivatives markets from a broadly conceptual perspective. Specifically, this section's collection of articles reviews (a) the potentially persistent sources of return in the commodity futures markets; (b) the differing risk-management priorities for commercial versus speculative commodity enterprises; and (c) the economic role of commodity market participants.

Each of this collection's three articles is summarized below.

Sources of Return in the Commodity Futures Markets

This digest article describes potentially persistent sources of return in the commodity futures markets due to (1) hedge pressure, (2) scarcity, and (3) weather-fear premia. Each of the strategies described in this article have all continued to exist, but sometimes, in addition, require careful timing and sophistication in trade construction.

Commodity Derivatives Risk Management: The Differing Priorities among Commercial and Speculative Enterprises

This paper discusses how risk management in commodity futures trading takes two different forms, depending on whether trading is done for a commercial or a purely speculative enterprise. The article argues that for commercial enterprises, the most important aspects of risk management are in (a) adhering to regulatory rules and laws, and in (b) establishing strict operational policies and procedures over every facet of risk-taking activity. In contrast, for a purely speculative participant, the emphasis is almost entirely on market risk-management.

The Economic Role of Hedgers and Speculators in the Commodity Futures Markets

This article notes how the terms, "hedging" and "speculation," are not precise. What futures markets accomplish is the specialization of risk-taking rather than the elimination of risk. In addition, this paper discusses how there is some empirical evidence to support the theory that speculative involvement actually reduces price volatility. This article also explains that even when commodity futures markets are viewed as "hedging" markets, there is still a vital role for speculators because there will not always be an even balance of short hedgers and long hedgers at any one time: speculators are needed to balance the market. The paper concludes by noting that it will likely always be useful to be reminded of the economic function of commodity futures markets, as public debate periodically flares up regarding these markets.

Sources of Return in the Commodity Futures Markets

Hilary Till
Solich Scholar, J.P. Morgan Center for Commodities, University of Colorado Denver Business School; and Contributing Editor, *Global Commodities Applied Research Digest*

This digest article describes potentially persistent sources of return in the commodity futures markets due to (1) hedge pressure, (2) scarcity, and (3) weather-fear premia. But the article also notes that active commodity futures strategies can be limited in scalability and can potentially lose their potency due to structural breaks or popularization.

Potentially Persistent Sources of Return

The key to understanding why there should be structural returns in the commodity futures markets is to realize that futures markets are not zero-sum games. When one only focuses on the narrow realm of commodity futures markets, it is obvious that for every winner there must be a loser. But this simplifies away the fact that each commodity futures market is embedded within a wider scheme of profits, losses, and risks of its physical commodity market. Commodity futures markets exist to facilitate the transfer of exceptionally expensive inventory risk. Moreover, commodity futures markets allow producers, merchandisers, and marketers the benefit of laying off inventory price risk at their timing and convenience. For this, commercial participants will tolerate paying a (slight) premium so long as this cost does not overwhelm the overall profits of their business enterprise.

Hedge Pressure

One source of structural return is from hedge pressure. In certain commodity futures markets, there tends to be an excess of commercial entities that are short hedgers. Therefore, in order to balance the market, investors must be willing to take up the slack of the long side of these markets. And in order to be persuaded to enter these markets, investors need a return for their risk-bearing.

In some commodity futures markets, producers are in a more vulnerable position than consumers and so will be under more pressure to hedge than consumers. This leads to a "congenital weakness" on the demand side for some commodity futures contracts, which causes these contracts' futures prices to be downwardly biased relative to future spot prices, which in turn leads to generally positive returns for holding the futures contract. Live cattle and gasoline are examples of two commodity futures markets where there appears to have historically been a systematic positive return due to a "congenital weakness" on the demand side for hedging.

For the grain markets, there have historically been seasonal times when commercial hedging tends to be long rather than short. Therefore, one might expect that in order to capture the gains from being on the other side of commercial hedge pressure, there are times when an investor's positioning needs to be from the short side rather than from the long side. In other words, when commercial hedgers are net long, we would expect that the corresponding futures price would have a tendency to be biased upwards, leading to systematic profits for an investor taking a short position in the contract. Conversely, when commercial hedgers are net short, we would expect the corresponding futures price would have a tendency to be biased downwards, leading to systematic profits for an investor taking a long position in the contract.

Scarcity

Another source of return in the commodity futures markets results from buying commodities when they are scarce. This sounds as simple as saying that a source of return in the stock market results from buying equities when they are cheap. The complications arise when one needs to define the technical indicator for when commodities are scarce or when equities are cheap. In the case of commodities, one either directly examines the commodity's supply/usage situation or indirectly examines its futures curve to determine whether a commodity is scarce or not. In the latter case, if the near-month futures contract price is trading at a premium to deferred-month contracts, one has a reliable indicator of scarcity: market participants are willing to pay a premium for the immediately deliverable commodity futures contract.

Weather Premia

Another source of systematic returns in the futures markets is due to "weather premia." A futures price will sometimes embed a fear premium due to upcoming, meaningful weather events that can dramatically impact the supply or demand of a commodity. In this class of trades, a futures price is systematically too high, reflecting the uncertainty of an upcoming weather event. We say the price is too high when an analysis of historical data shows that one can make statistically significant profits from being short the commodity futures contract during the relevant time period. And further that the systematic profits from the strategy are sufficiently high that they compensate for the infrequent large losses that occur when the feared, extreme weather event does in fact occur.

One example is from the coffee futures market. The uncertainty of weather in Brazil appears to have historically created a built-in weather premium in coffee futures prices during certain times of the year because of Brazil's susceptibility to frosts and droughts.

Scalability

The main limitation of active commodity strategies is admittedly scalability, which arises from two sources. First, one can argue that all strategies, which exploit inefficiencies, are by definition capacity-constrained. If funds are exploiting inefficiencies, this means that other investors are supplying those inefficiencies. And unfortunately, we can't all profit from exploiting inefficiencies since in that case, nobody would be supplying inefficiencies. A second factor that limits the size of active commodity strategies is unique to the futures markets. Unlike investors in the securities markets, traders of futures contracts in certain markets may not exceed the speculative position limits (spec limits) set for those markets.

Sustainability of Risk-Premia Strategies

One concern in identifying obscure strategies to monetize risk premia is that by their very identification, one will popularize these strategies to a sufficient degree that future returns may be dampened or even eliminated. For example, Siegel (2003) pointed out that "high-beta stocks beat low-beta stocks until William Sharpe discovered beta in 1964; [and] small stocks beat large ones until Banz and Reinganum discovered the size effect in 1979." Furthermore, Rosenberg *et al.* (1985) described how one could have earned abnormal returns in the stock market by buying stocks with a high ratio of book value to market price and selling stocks with a low book/price ratio. The authors' study was over the horizon, January 1973 through September 1984. The authors said, "we felt that the book/price ratio was an intriguing candidate for study. Since it had not been heavily described in the quantitative literature, it might possibly serve as an as-yet unspoiled instrument." Fourteen years later, Cochrane (1999) wrote that "the size and book/market premia [in the equity markets] seem to have diminished substantially in recent years. If this is permanent, it suggests that these opportunities were simply overlooked."

One can also point to other market "inefficiencies" that have been published and yet continue to exist. For example, Hicks (1939) developed the widely known "liquidity premium" hypothesis for bonds. In this hypothesis, Hicks notes that all things being equal, a lender would rather lend in short maturities since they are less volatile than longer-term-maturity bonds. On the other hand, an entrepreneur would rather borrow in a long maturity in order to fix his costs and better plan for the future. In order to induce borrowers to lend long, they must be offered a "liquidity premium" to do so. The result is that bond yield curves have tended to be upwardly sloping.

Like the hedging pressure hypothesis for certain commodity futures contracts, the central idea behind the "liquidity premium" hypothesis is that commercial entities are willing to pay premiums from the profits of their ongoing businesses in order to hedge away key volatile price risks. Hicks' identification of there being a liquidity premium in long-maturity bonds has not prevented the U.S. yield curve from continuing to usually be steep nor has it prevented both mutual funds and hedge funds from designing trading strategies that have historically monetized this premium.

Regarding weather-fear premia strategies, these risk premia could obviously be reduced if improvements in forecasting reduced weather uncertainty. It does not appear though that weather forecasting has improved sufficiently just yet to reduce the uncertainty surrounding key weather times. While weather uncertainty should remain a fundamental factor in commodity trading, there is another way that these strategies can become obsolete. For decades the United States had been the dominant soybean producer. It is now the case that Latin American countries produce a majority of the world's soybeans, which means that trading strategies, which focus on U.S. weather, no longer have the potency they once had in the past. Also, to the extent that Vietnam becomes a more significant coffee producer, one may see coffee futures strategies that are timed around Brazilian weather events lose their potency as well.

Conclusion

While a number of superior trading strategies have historically been quite fleeting, especially once they are popularized, one should add the following about the commodity strategies discussed in this digest article: they have all continued to exist, but sometimes, in addition, require careful timing and sophisticated trade constructions.

Endnotes

This paper is excerpted from a seminar provided by the author at the Chicago Institute of Investment on November 23, 2016. The concepts in this article were jointly developed with Joseph Eagleeye, Co-Editor of Intelligent Commodity Investing and Editorial Advisory Board member of the *GCARD*.

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Keywords

Commodity futures, trading, live cattle, gasoline, coffee, grain markets.

Commodity Derivatives Risk Management: The Differing Priorities among Commercial and Speculative Enterprises

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This digest article discusses how risk management in commodity futures trading takes two different forms, depending on whether trading is done for a commercial or a purely speculative enterprise.

In a commercial enterprise, the rationale for trading activity is usually to "optimize the value of physical assets;" and the returns and risks from this activity would be expected to be a fraction of the enterprise's overall profits and losses. One would include BP's trading activity in this category, for example.

Commercial and investment banks also engage in commodity derivatives trading, historically to facilitate their overall business in financing natural-resource producers. This is the case with Canadian commercial banks.

For commercial enterprises, the most important aspects of risk management are arguably in adhering to regulatory rules and laws, and in establishing strict operational policies and procedures over every facet of risk-taking activity.

For a purely speculative participant, the emphasis is almost entirely on market risk-management. The barriers-to-entry in futures trading are remarkably low: strictly speaking, a participant solely needs a quote device to track the markets and a Futures Commission Merchant (FCM) to execute and clear one's trades. The tail risk on a futures trading position is ultimately the responsibility of an FCM.

It has become ingrained in the minds of financial-market participants that should fixed-income or equity markets ever have extreme dislocations, they could ultimately rely on a "central-bank put" underwritten by either the Federal Reserve Board (Fed) or the European Central Bank. In contrast, commodity speculators are forced to rely on disciplined risk management. The financial writer, Ralph Vince, goes so far as to recommend that before studying the mathematics of money management, one should consider what would happen if the prospective trader suffered a cataclysmic loss:

"Take some time and try to imagine how you are going to feel in such a situation. Next, try to determine what you will do in such an instance. Now write down on a sheet of paper exactly what you will do, who you can call for legal help … Do it now … " [Vince (1992).]

Many experienced traders have noted how ephemeral trading strategies are, or at least, how all strategies have life-cycles: "Just when you think you found the key to the market, they change the locks," declared the late Gerald Loeb, who was a highly successful financier and founding partner of E.F. Hutton, as quoted in Cashin (2008).

As a matter of fact, Weisman *et al.* (2007) have quantified one of the consequences of Loeb's observation. The expected drawdown for a strategy is positively related to how consistently profitable a strategy is, *if a threshold of returns is constantly demanded*. In the words of Weisman *et al.,* the markets have "periodic market efficiency," which is another way of saying all strategies have a limited lifespan. The "tail loss," when a strategy finally (and inevitably) outlives its usefulness, can be found to be:

Loss = [(Demanded Returns) * Probability of the Strategy Succeeding /
Probability of the Strategy Failing].

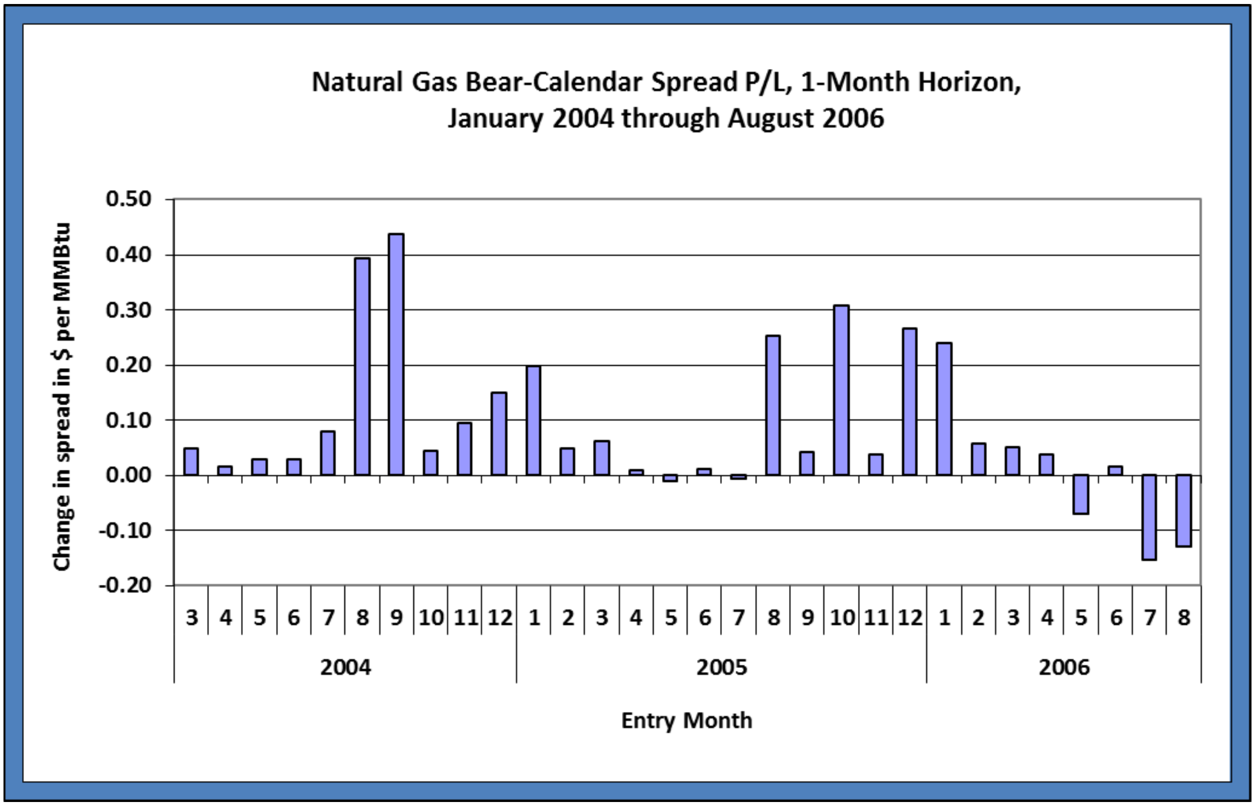
For strategies that target an absolute level of return, the natural consequences of this demand are that (1) losses are proportional to wins; and (2) losses are inversely proportional to their probability of occurrence, as explained by Weisman and his colleagues.

Ethical issues do not arise when Weisman *et al.*'s analysis is applied to proprietary trading firms since in this case it is the partners' capital at risk. The partners accept that drawdowns are endogenous to the trading strategy. As a result, they may not target absolute returns, knowing that trading strategies are fleeting. As Eagleeye (2007) wrote, "One can manage risk … [but] one can't demand a threshold return from the market." Enduring proprietary trading firms instead typically target risk.

Now, there are severe consequences to Weisman's analysis for investors in hedge funds, who historically have based their investment decisions on past historical track records, which may not be predictive of future results, and who pay hedge-fund traders based on short-term results, with no claw-backs of fees if the strategy suffers disastrous results.

We can take an example from the natural gas futures markets to illustrate the negative consequences to Weisman's observation of the "dangerous attraction" to absolute-return targeting.

Figure 1



Source of Data: The Bloomberg.

Figure 1 illustrates how consistent a strategy of trading natural gas bear calendar spreads was in the spring of 2004 through the spring of 2006. A "calendar spread" consists of taking offsetting positions during the different delivery months of a particular futures contract. A "bear calendar spread" consists of taking a short position in a nearer-month futures contract while simultaneously taking a long position in a later-delivery contract of the same futures market.

By early summer 2006, the profitability of this strategy had declined by about half of the performance of the previous two years. If the commodity futures trader had responded by doubling up his or her position size (to try to maintain an absolute-return target), then in July and August of 2006, that trader would have sustained losses about twice the size of the trader's year-to-date profits. The significance of such a loss is that when a trader's risk-and-return results differ dramatically from client and/or prime-broker expectations, this can set off a "critical liquidation cycle." In such an unfortunate cycle, client redemptions and/or additional demands for collateral from creditors cause a trader to liquidate positions in a distressed manner, which can then cause further losses that imperil a fund's survival, as both the fund's investors and creditors lose faith in the manager. This process is mathematically modeled in De Souza and Smirnov (2004) as being like a short barrier put option.

Keeping Weisman's and De Souza and Smirnov's analyses in mind, perhaps one should accept that individual trading strategies may not be enduring. But perhaps a trader's risk-management methodology can be enduring, instead.

A number of studies have indirectly verified this latter point. The fund-of-hedge-funds investor, David Gordon, found that while pre-investment returns for managers had *no* predictive value, as discussed in Gordon (2003a), it was different for risk:

"Historical standard deviation tends to be somewhat helpful in predicting future risk. The correlation between pre-investment standard deviation … [versus] downside deviation and maximum drawdown during the subsequent period of investment *is* [statistically] significant." (Italics added.) [Gordon (2003b).]

Further Kat and Menexe (2003) found that the historical value of a hedge-fund manager's track record is precisely in its risk characteristics; they found that the standard deviation of a manager's returns (and the manager's correlation to the stock market) was what persisted across time, but *not* manager performance itself.

Interestingly, for institutionally-scaled hedge funds, the publicly available information on these funds is precisely in the quality of their risk-management-and-monitoring infrastructure. In the past, this has been the message from the extensive Moody's operational reports on Chicago-based Citadel Investments and London-based Brevan Howard, both of which are multi-billion dollar hedge funds.

So perhaps it is not controversial, after all, to state that risk management is the most important aspect of a derivatives trading operation. Till (2016a) briefly discusses the apparent risk-management lapses at three large institutions involved in commodity derivatives trading; these lapses were mainly operational in nature rather than market-risk problems *per se*.

In contrast with a proprietary trading firm, one is not dealing with the complex external world of clients, distribution agents, and enhanced regulatory scrutiny, so complexity in the trading process is much more acceptable (and possible.) In addition, there is no agency-versus-principal problem of struggling to come up with the right incentives so that agents handle client or shareholder obligations responsibly. At a proprietary trading firm, the principals have their own capital at risk so a complex system of controls and incentives becomes a moot point: the possibility of facing personal bankruptcy is usually a sufficient disciplining mechanism in carrying out business operations responsibly. Accordingly, Till (2016b) discusses the practical issues involved in applying a disciplined risk management methodology to proprietary commodity futures trading.

Quite simply, a proprietary trading firm exploits some empirical regularity in the futures markets. There are two main risks to this business model. A strategy might have arisen because there was enormous commercial demand for some exposure, and there was not sufficient speculative capital to offset this demand, creating abnormal economic profits for speculators. The risk is then that what had once been one-sided flow becomes two-sided flow as more speculators enter a "too-good-to-be-true" strategy.

Another risk for proprietary traders is that there are structural breaks. A signature example is how *in the past*, the U.S. could safely be said to be the dominant participant in a number of commodity markets, especially on the demand side. This created numerous empirical regularities, particularly in the energy and grain futures markets. This is now a questionable proposition in the face of the historic Chinese industrial revolution. Another way of saying this is that numerous trading strategies, which relied on the continuation of the U.S. as the dominant factor in commodity demand, no longer work.

These two risks can best be explained by understanding that the fundamental nature of speculative commodity futures trading is "flow trading." As discussed in previous work:

- "Many traders in sizeable organizations benefit from extensive information flow, and many of these traders do not even realize the degree of their dependence on such information.
- Once removed from the deep information channels, many formerly successful traders may become incapable of trading profitably.
- In other instances, the … effects of reduced information flow are more difficult to detect. In these scenarios, it appears at first that a trader is unaffected by his or her new situation and is able to perform as well as he or she had historically.
- After a period of time, [however,] … the trader's performance dissipates dramatically.
- This phenomenon is often caused by the fact that when an individual leaves an institution, they may be able to maintain several key relationships with former colleagues, clients, or counterparties who are still in a position to provide valuable information flow for some while. As time passes, however, this information flow … often … dwindle[s], … thereby leaving these traders unable to perform as they had historically.
- In order to avoid such a situation, flow traders either need to find new return drivers or become large enough so that they can obtain similar information themselves before their relationships expire."

These observations help us understand how temporary any individual trader's capacity to be profitable can be, once they leave the employment of institutionally-sized firms.

Conclusion

This article takes the position that for institutionally-scaled firms, operational issues are of paramount importance in commodity risk management. For proprietary trading firms, the top priority is different: it is to manage the risk of decaying information flow.

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Keywords

Risk management, commodity derivatives, trading, natural gas.

The Economic Role of Hedgers and Speculators in the Commodity Futures Markets

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This digest article briefly explains the economic role of hedgers and speculators in the commodity futures markets based on a review of both historical and empirically-grounded literature.

Introduction

This article notes how the terms, "hedging" and "speculation," are not precise. What futures markets accomplish is the specialization of risk-taking rather than the elimination of risk. In addition, this paper discusses how there is some empirical evidence to support the theory that speculative involvement *actually* reduces price volatility. The article also explains that even when commodity futures markets are viewed as "hedging" markets, there is still a vital role for speculators because there will not always be an even balance of short hedgers and long hedgers at any one time: speculators are needed to balance the market.

Hedging as "Speculating on the 'Basis'"

In discussing the economic role of hedgers and speculators in the commodity markets, one nuanced point to make straightaway is that the terms, "hedging" and "speculation," are not precise, as developed by Cootner (1967) and discussed in Till (2012a, 2012b). For example, a commodity merchant who hedges inventories creates a "basis" position and is then subject to the volatility of the relationship between the spot price and the futures price of the commodity. The merchant is, in effect, speculating on the "basis." The basis relationship tends to be more stable and predictable than the outright price of the commodity, which means that the merchant can confidently hold more commodity inventories than otherwise would be the case. What futures markets make possible is the specialization of risk-taking and not the elimination of risk.

Speculation as a Risk-Bearing Specialization

Who would take the other side of the commercial hedger's position? Answer: A speculator who specializes in that risk bearing. The speculator may be an expert in the term structure of a futures curve and would spread the position taken on from the commercial hedger against a futures contract in another maturity of the futures curve. Or the speculator may spread the position against a related commodity. Till and Eagleeye (2004, 2006) provided examples of both intra-market spreading and inter-market spreading, which arise from such risk-bearing.

Alternatively, the speculator may detect trends resulting from the impact of a commercial's hedging activity, and be able to manage taking on an outright position from a commercial because the speculator has created a large portfolio of unrelated trades. Presumably, the speculator will be able to dampen the risk of an outright commodity position because of the diversification provided by other unrelated trades in the speculator's portfolio. In this example, the speculator's risk-bearing specialization comes from the astute application of portfolio theory.

Speculation's "Value to Society"

What then is the economic role of commodity speculation and its "value to society"? Ultimately, successful commodity speculation results from becoming an expert in risk bearing. This profession enables commercial entities to privately finance and hold more commodity inventories than otherwise would be the case because they can lay off the dangerously volatile commodity price risk to price-risk specialists. Those commercial entities can then focus on their area of specialty: the physical creation, handling, transformation, and transportation of the physical commodity.

Cootner (1961) wrote that in the absence of being able to hedge inventories, a commercial participant would not rationally hold "large inventories … unless the expected price increase is greater than that which would be required to cover cash storage costs by an amount large enough to offset the additional risk involved."

If the existence of price-risk-bearing specialists ultimately enables more inventories to be created and held than otherwise would be the case, we would expect their existence to lead to the lessening of price volatility. To be clear, why would this be the case?

The more speculators there are, the more opportunity there is for commercial hedgers to find a natural other side for hedging prohibitively expensive inventories. This in turn means that more inventories can be economically held. Then with more inventories, if there is unexpected demand, one can draw from inventories to meet demand, rather than have prices spike higher to ration demand.

Reduction of Volatility

There is some empirical evidence to support the theory that speculative involvement *actually* reduces price volatility.

For example, Professor David Jacks examined what happened to commodity-price volatility, across countries and commodities, before and after specific commodity-contract trading has been prohibited in the past. Jacks (2007) also examined commodity-price volatility before and after the establishment of futures markets, across time and across countries. Jacks' study included data from 1854 through 1990. He generally, but not always, found that commodity-price volatility was greater when there were *not* futures markets than when they existed, over 1-year, 3-year, and 5-year timeframes.

Irwin and Sanders (2011) noted that "[commodity] index positions [have] led to lower volatility in a statistical sense," when examining 12 agriculture markets and 2 energy futures markets from June 2006 to December 2009. Specifically, "… there is *mild* evidence of a negative relationship between index fund positions and the volatility of commodity futures prices, consistent with the traditional view that speculators reduce risk in the futures markets and therefore lower the cost of hedging." [Italics added.]

Holbrook Working's Answer on How to Measure "Excessive Speculation"

The historical writings of Holbrook Working frequently provide insight and a sense of constancy in how to frame the ongoing debate on futures trading. Working was a Stanford University professor whose writings on the economic role of futures trading are considered fundamental to our present understanding of these markets. His work spanned the 1920s through the 1970s.

According to Working, the economic purpose served by commodity futures markets is to allow commercial participants to hedge prohibitively expensive inventories. The role of the speculator, then, is to take on and manage this risk. If one accepts this framework, then one does not see futures exchanges as casinos.

A U.S. federal agency (which preceded the CFTC) provided data that classified market participation as either hedging or speculation. With this data, one could construct ratios to see how much excess speculation (if any) there was over hedging needs. Holbrook Working created a simple ratio to do just that. This is Working's Speculative T index.

Sanders *et al.* (2008) defined the Working T index as follows:

> "T = 1 + SS / (HL + HS) if (HS >= HL)
> or
> T = 1 + SL / (HL + HS) if (HL > HS)
>
> where open interest held by speculators (non-commercials) and hedgers (commercials) is denoted as follows:
>
> SS = Speculation, Short
> HL = Hedging, Long
> SL = Speculation, Long
> HS = Hedging, Short"

Some explanation is in order to make this statistic intuitive. The denominator is the total amount of futures open interest due to hedging activity. If the amount of short hedging is greater than the amount of long hedging, then speculative longs are needed to balance the market; and technically, speculative shorts are not required by hedgers. Any surplus of speculative short positions would thereby need to be balanced by additional speculative long positions. Technically, then the speculative short positions would appear to be superfluous or perhaps even "excessive." The Speculative T index measures the excess of speculative positions beyond what is technically needed to balance commercial needs, and this excess is measured relative to commercial open interest.

Sanders *et al.* (2008) explained, "Working is careful to point out that what may be 'technically an *excess* of speculation is economically necessary' for a well-functioning market."

For the Speculative T index, are value(s) greater than 1 considered excessive?

The following are average T indices from historical agricultural studies, excerpted from Sanders *et al.* (2008):

1.21 (calculated from 1954-1958 data);

1.22 (calculated from 1950-1965 data);

1.26-to-1.68 (calculated from 1947-1971 data); and

1.155-to-1.411 (calculated from 1972-1977 data).

Evidently, the concern in past historical studies was the *inadequacy* of speculation in the agricultural futures markets, so these historical T indices would therefore *not* be considered indicative of excessive speculation.

Interestingly, the past historical studies referenced in Sanders *et al.* (2008) contradict the assertion that well-functioning commodity futures markets should necessarily relegate speculative participation to a residual role. Perhaps if one sees commodity speculators as a heterogeneous set of risk-bearing specialists, then one would understand why it would not be beneficial to force speculative participation into a tertiary role.

Sanders *et al.* (2008) studied whether there was excessive speculation in the agricultural futures markets, updating previous studies that began with Working (1960), and using Working's T index. After calculating Working's T index across agricultural futures markets, these economists found no pervasive evidence that then-prevalent speculative levels were in excess of those recorded historically for agricultural futures markets, even after accounting for index trader positions.

In the Fall of 2009, the CFTC released a dataset, which facilitated further analysis of the speculative excess hypothesis across commodity markets. Specifically, on October 20, 2009, the CFTC released three years of enhanced market-participant data for 22 commodity futures markets in the "Disaggregated Commitments of Traders" (DCOT) report. The release of this data was important because one could then evaluate whether the balance of outright position-taking in the U.S. exchange-traded *crude oil* derivatives markets had been excessive relative to hedging demand during the previous three years. One could do so by calculating T indices for the U.S. crude oil futures market.

Using this data and with some notable caveats, one could conclude that speculative position-taking in the U.S. oil futures markets did not appear excessive when compared to the scale of commercial hedging at the time, according to Till (2009). One has to be careful with how strongly one states this paper's conclusions since, for example, the paper did not examine whether there was excessive speculation in the oil markets in other venues besides the U.S. oil futures markets.

Conclusion

Public scrutiny of, and skepticism about, commodity futures markets has had a long tradition in the United States, dating back to (at least) the last great era of globalization in the 1890s. As a result, it will likely always be useful to be reminded about the economic function of commodity futures markets, as public debate periodically flares up regarding these markets.

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Keywords

Hedging, speculation, price volatility, commodity futures.

Diversification Benefits of Commodities: A Stochastic Dominance Efficiency Approach

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https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2684842

This paper revisits the question of whether it is worthwhile for investors to include commodities in their equity and bond portfolios. For this purpose, the article employs a methodology that makes fewer assumptions than the classic mean-variance optimization approach to construct optimal portfolios with and without commodities. Specifically, the paper's approach circumvents the need to (a) make assumptions on the distribution of asset returns and (b) make restrictive assumptions on investor preferences. In-sample and out-of-sample, the findings suggest that commodities provide diversification benefits, especially, for second- and third-generation commodity indices. The paper shows that commodity returns cannot be explained by the factors that drive financial asset returns, which further verifies that commodities are a unique, potentially diversifying asset class.

Introduction

The growth in commodity investments since the early 2000s is commonly attributed to the fact that commodities form an alternative asset class; their returns are expected to show small or even negative correlation with the returns of assets that belong to traditional asset classes like stocks and bonds. Therefore, the inclusion of commodities in portfolios consisting of traditional asset classes is expected to yield diversification benefits; namely, their inclusion increases expected return per unit of risk. However, there is still an ongoing debate on whether the inclusion of commodities in portfolios of traditional asset classes makes investors better off. To shed light on this debate, this paper adopts a non-parametric approach that allows for constructing portfolios without (a) having to make assumptions on asset class return distributions and without (b) having to make very restrictive assumptions on investor risk-and-reward tradeoffs.

Why the Paper's Research Question is Important

The previous literature about the diversification benefits of commodities makes strong assumptions about investors' preferences and the distributional properties of asset returns. The authors revisit this

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research question by employing an approach that in the main circumvents these two obstacles and requires minimal knowledge of an investor's preferences in terms of risk-and-reward tradeoffs.

Data Description

In their main study, the authors employ the S&P 500 Total Return Index, the Barclays U.S. Aggregate Bond Index and the one-month Libor rate to proxy the equity market, the bond market and the risk-free rate, respectively. To access the commodity asset class, they use a number of widely-followed first-, second- and third-generation commodity indices. This is in contrast to the previous literature that considers only first-generation commodity indices for portfolio construction purposes. Second- and third-generation commodity indices allow for both long and short positions in constituent commodity futures, and they take changes in the term structure of commodity futures into account. The authors consider the S&P Goldman Sachs Commodity Index, the Dow Jones-UBS Commodity Index (which was rebranded as the Bloomberg Commodity Index in 2014), and the Deutsche Bank Liquid Commodity Index as representatives of the first-generation indices. Similarly, the J.P. Morgan Commodity Curve Index, the Deutsche Bank Liquid Commodity Index-Optimum Yield, the Morningstar Long/Flat Commodity Index and the Morningstar Long-Only Commodity Index are considered as representatives of the second-generation indices. Finally, the Morningstar Short/Flat Commodity Index, the Morningstar Short-Only Commodity Index and the Morningstar Long/Short Commodity Index are employed to proxy the third-generation indices. The dataset spans the period from January 1990 to September 2013 with the exception of the Dow Jones-UBS Commodity Index that covers the period from January 1991 to September 2013 due to data availability constraints.

Description of Investigation

The paper starts by investigating the question whether the introduction of commodities in the investor's asset universe yields diversification benefits in-sample. To this end, they employ a statistical procedure that assesses whether an asset universe that includes commodities yields a portfolio that dominates a portfolio originated from the same asset universe without commodities. This statistical procedure is described in Scaillet and Topaloglou (2010).

Second, moving on to the out-of-sample exercise, the authors construct optimal portfolios with and without commodities at any point in time from January 2001 to December 2013 in a rolling window fashion using the same statistical procedure as in step one. The task of comparing the out-of-sample performance of the alternative optimal portfolios is based on the complex statistical approaches described in both Scaillet and Topaloglou (2010) and in DeMiguel *et al.* (2009).

Results

The main finding from both the in- and out-of-sample exercises is that the inclusion of the commodity asset class in portfolios comprising traditional asset classes makes investors better off. Moreover, the diversification benefits of commodities are more pronounced in the case where the investor accesses commodities via the second- and third-order generation commodity indices. They explain their evidence on the diversification benefits of commodities by the notion of market segmentation. More specifically, by implementing Campbell and Hamao's (1992) test for market integration, they find that commodity portfolio returns cannot be forecasted by the same instrumental variables that predict stock and bond market returns. This suggests that commodity markets are segmented from equity and bond markets.

Endnotes

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Keywords

Alternative asset class, commodity indices, portfolio choice, stochastic dominance.

Is Idiosyncratic Volatility Priced in Commodity Futures Markets?

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This article investigates the nexus between idiosyncratic volatility and returns in commodity futures markets. The findings indicate that the abnormal performance of active strategies, which systematically exploit idiosyncratic volatility, is a fallacy associated with the use of an inappropriate benchmark. Suitable benchmarks that are related to a commodity's curve shape (i.e., whether the market is in backwardation or contango) reveal instead the reality of idiosyncratic volatility not being priced because it can be diversified away.

Introduction

A financial asset's idiosyncratic volatility is typically measured as the residual standard deviation of an appropriate empirical model that captures the relationship between systematic risk and expected return. A challenging question still subject to debate in the context of commodities is: which are the most appropriate risk factors? This paper measures idiosyncratic volatility relative to two families of pricing models as benchmarks. Inspired by the traditional asset pricing literature, the first family of models includes as risk factors the S&P-GSCI, U.S. value-weighted equity index, equity size (known as small-minus-large, SMB), equity value (or high-minus-low, HML), equity momentum (or up-minus-down, UMD), and the Barclays bond index.

The second family of commodity pricing models employed in this paper stems from the theories of storage (Kaldor, 1939; Fama and French, 1987) and hedging pressure (Cootner, 1960). The risk factors that emanate from these theories are designed to capture the fundamentals relating to a commodity futures contract's curve shape.

The main finding of the paper is that traditional benchmarks lead to a spurious negative relationship between past idiosyncratic volatility of commodity futures contracts and subsequent excess returns. The paper shows that when the benchmarks are based on long-short commodity risk factors that exploit term structure, hedging pressure or momentum signals (and thus, capture the fundamentals of

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backwardation and contango), there is no significant relationship between past idiosyncratic volatility and subsequent returns in commodity futures markets.

Why the Paper's Research Question is Important

The paper provides findings that are relevant for commodity pricing theory in highlighting the relevance of benchmarks that employ risk factors that are related to a commodity's futures curve shape. The article also provides lessons for market practitioners as it uncovers the fallacy of abnormal profitability of idiosyncratic volatility trading in commodity futures markets.

Commodity Futures' Risk Factors

The paper's commodity risk factors are constructed as long-short portfolios according to term structure (TS), hedging pressure (HP) and momentum (Mom) signals from a wide cross-section of 27 commodity futures. The TS portfolio buys the 20% of contracts with the most downward-sloping term structures and shorts the 20% of contracts with the most upward-sloping term structures. The HP portfolio buys the 20% of contracts for which hedgers are the shortest and speculators the longest and sells the 20% of contracts for which hedgers are the longest and speculators the shortest. The Mom portfolio buys the 20% of contracts with the best past performance and sells the 20% of contracts with the worst past performance. These end-of-month rebalanced portfolios are based on 12-month (ranking period) averaged signals. The holding period is 1 month. The quintile constituents are equally-weighted. The portfolios are fully collateralized.

The data employed in the analysis are sampled at the daily frequency and cover the period from January 1989 to December 2013. Summing up the performance of the risk factors over the sample period, the paper observes that the Sharpe ratio of the long-short commodity portfolios averages 0.46, whereas that of the long-only S&P-GSCI is just 0.02. This confirms the wisdom that investors benefit from taking long positions in backwardated markets and short positions in contangoed markets.

Does Idiosyncratic Volatility Explain the Cross-Section of Commodity Returns?

At the end of each month during the sample period, the paper measures the idiosyncratic volatility of each commodity as the residual standard deviation of a daily time-series regression model of the commodity excess returns on the relevant set of risk premia factors, according to the benchmark (pricing model) at hand. For each commodity and per sample month t, this procedure results in the calculation of the betas or factor loadings, $\beta(t)$, and an idiosyncratic volatility measure, $IVol(t\text{-}R,t)$, where R={1, 3, 6, 12} denotes the length of the ranking period or time-series regression estimation window in months. Next a cross-section regression is estimated per sample month t to explain the variation in excess returns of the 27 commodities using as regressors the contemporaneous risk factor loadings, $\beta(t)$, and the prior R-month IVol measure.

The results of using one *versus* another type of benchmark provide a stark contrast:

a) In the context of traditional benchmarks, IVol is priced cross-sectionally and commands a significantly negative risk premium.

b) In the context of curve-shape-related benchmarks, IVol is not priced.

The contrasting findings indicate that idiosyncratic volatility proxies for a "missing" risk factor in traditional benchmarks that relate to backwardation and contango.

Idiosyncratic Volatility Trading is Not Worthwhile

The paper examines the performance of a long-short idiosyncratic volatility strategy which buys the quintile of commodities with the lowest IVol(t-R,t) over the past R (=1, 3, 6 or 12) months, sells the quintile with the highest IVol(t-R,t) and holds the positions for a month. These long-short portfolios are fully collateralized, rebalanced at the end of each month, and the quintile constituents are equally weighted.

From the lens of traditional benchmarking, the idiosyncratic volatility strategy attains a Sharpe ratio of 0.41 and earns an alpha of about 3.89% a year. In the context of more realistic benchmarks, however, the Sharpe ratio and alpha of the idiosyncratic volatility portfolios drop substantially to 0.12 and 0.86%, respectively, suggesting that the strategy is not worthwhile (if one is already engaging in the three benchmark long-short strategies.) These findings reaffirm the tenet that idiosyncratic volatility is not priced because it can be diversified away.

Conclusions

This paper investigates the relation between idiosyncratic volatility and expected returns in commodity futures markets using traditional and curve-shape-related benchmarks. The paper shows that using traditional benchmarks leads to the spurious finding that the idiosyncratic volatility signal is negatively priced in the cross-section, and the resulting long-short portfolios are profitable as suggested by an annualized mean excess return, Sharpe ratio and *alpha* of 3.98%, 0.41 and 3.89% on average, respectively. When the benchmarks are based on long-short commodity risk factors that exploit term structure, hedging pressure or momentum signals (and thus, capture the fundamentals of backwardation and contango), the idiosyncratic volatility signal is not priced and the mean excess return, Sharpe ratio and *alpha* of the *IVol* portfolio shrink to 1.18%, 0.12 and 0.86% a year on average, respectively.

The main contribution of the paper is to demonstrate the "fallacy" of the pricing of idiosyncratic volatility in commodity futures markets. The profits made by selling commodities with high idiosyncratic volatility and buying commodities with low idiosyncratic volatility is an artifact of two methodological problems pertaining to the choice of asset pricing model. One is that the idiosyncratic volatility signal derived from traditional benchmarks is not idiosyncratic because it contains a systematic risk component related to the backwardation and contango fundamentals. Another is that the *alpha* is measured using an improper benchmark for the same reason. This digest article's research paper provides additional evidence to reaffirm that risks that relate to the backwardation and contango dynamics of commodity futures markets ought to be factored in an appropriate pricing model.

Endnote

The author of this digest article is also a member of the Editorial Advisory Board (EAB) of the *Global Commodities Applied Research Digest (GCARD).* The *GCARD*'s EAB membership is listed here: http://jpmcc-gcard.com/editorial-advisory-board/.

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Keywords

Commodity futures, idiosyncratic volatility, backwardation, contango.

Small-Scale Electricity Storage: Future or Folly?

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This digest article is based on Thorvin Anderson's presentation to the JPMCC's Research Council on September 30, 2016.

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Introduction

Recent developments in battery technology have given rise to energy storage devices targeting not just wholesale or grid support operations, but residential buyers as well. While several manufacturers compete in this space, it is Tesla, with its Powerwall, that has commanded the majority of media attention. Billed as a complement to residential rooftop solar installations, the Powerwall offers homeowners the allure of some measure of energy independence, reliability, and cost savings, all with not-too-subtle intimations that use of this storage technology is associated with superior environmental stewardship. This paper examines the Powerwall product, and by implication its competitors, in the context of today's electricity markets to consider the validity of these claims and the prospect of retail electricity storage significantly impacting the electric market.

Current State of the Retail Electricity Market

The wave of deregulation that swept through the electricity industry in the late 1990s brought vibrant wholesale markets to much of the U.S. population. In the large states of California and Texas, and from Illinois across to the eastern seaboard and up to New England, Independent System Operators (ISOs) run the electric grids, and coordinate markets that publish unique prices for sub-hourly intervals, theoretically reflective of the marginal cost to the system of producing the electrical energy. These markets represent a significant step forward in transparency and the ability to optimize asset utilization and capital allocation, compared to the monopolistic regimes that existed before and still dominate in the unreformed regions of the country. But despite the progress in wholesale deregulation, the changes stopped short of bringing retail choice to the majority of Americans. Today, only about a dozen states should even be considered as having any meaningful retail competition, and in many of those, access to a competitive retail market is severely limited. In Texas, the state with the most widespread access to retail choice, roughly 85% of the residents are able to choose their own electric providers.[1] Political pressures at the moment seem to favor a renewed push toward deregulation, however, with 72.4% of Nevada voters approving a measure last November that paves the way for eventual retail choice in that state.[2]

Any view of the retail electric market must acknowledge the non-homogeneity of not only the regional generation mix and resulting prices, but also retail policy environments; a lucrative value proposition for retail customers in one state may not be of comparable value, or even available, for their neighbors in another state. Nonetheless, we can make a few general observations that will be important to bear in mind as we consider the value of electricity storage inside a home.

- Almost all residential customers, in both regulated and choice markets, are currently insulated from real-time pricing. This means that they are separated from the price signal that could communicate to them, say, the true market value of deferring consumption to another hour. In markets that remain regulated, electricity tariffs are set through rate cases and sanctioned by the utility commissions of the respective states. They therefore bear little relationship to the wholesale market value of electricity. Even in markets with alleged "time-of-use" pricing, such as the California utilities have been directed to embrace, price differentials are set by fiat, with roughly drawn "peak" and "off-peak" periods, and are not reflective of dynamic market conditions. This separation of the retail customer from the wholesale market is not exclusive to regulated markets - in retail markets that are almost completely vertically deregulated, most customers choose rate plans which lock in their electricity prices at fixed rates for some term, such as 6 months or a year. The customer typically pays that rate on all kilowatt-hours (kWh) consumed, regardless of the timing or amount.

- Tiered pricing exists in both regulated and deregulated markets, but is typically calculated monthly, not by hour, so smoothing consumption across time periods inside a month is of limited value in avoiding higher-priced tiers. Many regulated utilities set their rates based on tiers of monthly consumption. The lowest price applies to the first tier of kWh, after which a higher price is charged on additional kWh. There may be three or more such tiers, each of successively higher price. If this tiered calculation were conducted over a short time period (such as an hour), a user could use various means to smooth consumption to avoid high-priced tiers, but that is not the way tiered pricing is typically implemented.

- Transmission and distribution (T&D) cost recovery charges are very significant, but are not levied in a manner that encourages residential customers to reduce their peak demand. Utilities have invested heavily in transmission and distribution infrastructure, and must not only recover those investments, but earn a return on the capital employed. The manner in which this occurs is generally via a $/kWh charge multiplied by the kWh energy consumption of the customer. While this value may be relatively large (approximately half the total $/kWh cost in many cases), making this cost proportional to energy consumed is at best an approximate allocation. The magnitude of transmission and distribution infrastructure required to serve a particular customer is dictated by that customer's *peak* load, not its *average* load. As an extreme example: a customer that draws 1000 kWh ratably in every hour of a month will pay the same in T&D charges as a hypothetical customer that takes the 1000 kWh in total over a month, but takes that energy all in just one hour of the month! Obviously, the delivery infrastructure required to serve the second customer is much greater than the first. Yet, given the equivalence in their T&D charges under current residential pricing schemes, each customer would pay the same.

These three phenomena serve to create informational inefficiencies in the retail markets, and inhibit customers from acting in a manner that is consistent with optimizing the use of the electricity resource, such as through energy storage via a battery. In deregulated retail markets, this may be a matter of market maturity, that participants need additional time to develop relationships and adapt to technology that allows for the communication of price information and market-responsive decision-making.

Given conducive policy and market rule frameworks, true time-of-use pricing might be offered by more retail providers if demanded by the customers, and retail providers may find ways of recovering T&D charges based on maximum usage instead of average usage. In Texas, for example, retail electric providers already offer plans that charge the customers the Locational Marginal Price (LMP) of the wholesale market, by 15-minute interval, plus a service charge.[3]

Given the advanced state of the Texas market, we will use as an example case, data from a particular residential meter in southeast Texas associated with a family of four and a relatively large dwelling. This meter was matched with a hypothetical 8 kW DC rooftop solar installation, which produces a modeled 15.4% capacity factor.[4] As emphasized earlier, retail market features are very location-specific, so conclusions drawn from this example do not necessarily apply across the United States. However, given Texas' progressive policy stance on retail deregulation, it likely represents an aggressive evaluation of the value proposition of residential storage.

Residential-Scale Storage Devices

The unveiling of Tesla's Powerwall product in April 2015, the company's first foray into residential energy storage, created considerable stir. Previous electricity storage mechanisms had stubbornly remained the domain of either utilities (as in the case of pump storage hydro-electric or compressed air energy storage facilities), or the hobbyist electing to go "off the grid" with a custom-engineered system of lead-acid batteries to complement a small generation source. With the Powerwall, Tesla clearly targets mainstream consumers. The Powerwall consists of lithium ion cells packaged into a clean, attractive housing that can be mounted to a floor or wall, either inside a house or outside.

The second generation Tesla Powerwall, announced in October 2016 and scheduled for delivery starting in early 2017, represents a significant improvement over its predecessor and competing products. The original Powerwall was a 6.4 kWh battery with peak deliverability of 3.3 kW. Tesla claims its successor will store 13.5 kWh of electrical energy, with continuous deliverability of 5 kW, and rated to accommodate surges, such as required to start inductive loads like motors, of up to 7 kW. Unlike its predecessor, the Powerwall 2 contains an onboard inverter, eliminating additional purchase of that equipment. Tesla offers its Powerwall 2 for $5500, and lists installation and supporting hardware starting at $1500, for a minimum installation cost of $7000.

No battery is 100% efficient. In other words, more electrical energy must be sourced to charge it than can be recovered during its duty cycle. In the case of the Powerwall 2, Tesla states round-trip efficiency to be 90% with a depth of discharge of 100%. Thus, a full 13.5 kWh can be discharged from the battery, but this requires 13.5/0.9 = 15kWh of energy to charge.

Prospective buyers must also be aware of another physical feature of batteries: their degradation over time. The storage capacity of batteries declines with duty cycles, and Tesla's updated warranty explicitly excludes "normal degradation of your Powerwall's energy capacity over time."[5] This means that consumers must factor in a decline in future performance by as much as 40% over 10 years, based on minimum performance guarantees in earlier formulations of the Tesla warranty.[6]

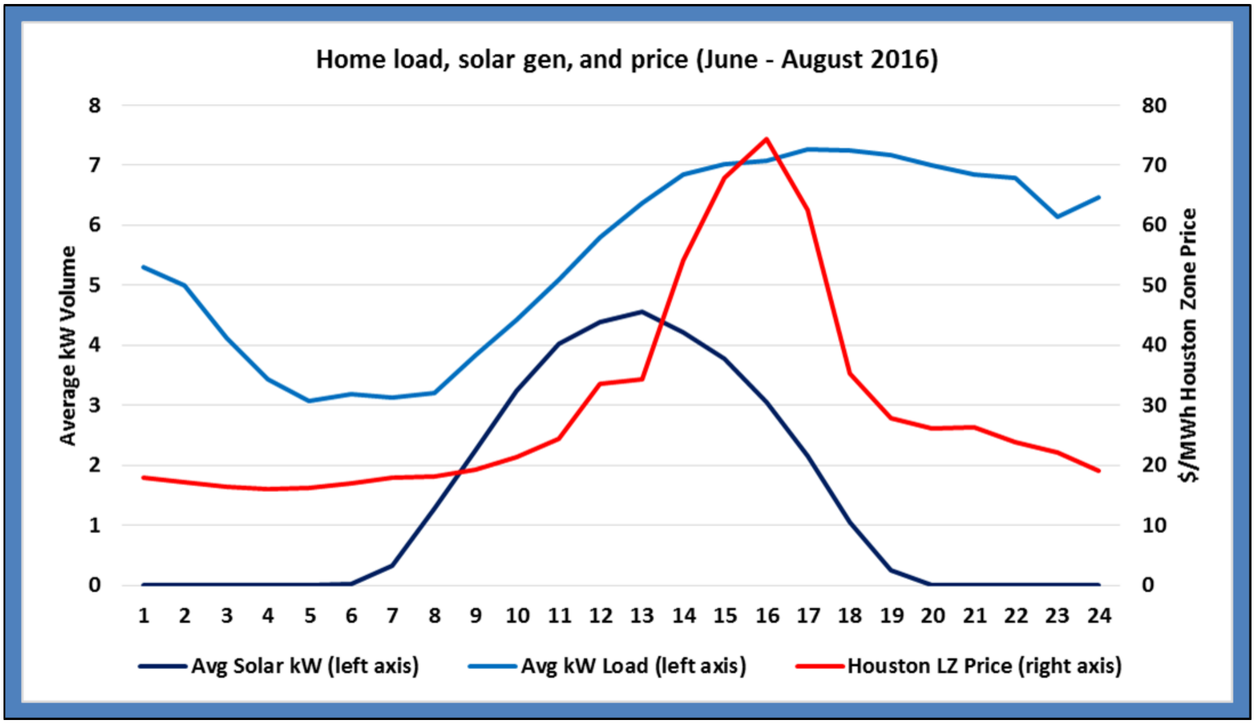
Value Propositions of Small-Scale Storage

Tesla states four "Supported Applications" of the Powerwall 2: solar self-consumption, time-of-use load shifting, backup, and off grid.

The idea of "solar self-consumption" figures prominently in Tesla's Powerwall marketing history. In a reference since removed, the Tesla website originally said the Powerwall "bridges the gap between peak solar and peak demand, allowing you to use your photons when you need them." Indeed, while solar power peaks during the middle of the day, and maximum residential load occurs during daylight hours as well, the respective hours of maximum solar generation and maximum residential demand are, in most cases, not perfectly coincident. This means that, if the solar system of a residence is large enough, its output can exceed the simultaneous consumption of the household. Excess solar generation is typically sent to the grid, and the customer is paid by the utility based on a feed-in tariff.

The diagram below in Figure 1 examines the actual average hourly demand associated with our example meter during the three peak summer months of June – August 2016. This is set against the expected hourly generation from the hypothetical rooftop solar installation. The solar generation peaks at about noon, whereas the electric demand peaks later in the afternoon, around 5:00 PM. We see that, if the solar generation were scaled up large enough, its mismatch with the load would mean excess generation sent to the grid during mid-day hours, and significant deficits during the nighttime hours. Solving this discrepancy is at the core of Tesla's proposed "solar self-consumption."

Figure 1



To examine the economic merits of solar self-consumption, energy market practitioners employ a simple technique evaluating the relative value of two schedules of energy flows via determination of a ratio variously termed the "covariance ratio," or "uplift ratio," among other names. Effectively this covariance ratio consists of the ratio of the weighted average cost to serve divided by the average price. Put mathematically, this may be represented as:

Covariance ratio = $E(P * Q) / (E(P) * E(Q))$, where

P = Interval price and

Q = Quantity consumed

This ratio captures the covariance of price and quantity, ascribing a higher value to data sets in which high prices correspond with high volumes, and a lower ratio to data sets in which price and volume do not exhibit such strong positive covariance. A load with a high covariance ratio will be more expensive to serve on a $/kWh basis than a load with a low covariance ratio. Correspondingly, an intermittent renewable generation source (such as solar) with a high covariance ratio will be more valuable than one with a low covariance ratio (such as wind generation, which typically offers higher volumes during low-priced nighttime hours).

In our example data, the covariance factors of the load and solar generation, as evaluated against Houston Zone Price with 15-minute granularity, are shown on Table 1.

Table 1

Full Period June - Aug 2016:

	Weighted Avg	Average	"Covariance Ratio"
Home Load	$ 34.13	$ 29.55	1.16
Solar Gen	$ 42.09	$ 29.55	1.42

Covariance Ratios:

	Home Load	Solar Gen
June - Aug	1.16	1.42
June	1.17	1.39
July	1.10	1.32
August	1.18	1.55

We see that the solar product, with a three-month covariance ratio of 1.42, is considerably more valuable than the load, with a covariance ratio of 1.16. In other words, using an energy storage device to shape the solar generation to make it match the shape of the home load would destroy value, not add value. It should be noted that residential loads have widely varying covariance factors, and these may be much higher in conditions that do not require nighttime air conditioning. Nonetheless, the concept still remains – solar generation's delivery of energy purely during the daytime period when prices are relatively high gives it a high relative value compared with almost any load that actually exhibits nighttime demand.

If we are inclined to dismiss the idea of "solar self-consumption" on the basis of the logic above, we might modify the objective by embracing Tesla's second Supported Application: time-of-use load shifting. Instead of forcing solar generation to match on-site consumption profile, we might make use of the market (which few residential customers can outside of places like Texas) to minimize demand during the highest price hours by discharging the battery, and recharge during the lowest price hours. This is effectively the same as an activity that wholesale traders optimizing the battery might consider: simply buying during the low-price hours to charge battery and selling into the market during high-price hours.

Turning once again to our data set of summer 2016 15-minute prices, we see that the average daily spread between the cheapest and the most expensive 15-minute interval was $0.15/kWh, a value intentionally made aggressive by selection of summer months. Setting aside physical charging and discharging constraints, let us suppose that the Powerwall battery could be fully cycled within two 15-minute periods (the cheapest for charging and the most expensive for discharging.) Accounting for the 90% efficiency, but neglecting any degradation effects over time, a single duty cycle per day capturing $0.15/kWh EVERY DAY on the full volume of the battery leads to a simple break-even term of more than 10 years. Including degradation, even with optimistic performance decline assumptions, will make this break-even term even longer.

Tesla's third Supported Application is to use the Powerwall to supply backup electricity in the event of a grid outage. With 5 kW of continuous power generation, the Powerwall has sufficient capacity to power a flat screen TV, a tea kettle, the compressor of a refrigerator/freezer, and several light bulbs. However, assuming average draw equal to just half of that 5 kW, or 2.5 kW, the battery's charge would last only 5.4 hours. Consumers may compare this performance to the alternative offered by a quality portable inverter generator. For example, for $4500 the Honda EU7000iS offers comparable peak and continuous AC output, but the gasoline generator will operate for 6.5 hours at 100% of its 5.5 kW rated load, and 18 hours at ¼ of its rated load.[7] The portable generator has the additional advantage of repeating these run times with each 5 gallon can of gasoline available, which proves an advantage to consumers potentially facing outages of greater duration, such as hurricanes. The Tesla Powerwall therefore seems best positioned to serve as a backup for applications in which short-durations are the most likely/problematic, or in the event that use of a gasoline generator is excessively inconvenient or prohibited. Additionally, it may prove an effective solution to small proprietors in Third World countries, where electric grid mismanagement frequently causes routine outages of short duration.[8] For example, a small convenience store owner may find value in a battery system that keeps refrigeration and lights running during such outages, to prevent spoilage and allow for continuation of business.

Tesla's last suggested Supported Application is for off-grid use, when customers, either by choice or necessity, are not connected to a broader electric grid. Storage eliminates the need for a constant source of generation, such as wind, electricity, or gasoline engine. The Tesla Powerwall, and its competitors, present what may be the only energy storage approach aside from reverting to earlier technologies such as lead-acid batteries, and enduring their drawbacks. Nonetheless, any prospective off-grid customer would be wise to understand that the off-grid cost of energy may be several times what is available on-grid. An analysis by *Forbes* concluded that average cost for solar plus Powerwall energy would likely be on the order of $0.30/kWh, or roughly 2-3 times the rate available from the grid, depending on location.[9]

Conclusion

In short, the naïve interpretations of the Tesla Powerwall's value propositions don't pencil out with supportive economics under present market conditions. However, the technology is intriguing and alluring, leaving us to speculate on what changes might rehabilitate the economic viability of products like this. These changes might include:

- Dramatic change in system price. Declines in the cost of lithium-ion batteries gave rise to the use of lithium technologies in stationary energy storage. For example, IHS Markit forecasts declines of more than 50% on the installed cost of large-scale battery systems.[10] Comparable price declines for small systems could significantly swing economics in favor of residential systems.

- Changes in electric market fundamentals, residential tariffs or electric market design.

    - The continued penetration of solar generation in states such as California causes significant system instability and price dislocations between the ending hours of solar generation and the daily peak consumption. If market design allows, solutions could arise whereby owners of distributed storage are allowed to address these problems and profit from their contributions in a way that is not possible now.

    - Utilities may succeed in attaining highly punitive feed-in tariffs that don't offer value to small-scale solar producers through net metering. If excess solar generation is ascribed a value low enough, homeowners could see value in buying battery capacity to recover that undervalued electricity.

    - Utility changes to time-of-use pricing that matches price more accurately to real wholesale conditions will give more residential customers transparency into market conditions, and may allow them to use their combination of load and a battery for arbitrage opportunities.

Endnotes

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Author Biography

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In addition to his position at the JPMCC, Thorvin Anderson is also the president of Razor Commodity Advisors, LLC. He has spent seventeen years in the commodities space, both in industry and on Wall Street, with firms ranging from Koch Industries and Calpine Corporation to Bear Stearns and J.P. Morgan. Thorvin specializes in fundamental commodity market analysis and the valuation of complex structured transactions, such as wind offtake agreements, power plant tolls, load serving obligations, hydro-electric entitlements, natural gas storage, and gas asset management agreements (AMAs).

Actively involved in commodities education throughout his career, Thorvin has orchestrated and led multiple training programs focused on introducing participants to key concepts in commodities. At J.P. Morgan, Thorvin initiated and managed a rotational program to recruit and develop junior talent in a cross-disciplinary manner. He graduated from Stanford University with a B.A. in Economics in 1997, and received his CFA Charter in 2006.

Thorvin is also a member of the JPMCC's Advisory Council and its Research Council. In addition, he serves as a member of the *Global Commodities Applied Research Digest's* Editorial Advisory Board.

Asset Valuation and Market Expectations in Dry Bulk Shipping

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This digest article is based on Professor Nikos Nomikos' presentation to the JPMCC's Research Council on September 30, 2016.

During the JPMCC's Research Council meeting on September 30, 2016, Professor Nikos Nomikos (far left-hand side), Cass Business School, City, University of London (U.K.), presented during the "Emerging Risks and Challenges in Commodity Supply Chains" morning panel. The other participants in the panel were (starting to the right of Professor Nomikos, from left-to-right) Mr. John Schmitter, KEP LLC; Mr. Steffen Hammer, Robert Bosch GmbH (Germany); and Professor Colin Carter, University of California, Davis and Research Council Chair, JPMCC. Professor Carter moderated the panel.

Introduction

The shipping industry plays an important role in the world economy since about 90% of the world trade is carried by sea, according to the International Chamber of Shipping (2017). One of its sectors is the *dry bulk* market that involves the transportation of homogeneous bulk commodities, typically raw materials such as iron ore, grains, coking and thermal coal, bauxite and alumina, on non-scheduled routes, mainly on a "one ship-one cargo" basis (Alizadeh and Nomikos, 2010). The dry bulk sector is important in its own right, as it represents by far the largest shipping segment in terms of both cargo carrying capacity and quantity transported. Last year, dry bulk vessels carried more than 43% of the world's seaborne trade. It is thus not surprising that dry-bulk freight rates are considered as indicators for world economic activity (Kilian, 2009).

Shipping Demand

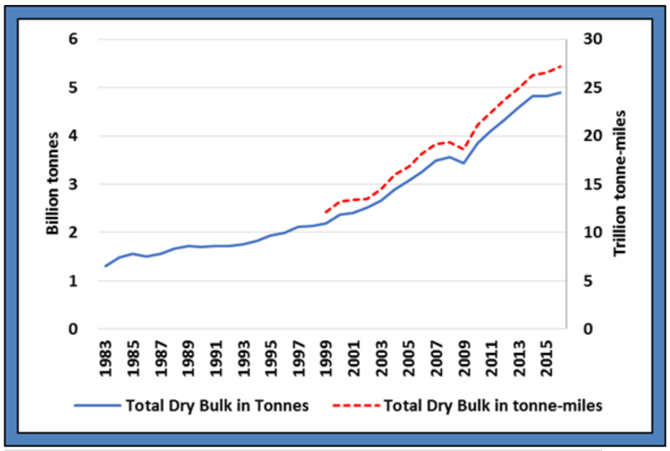
Demand for dry bulk shipping services translates into demand for seaborne trade which, in turn, is driven by a few main factors. Undoubtedly, the most important one is the world economy; as Stopford (2009) documents, seaborne trade is highly correlated with world GDP cycles. In addition, seaborne trade is affected by the prevailing conditions in the related commodity trades. Commodity markets affect the demand for shipping in both the short- and long-term. Regarding the former, short-term fluctuations in shipping markets may be caused by the seasonal character of some trades (e.g. in agricultural commodities). On the other hand, long-term fluctuations can be mainly attributed to changes in the economies of the countries that import and export the corresponding commodities. In addition to those factors, which are exogenous to the shipping industry, demand is also affected by the distance over which commodities are transported, known as the "average haul" and measured in tonne-miles.[1] Finally, one must also consider random shocks that perturb the shipping equilibrium and result in the well-known shipping boom-bust cycles or, equivalently, generate the extraordinary volatility that characterizes the industry. These unique and unpredictable shocks in shipping demand may be caused by economic disturbances superimposed on business cycles such as the two oil price shocks in 1973 and 1979 and the recent financial crisis, or political events such as wars, revolutions and strikes (Stopford, 2009).

Consequently, demand is considered as rather inelastic and exogenous to the shipping industry. Panel A of Figure 1 presents the evolution of dry bulk seaborne trade from 1983 to 2016. Evidently, the aggregate demand variable follows an upward sloping time trend that results in a significant aggregate increase over the respective years. Specifically, the total increase is equal to 376.6%, corresponding to an annual average compound growth rate of 4.1%. However, as we observe in Panels B and C, commodity-specific and country-specific demand fluctuates significantly around this upward trend. Panel C of Figure 2 illustrates that annual demand changes of around 10% are not an unusual phenomenon in this industry. In conclusion, we can characterize the evolution of dry bulk demand as a mean-reverting process around a positive drift.[2]

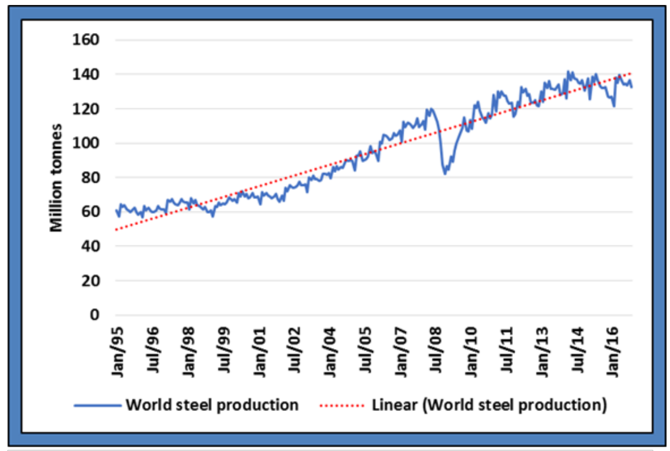
Shipping Supply

The supply component of the shipping mechanism corresponds to the cargo carrying capacity of the dry bulk fleet. Depending on the size of the vessel, the dry bulk fleet can be subdivided into four main sectors, which researchers and industry participants treat as different markets; that is, the Capesize, Panamax, Handymax, and Handysize sectors. At the largest end of the range, Capesize carriers have a cargo carrying capacity that exceeds 100,000 dwt and carry primarily iron ore and coal.[3] Panamax carriers (60,000-80,000 dwt) serve mainly the coal, grain, bauxite and the larger minor bulk trades. At the lower end of the range are the Handymax (40,000-59,000 dwt) and Handysize (20,000-39,000 dwt) carriers. These ships serve as versatile workhorses in trades where parcel size and port restrictions require smaller vessels. Usually, they carry minor bulks and smaller quantities of major bulks. As of December 2016, the Capesize, Panamax, Handymax, and Handysize dry bulk sectors consisted of 1,651, 2,450, 3,445, and 3,316 vessels, respectively. Equivalently, the total cargo carrying capacity amounted to approximately 793 million dwt (or 10,862 vessels).

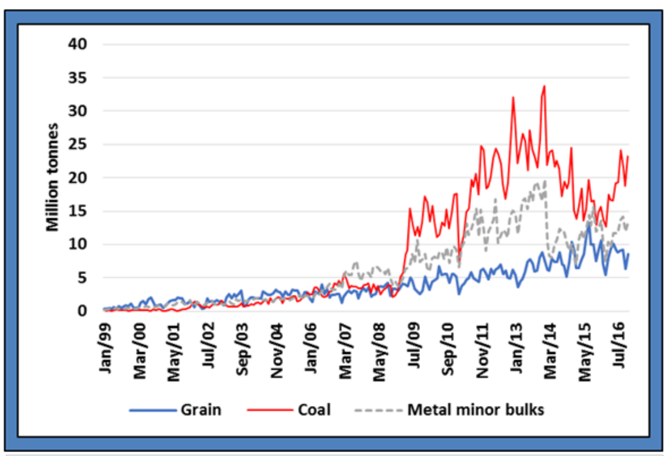
Figure 1
Demand for Dry Bulk Shipping Services



Panel A: Total dry bulk seaborne trade, from 1983 to 2016.



Panel B: World steel production, from 1/1995 to 11/2016.



Panel C: China's coal, grain, and metal minor bulk imports, from 1/1999 to 11/2016.

Panel A illustrates the evolution of total dry bulk seaborne trade measured in both tonnes and tonne-miles at an annual frequency. Panel B shows the monthly world steel production measured in million tonnes. Finally, Panel C shows the evolution of China's coal, grain, and metal minor bulk imports measured in million tonnes at a monthly frequency.

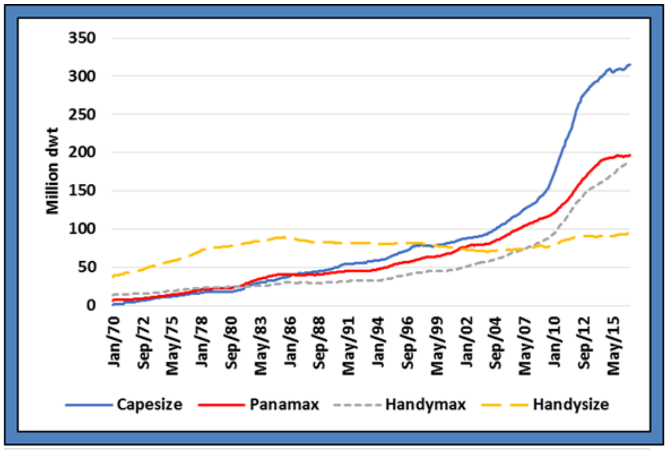
Source: Clarksons.

The dry bulk industry consists of a large number of ship owning corporations that essentially act as price-takers. Therefore, from an economic point of view, dry bulk shipping is considered as a highly competitive industry. Panel A of Figure 2 illustrates the evolution of fleet capacity (measured in dwt) for each of the four sectors while Panel B depicts the development of the aggregate dry bulk fleet. The evolution of the sector-specific and aggregate supply variables is very similar to those of demand; since 1983, total growth in the aggregate dry bulk supply is 450.6% which is equivalent to 4.7% average annual increase (Panel B of Figure 2).

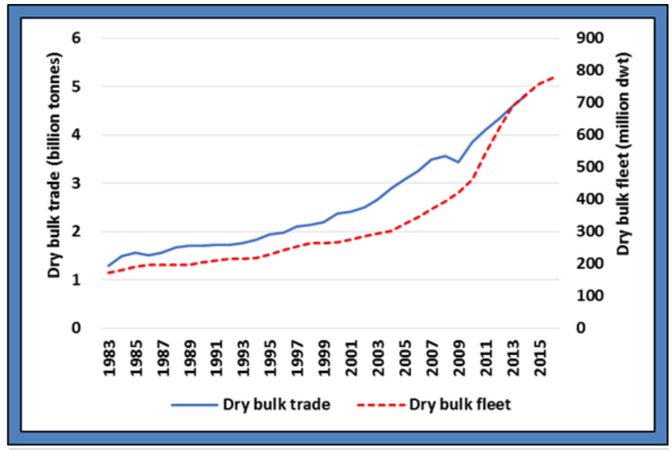
In contrast to demand, shipping supply is determined by the investment decisions of market agents and therefore, is endogenous to the dry bulk industry; it can be increased through the ordering of newbuilding vessels, and decreased through the demolition of existing ones. Thus, supply is highly elastic in the long run. To quantify this inherent feature of the shipping industry, consider the following stylized fact: during the market peak of 2007, the order book was approximately 70% of the corresponding fleet.[4] Thus, by 2016 the net increase in the size of the fleet, that is after accounting for scrapping activity, was more than 100%, compared to its 2007 level (Panel B of Figure 2).

Another interesting feature is that the delivery of a newbuilding order requires a time-to-build that can vary from 18 months upwards and depends on the prevailing market conditions (Kalouptsidi, 2014). Hence, in the short-term, shipping supply can be inelastic and supply adjusts sluggishly to changes in demand (Greenwood and Hanson, 2015). Consequently, as Panels B and C of Figure 2 demonstrate, while the levels of aggregate shipping supply and demand exhibit a high degree of co-movement, their respective growth rates are less correlated, the correlation coefficients being 0.96 and 0.26, respectively. The implications of this feature are very important both in terms of shipping lease rates (net earnings)[5] and vessel prices.

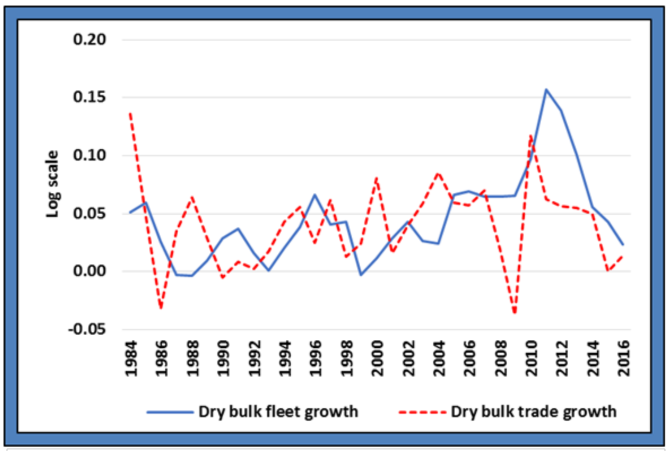
Figure 2
Dry Bulk Shipping Supply and Correlation with Demand



Panel A: Dry bulk fleet development, from 1/1970 to 12/2016.



Panel B: Dry bulk fleet and trade development, from 1983 to 2016.



Panel C: Dry bulk fleet and trade growth, from 1983 to 2016.

Panel A illustrates the fleet development for each dry bulk sector (measured in million dwt) at a monthly frequency. Panel B provides a comparison between the total dry bulk fleet development (measured in million dwt) and the evolution of the total dry bulk trade (measured in billion tonnes). Finally, Panel C compares the evolutions of total dry bulk fleet and total dry bulk trade growth. The data corresponding to Panels B and C are measured annually.

Source: Clarksons.

Shipping Earnings, Vessel Prices, and Market Conditions

From a shipping investor's perspective, changes in net earnings directly affect asset values, i.e. vessel prices. Specifically, random shocks in demand perturb the short-run shipping equilibrium and, consequently, the prevailing net earnings; this can be thought of as a first-order effect. In turn, an increase in current net earnings has an indirect effect on future net earnings through the current investment decisions of market agents. Due to the time-to-build constraint though, changes in supply will not be realized immediately but in future periods which can be thought of as a second-order effect. This fact, in conjunction with the mean-reverting (around an upward trend, as illustrated above) character of the exogenous demand result in extremely volatile shipping cash flows. Consequently, shipping net earnings are not exogenously, but partially endogenously determined by the investment decisions of market participants.

Therefore, one should expect net earnings to be positively and negatively related to shipping demand and supply, respectively. Indeed, Nomikos and Moutzouris (2015) proxy shipping demand through the aggregate dry bulk seaborne trade and estimate a significant positive relationship between net earnings growth and shipping demand growth across all dry bulk sectors (with correlations ranging from 0.49 to 0.63). Furthermore, they show that net earnings growth is negatively related to the spread between supply and demand growth rates (the respective correlation coefficients range from -0.79 to -0.87). In the following, we incorporate findings from Nomikos and Moutzouris (2015) for the Capesize sector; results in the other three sectors are both quantitatively and qualitatively similar.

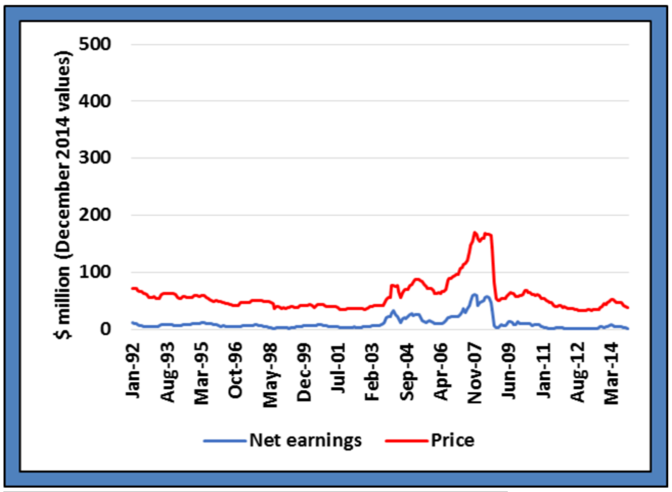
For illustrational purposes, consider a discrete-time, dynamic environment where annual net earnings are determined through the previously analyzed supply and demand mechanism. Assume further that due to an unexpected demand shock, current net earnings are significantly high. Therefore, the owner of a vessel can immediately exploit the prosperous market conditions. In anticipation of this increased short-term cash flow, current vessel prices increase compared to their previous level; this substantial price increase is a positive first-order effect of the increased net earnings.[6] The strong, positive relationship between current net earnings and vessel prices is depicted in Panel A of Figure 3.

Furthermore, in analogy to commodity markets literature, due to the time-to-build required for the delivery of a newbuilding order, this first-order effect can be interpreted as a “convenience yield”, which is reflected in the ratio of the price of a 5-year second-hand (SH) vessel to the price of newbuilding (NB) vessel. In particular, as we observe in Panel C of Figure 3, this ratio increases with net earnings. Noticeably, during market upturns (downturns) the ratio is significantly higher (lower) than one; that is, 5-year old vessels are more (less) expensive than newbuilding ones. This result becomes even more interesting if we consider that the latter have significantly longer economic lives compared to the former.

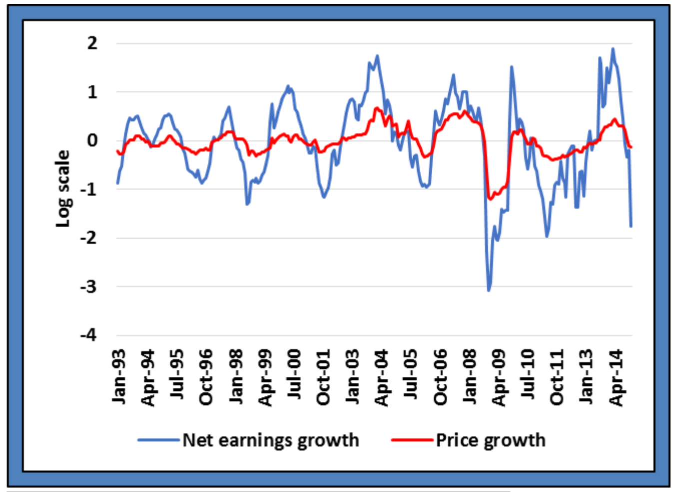
In addition, high current net earnings result in increased current net investment. As Kalouptsidi (2014) argues, entry into dry bulk shipping markets is free, subject to an entry cost and time-to-build delays. Panel D of Figure 3 demonstrates that current net earnings and current scaled net investment are significantly positively correlated. Accordingly, increased net investment results in increased future fleet capacity, which *ceteris paribus* leads to decreased future net earnings. Notice that this decrease can be highly exacerbated due to the mean-reverting character of demand. Nomikos and Moutzouris (2015) justify this argument formally by performing predictive ordinary least squares regressions of future net earnings growth on current net investment; as one would expect, their results suggest that current net investment negatively predicts future net earnings growth.

Consequently, market participants at time t anticipate this mechanism and value second-hand vessels as if they expect future net earnings to be lower compared to the prevailing ones. Hence, current net earnings - through current investment - have a negative second-order effect to current second-hand prices. Therefore, in market upturns the growth rate of net earnings is significantly higher compared to that of prices (Panel B of Figure 3). On the other hand, during market downturns current net earnings decrease substantially more than vessel prices as investors anticipate that future net earnings will be higher in the future. Specifically, low net earnings result in lower (even negative) current net investment, which in conjunction with an expected increase in future demand, results in expectations of higher future net earnings. In this case, current net earnings have a negative first-order effect to current prices but a positive second-order one.

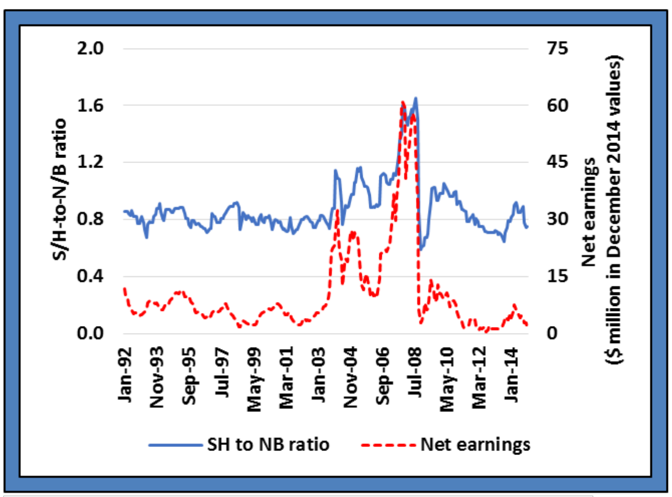
Figure 3
Net Earnings, Vessel Prices, and Investment



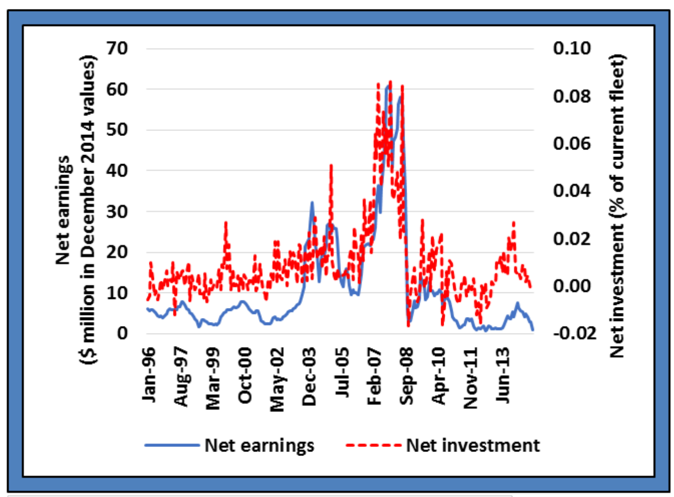
Panel A: Net earnings and vessel prices.



Panel B: Net earnings and price growth.



Panel C: Net earnings, second-hand, and newbuilding prices.



Panel D: Net earnings and net investment.

Figure 3 summarizes findings from Nomikos and Moutzouris (2015) related to the Capesize dry bulk sector for the period January 1992 to December 2014. Panels A and B depict the relation between real annual net earnings and real 5-year vessel prices and their respective growth rates. Panel C depicts the relation between the ratio of 5-year old to newbuilding vessel prices and current net earnings. Panel D illustrates the relation between net earnings and net investment. All variables are in monthly frequency.

A first implication of this mechanism is that shipping net earnings are substantially more volatile than vessel prices. This is in line with Greenwood and Hanson (2015) who argue that investors recognize, up to a certain degree, the mean-reverting character of net earnings. This in turn results in a more conservative and less naïve valuation of vessels, compared to the case of perfect extrapolation in which investors assume that current earnings will also prevail in the future. Second, earnings yields are strongly positively related with net earnings and vessel prices. Since in financial and real estate markets valuation ratios are used as indicators of fundamental value of the generated cash flow relative to corresponding price of the asset (Campbell and Shiller, 1988), we can argue that in shipping, during market peaks (troughs) vessels are undervalued (overvalued) compared to their respective generated cash flows (Panel A of Figure 3). Finally, a third and most important implication of this mechanism is that high shipping earning yields strongly reflect market expectations about deteriorating future market conditions (i.e. net earnings growth). Equivalently, we can argue that vessel prices mainly move due to investors' expectations about future market conditions.

Endnotes

1 Tonne-miles are defined as the product of the tonnage of shipped cargo times the transportation distance (Stopford, 2009).

2 The assumption of a simple mean-reverting process for demand has also been proposed by Kalouptsidi (2014) and Greenwood and Hanson (2015).

3 dwt stands for deadweight tonnage and measures the cargo carrying capacity of a vessel. Minor bulks refer to commodities that are transported in smaller parcels such as forest products, bauxite and alumina, fertilizers, cement, petroleum coke, and nickel ore.

4 The order book measures the number of vessels under construction or awaiting construction (Papapostolou *et al.*, 2014).

5 Net earnings are defined as the operating profit for the owner of the vessel and is calculated as freight income minus operating costs.

6 Technically, this is an implication of the fact that net earnings for period $t \to t+1$ are $\mathcal{F}_t$-measurable.

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Nikos Nomikos is Professor of Shipping Risk Management at Cass Business School. He commenced his career at the Baltic Exchange as Senior Market Analyst where he was responsible for the development of the shipping indices that are currently used in the market as pricing benchmarks. For the last 10 years he has been with the Faculty of Finance at Cass Business School, where he is also the Director of the M.Sc. course in Shipping, Trade and Finance, a leading postgraduate program that attracts high calibre graduates from around the world. His area of expertise is Ship Finance and Risk Management. As such, he particularly enjoys lecturing on the topics of shipping economics, ship finance and shipping risk management as well as quantitative finance and risk management in financial and commodity markets.

Dr. Nomikos has collaborated with a number of companies both as consultant as well as educator in executive training programs. Some of the companies include AP Moeller Maersk, the Baltic Exchange, Boston Consulting Group, Clarksons, Far East Trading/Sinochem, Korean Banking Institute, Overseas Shipholding Group and TBS Shipping Services. He also holds visiting faculty positions in Copenhagen Business School, University of Geneva and International Hellenic University where he lectures on topics such as Insurance and Risk Management, Shipping Trading and Finance and Energy and Power Markets Trading & Risk Management. He was appointed as "The Wilmar Professor in International Commodity Business" for 2013 at the Singapore Management University. He is also a regular speaker in a number of practitioner seminars and symposia such as the *Financial Times* Investment Series Seminars, London Biennial Meetings, The Freight Derivatives Annual Seminars and Energy Risk Europe.

Dr. Nomikos has published his research in numerous academic and practitioners journals. He has published more than 40 papers in international academic journals such as *Review of Finance, Energy Economics, Energy Policy, Transportation Research, Journal of Banking and Finance, Applied Mathematical Finance, Journal of Futures Markets, Journal of Derivatives,* and *Logistics and Transportation Review*. He has also published numerous book chapters and has co-authored the book, Shipping Derivatives and Risk Management, which is considered the leading reference book in the area of shipping risk management. His views about commodity and shipping markets have also been profiled in a number of newspapers and other media such as *International Herald Tribune, NY Times, Financial Times, Lloyd's List, Tradewinds, Bloomberg, CNBC News,* and *Daily Telegraph*.

Professor Nomikos holds a B.Sc. in Economics from Athens University of Economics and Business, an M.Sc. in Shipping, Trade & Finance (Distinction) from Cass Business School and a Ph.D. in Finance from Cass Business School. In addition, he is a Member of the Institute of Chartered Shipbrokers.

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Emerging Challenges for Commodity Risk Managers from an Industrial Consumer's Standpoint

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This digest article is based on a similarly themed presentation to the JPMCC's Research Council on September 30, 2016.

Sven Streitmayer's colleague, Steffen Hammer, represented Robert Bosch GmbH (Germany) at the JPMCC's September 30, 2016 Research Council meeting. Mr. Hammer is Vice President for Commodity Purchasing at Bosch and is also a member of the JPMCC's Advisory Council. In this photo, Mr. Hammer is discussing his JPMCC Research Council presentation on "Emerging Risks and Challenges of Managing Global Commodity Supply Chains" with (L-to-R) Dr. Robert Vigfusson of the Federal Reserve System (Washington, D.C.), Professor James Hamilton of the University of California, San Diego, and with Professor Vince Kaminski of Rice University. Drs. Vigfusson, Hamilton, and Kaminski are all members of the JPMCC's Research Council. Mr. Streitmayer of Robert Bosch GmbH, the author of this article, joined the JPMCC's Research Council at the end of 2016.

The Case for Risk Management

In an increasingly complex economic environment with business models changing rapidly, and with technological innovations altering whole industries and dynamic new competitors from the likes of Google, traditional sectors like the automotive industry have to adapt fast or even reinvent a significant share of their products, processes and culture. Naturally, this causes a lot of uncertainty in future strategy and earnings.

Against this background the prudent management of corporate risks has become ever more important. For a manufacturing company like Bosch with a turnover of more than 70 billion Euro and a purchasing volume of roughly 30 billion Euro, whereof more than 10% are raw materials like copper, aluminum or steel, an active management of commodity risks (alongside currency and interest rate risks) is inevitable to ensure planning reliability on a product and P&L level.

Commodity Risk Management Approaches

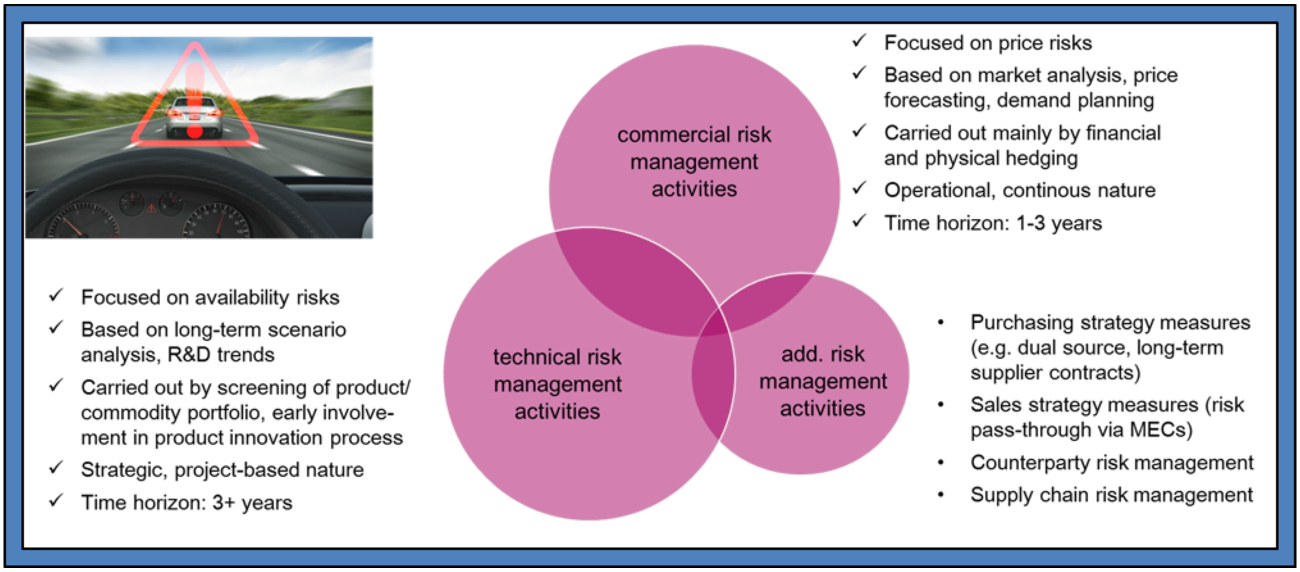
At Bosch we essentially distinguish between two broad types of commodity risk-management approaches: (1) commercial risk-management activities and (2) technical risk-management activities, which are illustrated in Figure 1 on the next page.

The first one originates from the natural volatility of commodity markets where temporary supply-demand imbalances lead to price fluctuations. In this regard our main focus is to manage the price risks by hedging our future commodity demands for the production process on a financial (derivative) or physical basis. By this means price and planning stability for the raw material content of our products can be achieved as we are no longer exposed to the volatility of commodity prices. These commercial risk-management activities are operational and continuous in nature and normally have a time horizon of up to three years – limited by the availability of reliable and concrete sales forecasts to assess the prospective commodity demand accordingly.

The second area of commodity risk-management activities is a more technologically driven approach centered on the availability risks of Bosch´s commodity demand. After the shortage in the supply of rare earth metals emerged in the years 2010/2011, Bosch introduced a system of regular checks and screenings of our product portfolio in terms of potentially scarce raw materials. This is accompanied by early involvement measures within the product innovation process. Commodity market experts team up with research and development departments in order to proactively identify critical raw materials intended for the usage in newly invented products. Thus technological alternatives or rather substitution of the commodity input can be considered in a very early stage. A recent example stems from the field of battery technology where market participants have to carefully weigh the long-term availability of commodities like lithium or nickel before deciding on a standard technology to be introduced.

In sum the technical risk-management activities are more strategic and project oriented. Based on long-term scenario analysis, the time horizon of the measures ranges from three to ten years.

Figure 1
Types of Commodity Risk Management Employed



Abbreviation: MEC stands for "metal escalation clause," which is a term used within sales contracts when the price risk of a specific commodity processed in a product is transferred to the customer.

Source: Robert Bosch GmbH.

Emerging Challenges for Commodity Risk Managers

Today's commodity risk managers are faced with numerous challenges. Some of them are new, resulting from a changing regulatory landscape or an evolution in technology, and some of them are reoccurring topics such as the selection of an efficient hedging instrument. Below we outline selected challenges that we consider relevant for our business and at the same time can be seen as recent use cases.

Increasing Requirements from Financial Market Regulation

One of the big changes impacting commodity trading and hedging in recent years are the increasing requirements from financial market regulators. In the aftermath of the 2007/2008 financial crisis, authorities around the world switched from a light-touch approach to a much more extensive and strict way of market governance and surveillance. This came along with a whole new set of regulatory rules and financial market laws such as the Dodd–Frank Act in the United States and the European Market Infrastructure Regulation (EMIR) legislation within the European Union. Generally the aim was "to improve transparency in the derivatives markets, mitigate systemic risk, and protect against market abuse" (G20 Leaders Statement from The Pittsburgh Summit, September 2009). Surely the new rules are well intended and should be beneficial to all market participants. The flip side of this is increasing bureaucracy and significant administrative effort on the side of the regulated companies. For corporate hedgers that means, to give an example, that to comply with EMIR rules, every single Over-the-Counter transaction carried out for risk-management purposes has to be reported to a central trade repository. Furthermore risk-mitigation techniques and clearing obligations have been introduced, adding to the need for a major adjustment of back-office and front-office processes. Other than financial institutions like banks and brokers, it is relatively new for most industrial corporations to be in the scope of regulatory activities. Risk managers are therefore facing completely new responsibilities in their daily routine, which will require an enlarged set of skills and competencies.

Risk Management of Non-Exchange-Traded Commodities

Whereas the risk management of standardized, exchange-traded commodities like copper, nickel or crude oil is facilitated by data availability, market transparency and (of course) liquid hedging instruments is lacking in most of the non-exchange-traded commodities. This is a challenge as the assessment and management of price and availability risks for these commodities can be very difficult. At Bosch we currently have to handle this task in the case of lithium, which is an important raw material in the batteries we are sourcing for usage in our power tools. In this regard the key questions for the purchasing strategy of battery packs are (1) how to secure indirect lithium supply in a distributed supply chain and (2) how could a cell purchaser safeguard the price of lithium? Hence the first question addresses the availability risk, which is even more complicated by the fact that the input of the raw material from the mined lithium via different semi-finished qualities is spread over numerous steps in the supply chain. Additionally the market is dominated by a few large primary lithium producers, making it prone to supply disruptions and information imbalances.

The second element handles the question of price risk management for a commodity where no futures or forward market exists. In the absence of available derivative instruments for lithium, the only way to provide for price stability is to enter into long-term, fixed price contracts with the battery suppliers, assuming their willingness to do so. That, on the other hand, is only possible at the expense of flexibility, as one has to commit guaranteed quantities to certain suppliers. In sum one can state quite simply that the risk management of non-exchange-traded commodities is quite demanding and challenging.

Involvement in Newly Launched Commodity Futures Contracts

Another use case that commodity risk managers regularly have to deal with is the question of the involvement in newly launched derivative markets and instruments. There have been a couple of failed attempts to establish new commodity futures contracts such as plastics trading on the London Metal Exchange (LME), which was introduced in 2005 but delisted in 2011 due to a lack of significant trading volume or open interest. Nonetheless commodity exchanges around the globe are continuously looking to expand their offerings. Of the more recent examples, the aluminum premium contracts launched by the CME Group as well as its steel futures look especially promising to us as a big metals consumer. However with the recent futures market history in mind, one should carefully weigh the benefits of using newly launched derivative contracts against the risk of a possible failure of these.

In our view the following questions have to be addressed before entering new futures markets: is there enough liquidity in these relatively young futures contracts to enter and exit positions smoothly? What about the costs of trading in terms of bid-ask-spreads? How useful is the forward curve in these cash-focused markets like steel or aluminum premiums? Do contract specifications and reference benchmarks (such as *Metal Bulletin* or CRU in the case of CME´s contracts) match conventions of physical trading? If most of these questions can be affirmed, the chances of a successful implementation of newly launched commodity futures contracts within an existing risk management system seem quite high.

Conclusion

In a nutshell, the goals of commodity risk management within an industrial corporation are to (a) reduce the impact of short- and long-term price volatility to stabilize earnings, (b) foster planning reliability, and (c) identify and manage availability risks in the supply chain of raw materials. In a broader context, commodity risk management should therefore be seen as an essential instrument for the implementation of corporate strategy.

At the same time, emerging challenges like the ones described above are a vital and exciting part of a commodity risk manager's daily business, adding to the scope and responsibilities of that function.

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Commodity Futures Trading Strategies: Trend-Following and Calendar Spreads

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This digest article discusses the most common strategies employed by futures traders, namely: trend-following and calendar-spread trading.

Commodity Trading Advisors (CTAs) and Trend-Following

Although two basic types of CTAs – discretionary and trend-following – exist, the investment category is dominated by trend-followers. As Campbell and Company (2013), note, "[M]ore than 70% of managed futures funds [are estimated to] rely on trend-following strategies." Trend-followers are also known as *systematic traders*. The operative word here is systematic. Automated programs screen the markets using various technical factors to determine the beginning or end of a trend across different timeframes. As Lungarella (2002) writes, "[t]he trading is based on the systematic application of quantitative models that use moving averages, break-outs of price ranges, or other technical rules to generate the 'buy' and 'sell' signals for a set of markets."

In this investment process, automation is key and discretionary overrides of the investment process tend to be taboo. Discretionary traders occupy the other end of this bifurcated CTA spectrum. For discretionary traders, Lugarella (2002) explains that "[p]ersonal experience and judgment are the basis of trading decisions. They tend to trade more concentrated portfolios and use fundamental data to assess the markets, and also technical analysis to improve the timing."

Description of Trend-Following

The basic idea underlying trend-following strategies is that all markets trend at one time or another. As put forward by Rulle (2003), "A trend-following program may trade as many as 80 different markets globally on a 24-hour basis. Trend-followers try to capture long-term trends, typically between 1 and 6 months in duration when they occur."

Trend-followers will scan the markets with quantitative screens designed to detect a trend. Once the model signals a trend, a trade will be implemented. A successful trend-follower will curb losses on losing trades and let the winners ride. That is, false trends are quickly exited and real trends are levered into. In a sense this is the distinguishing feature amongst trend-following CTAs. The good managers will quickly cut losses and increase their exposure to winning trades. In a sense, alpha may come from this dynamic leverage. As Fung and Hsieh (2003) explain, "…trend-following alpha will reflect the skill in leveraging the right bets and deleveraging the bad ones as well as using superior entry/exit strategies.

Negative alphas will be accorded to those managers that failed to lever the right bets and showed no ability in avoiding losing bets irrespective of the level of overall portfolio return – luck should not be rewarded."

Proprietary Futures Traders and Calendar-Spread Trading

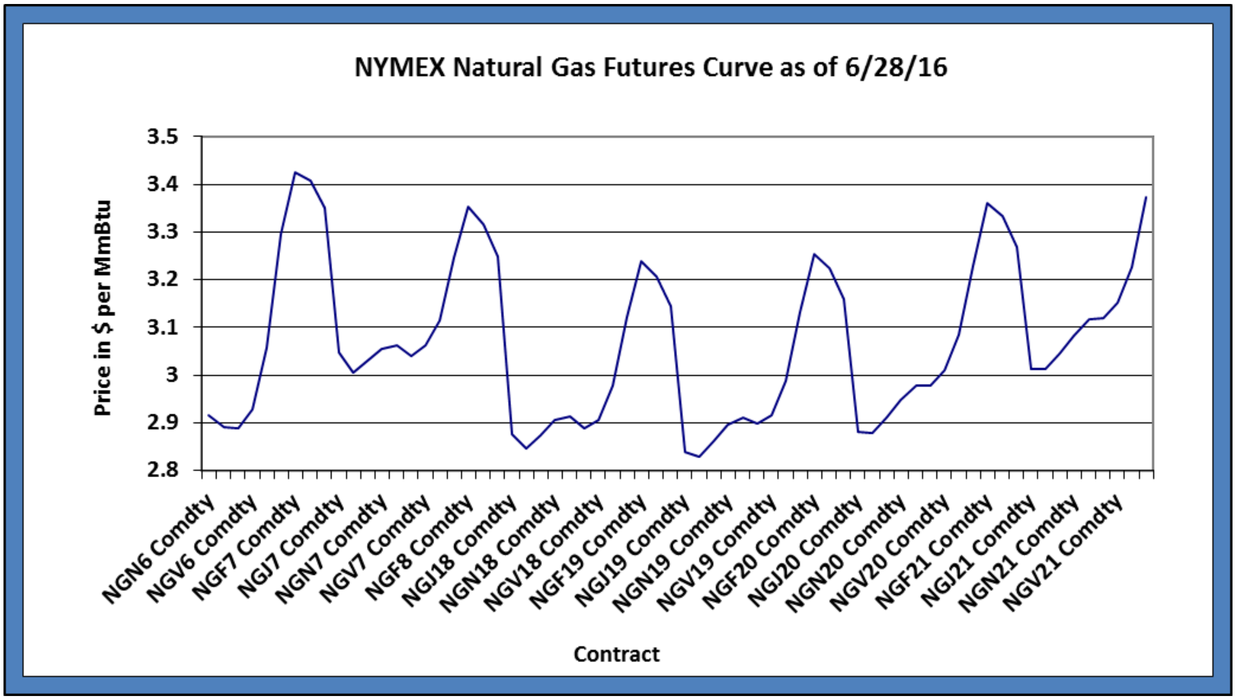
In contrast to highly scalable CTA programs, proprietary futures traders often specialize in understanding the factors that impact the spread between two (or more) of a commodity futures contract's delivery months. This strategy is known as *calendar-spread trading*. By way of further explanation, in all commodity futures markets, a different price typically exists for each commodity, depending on when the commodity is to be delivered. For example, with natural gas, a futures contract whose delivery is in October will have a different price than a contract whose delivery is in December. Accordingly, a futures trader may trade the spread between the October vs. December futures contracts.

Calendar spread opportunities arise when a seemingly predictable one-sided commercial or institutional interest exists in particular futures contract(s): a proprietary trader will thereby take the other side of this "flow." Examples of one-sided flow have occurred during seasonal inventory build-and-draw cycles and during the scheduled times when futures contracts are rolled in commodity indices, as discussed in the next section.

<u>Trading Strategies Keyed to Seasonal Inventory Build-and-Draw Cycles</u>

Figure 1 on the next page shows the futures curve for natural gas on June 28, 2016. The term structure of a commodity futures market is classified as a curve because each delivery-month contract is plotted on the x-axis with their respective prices on the y-axis: thus, tracing out a curve.

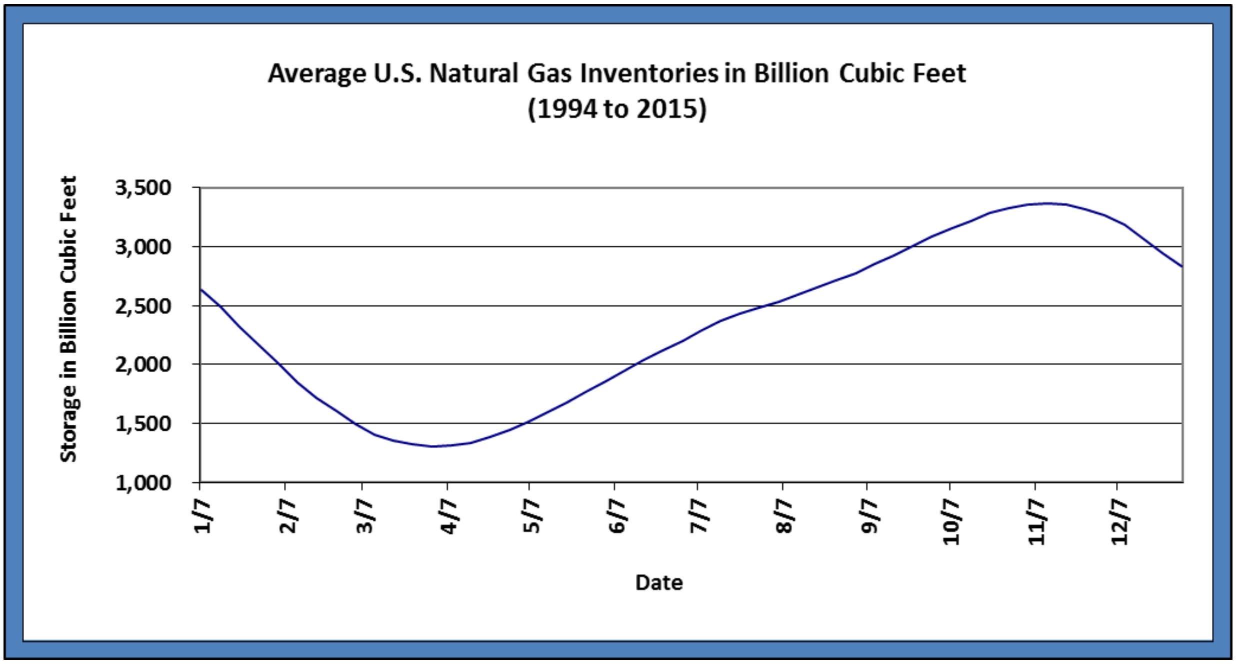
Figure 1



Source of Data: Bloomberg.

When the near-month futures contracts trade at a discount to further-delivery contracts, one terms the futures curve as being in *contango*. When the near-month futures contracts instead trade at a premium to further-delivery contracts, one terms the futures curve as being in *backwardation*. The yearly futures curves for natural gas in Figure 1 approximately mirror the average seasonal inventory build-and-draw pattern shown in Figure 2 on the next page. The prices of summer and fall futures contracts typically trade at a discount to the winter contracts. The markets thus provide a return for storing natural gas. An owner of a storage facility can buy summer natural gas and simultaneously sell winter natural gas via the futures markets. This difference will be the storage operator's return for storage. When the summer futures contract matures, the storage operator can take delivery of the physical natural gas, and inject this natural gas into storage. Later when the operator's winter futures contract matures, the operator can make delivery of the physical natural gas by drawing physical natural gas out of storage for this purpose. As long as the operator's financing and physical outlay costs are under the spread locked in through the futures market, this operation will be profitable.

Figure 2



Sources of Data: Bloomberg, U.S. Energy Information Administration.

Note: This graph specifically shows the U.S. Department of Energy's total estimated storage data for working natural gas inventories averaged over the period, 1994 to 2015.

Now to the extent that the hedging activity by storage operators causes trends in calendar spreads, a speculator can potentially have a profitable edge in taking the other side of these trades.

Cootner (1967) describes analogous price-pressure effects in the grain futures markets, keyed off the following factors: (1) peaks and troughs in visible grain supplies, (2) peaks and troughs in hedging positions from data provided by the Commodity Exchange Authority, a predecessor organization to the Commodity Futures Trading Commission (CFTC), and (3) fixed calendar dates that line up on average with factors (1) and/or (2). In practice, these effects can potentially be monetized through calendar spreads.

Trading Strategies Keyed to Commodity Index Rolls

Another example of calendar-spread trading arises from commodity-index roll dates. Unlike an equity index, one unique aspect of a commodity futures index is that its precise rules need to specify on what dates each of its contracts have to be rolled before the maturity of each contract. These rules are known as *roll rules*. The rules specify when a particular index constituent should be sold and a further-maturity contract should be bought. In advance of such a procedure, speculators in futures contracts such as in the wheat market have historically sold the front-month while buying the next-month contract, establishing what is known as a *bear-calendar spread*. They would then unwind this position during index roll dates, preferably profitably, but not always, as described in Collins (2007).

Conclusion

One typically finds that institutionally-scaled futures programs employ trend-following algorithms. Here, the key is employing such algorithms across numerous and diverse markets such that the overall portfolio volatility is dampened. On the other end of the spectrum are calendar-spread strategies. These strategies typically have limited scalability but individually can potentially have quite consistent returns.

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http://faculty-research.edhec.com/faculty-researchers/alphabetical-list/r-s-t/till-hilary-143898.kjsp?RH=faculty-gb1

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Ms. Till has presented her analysis of the commodity futures markets to the following institutions: the U.S. Commodity Futures Trading Commission, the International Energy Agency, and to the (then) U.K. Financial Services Authority. Most recently, she was a panel member at the U.S. Energy Information Administration's workshop on the "evolution of the petroleum market and [its] price dynamics" and at the Bank of Canada's joint roundtable with the International Energy Forum on "commodity cycles and their implications." She is also the co-editor of the bestselling Risk Book (London), Intelligent Commodity Investing, http://riskbooks.com/intelligent-commodity-investing.

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He was also a senior consultant for Merrill Lynch Investment Management in their Risk Management Group where he advised on benchmark construction, hedging strategies, index replication strategies, portfolio construction, performance attribution and risk management. Prior to joining Putnam Investments, Mr. Eagleeye developed programmed trading applications for Morgan Stanley's Equity Division.

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Additionally, Mr. Eagleeye has co-authored the following articles: "Implicit Options in Hedge Fund Products" (*Derivatives Week*), "Traditional Investment Versus Absolute Return Programmes" (*Quantitative Finance*), "Timing is Everything, Especially with a Commodity Index" (*Futures Magazine*), "Challenges in Commodity Risk Management" (*Commodities Now*), "Risk Management & Portfolio Construction in a Commodity Futures Programme" (*Commodities Now*), and "The Impact of Indexing in the Equity and Commodity Markets" (*EDHEC-Risk Institute Working Paper*).

Mr. Eagleeye has presented at the following industry conferences: *Financial News*' "The Next Generation of Commodity Investment: A Strategic Conference for Active Investors" (in London); the World Research Group's "Performance Attribution" conference (in New York City); the Chicago exchanges' "Annual Risk Management Conference" (in Huntington Beach, California); and at Terrapinn's "Commodities Week – MENA" conference (in Dubai).

Mr. Eagleeye holds a B.S. in Applied Mathematics from Yale University and an M.B.A. from the University of California at Berkeley.

Good Ol' American Shale

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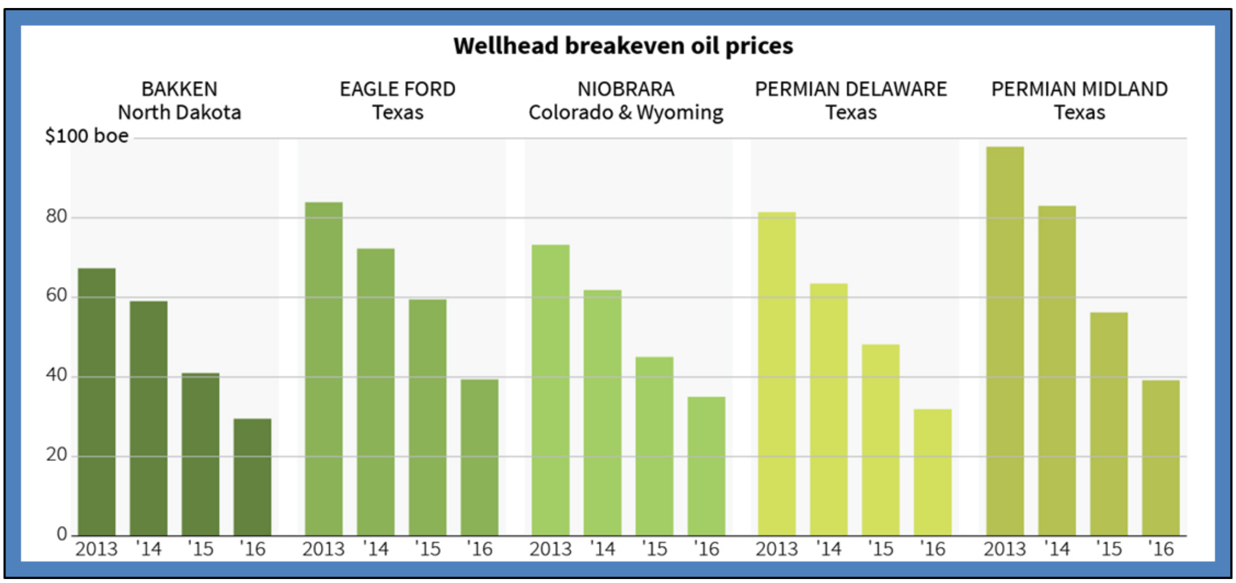
Over the past two years, American shale oil producers have suffered. The low price environment destroyed returns, bankrupted weak companies, and abruptly halted the Shale Revolution; geographically, most of shale production shriveled to a mere handful of counties. With lower oil prices, the exuberance of 2012-2014 was finally reined in. The price downturn taught producers to be more disciplined, forcing them to be smarter about geology, asset choice, technological efficiencies and capital deployment. Most producers now smartly cover capital expenditure with cash flow as opposed to dependence on leverage and financing. In barely three years, the American shale producer has halved their cost of production through operational efficiency gains and large savings in service costs. (See Figure 1.) American shale went head on with the OPEC Cartel, and emerged stronger, leaner and smarter.

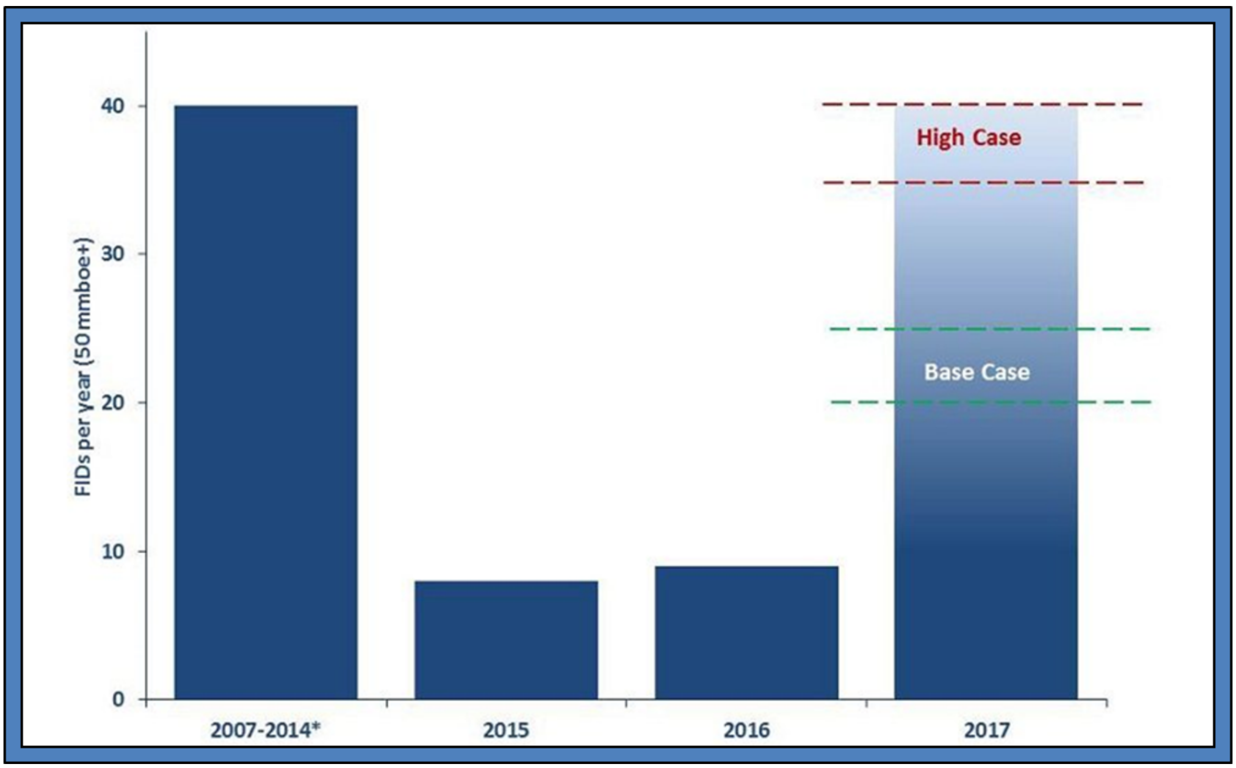
Figure 1



As of 11/26/2016
Sources: Reuters, NASWellCube. The companies, securities, or investments above are shown for illustrative purposes only. Their inclusion should not be interpreted as a recommendation to buy or sell. J.P. Morgan Asset Management may or may not hold positions on behalf of its clients in any or all of the aforementioned securities or investments. Past performance is not necessarily a reliable indicator for current and future performance.

With oil prices significantly above their lows of 2016 and OPEC's commitment to price stability, shale companies are once again starting to raise money for increased production. Notably, Diamondback Energy raised over $1 billion in December 2016, as it looked to expand its footprint in the Permian Basin. According to the U.S. Bureau of Labor Statistics, the downward trajectory of oil and gas extraction and services jobs seems to have not only stopped but also turned higher. In November 2016 we saw the number of jobs in this category rise by about 3,300, the first increase since September 2014. Also, rig counts are now at the highest level seen since December 2015 as short cycle shale producers smartly deployed capital in high yielding acreage as prices stabilized above $45. It is anticipated that U.S. oil producers will increase spending this year, as current guidance from numerous shale producers is indicating a growth of 350kb/d over the course of 2017. Wood Mackenzie expects a 3% (to $450 billion) increase in 2017 global upstream spending, with an increase of 23% (to $61 billion) for the lower 48 states spending as well. The research company also expects global Final Investment Decisions (FID's) to rise by 11 to 20 in 2017. (See Figure 2.) With oil prices forecasted to average $60-65 in 2017, and higher through 2020, there is little doubt that the recovery has begun and we are entering a new phase of the Shale Revolution.

Figure 2
Final Investment Decisions by Year



Source: Wood MacKenzie forecast 2017. Forecasts, projections and other forward looking statements are based upon current beliefs and expectations. They are for illustrative purposes only and serve as an indication of what may occur. Given the inherent uncertainties and risks associated with forecasts, projections and other forward statements, actual events, results or performance may differ materially from those reflected or contemplated.

There is concern that U.S. oil producers will once again hamper price appreciation by flooding the market with crude. Though possible, anticipated backwardation in the crude curve will limit the upside required to hedge future production. OPEC production cuts, announced November 30, 2016, will likely be enforced with about 65-70% compliance. In complying with these cuts, OPEC is looking to flip the crude oil curve into backwardation. Allowing prompt prices to rise to a healthy target of $60 or higher while keeping forward prices depressed at (or below) $55 a barrel will ensure that the rate of future shale production growth is contained. This curve structure also allows OPEC to increase production when immediate demand arises. Another argument against shale producers oversupplying the market is the fact that increases in rig counts have been required to counter the normal depletion rate of existing wells. New shale well production rates typically drop about 75% during the first year of production, with the U.S. Energy Information Administration estimating the annual decline rates of Bakken, Eagle Ford and Permian wells at 47%, 55% and 22% respectively. Lastly, offshore oil companies, both domestic and abroad, are less likely to benefit as much as their shale counterparts due to additional costs and longer investment cycles, which lead to a higher breakeven price. As such, it is more likely that we see a steady to gradual increase in U.S. production rather than a "flood" as some analysts have suggested.

The oil price recovery that started in mid-2016 is likely to continue through 2017 and U.S. shale companies are an investment most likely to benefit from this price appreciation. They learned from their mistakes and have become nimbler. Good Ol' American Shale is back! And it's stronger, leaner and smarter.

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Ebele Kemery, executive director & portfolio manager, is a member of the Global Fixed Income, Currency & Commodities (GFICC) group at J.P. Morgan Investment Management. Based in New York, Ebele is the Head of Energy Investing. An employee since 2007, she has previously held roles in London, New York and Houston as a physical and derivatives oil trader, specializing in the North American and Transatlantic energy markets. She is currently actively managing four commodity funds, with outperformance primarily driven by repeatable energy alpha generation. Ebele's investment strategy is a bottoms-up fundamental approach, which employs a set of disciplined qualitative and technical variables to evaluate market opportunities, whether the market is in bull or bear cycles. Her expertise in accurately understanding and forecasting supply/demand dynamics and capitalizing on inventory imbalances is used to develop a well-diversified set of tactical and thematic alpha strategies. Ebele's physical oil background allows her to digest market information typically overlooked by the average investor, and her experience in options gives her the ability to state high conviction views within risk parameters. Her views also drive thematic fixed income investments across Macro, Emerging Markets, Investment Grade/High Yield Credits and Foreign Exchange investment vehicles.

Is Inflation Hedging a Reason to Save in Gold?

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Gold is seen by some investors as the ultimate long-run hedge against the risk that inflation poses to their savings' purchasing power. This article provides a brief review of the research on why and whether gold provides an inflation hedge and then gives an alternative view on whether this was a legitimate reason for U.S. dollar-based investors to buy gold over the last 217 years.

This brief paper specifically examines gold from the perspective of an investor who starts to save towards retirement, over time horizons between 25 and 40 years, buying one unit of gold per year. This practical vantage point is very different from most academic research, which focuses on whether gold and inflation have a long-run equilibrium relationship, as assessed through cointegration tests.

Why Would Gold Be an Inflation Hedge?

Gold's total stock is limited by nature, and new supply from mining is relatively inelastic and small at about 1.6% per annum. This characteristic is in contrast with central banks' and governments' ability to drive inflation by increasing the money supply at will. One might expect as fiat money's purchasing power falls with inflation, gold's value should be maintained – protecting gold holders from losses in purchasing power.

This idea requires that the price of gold increases in terms of other currencies by at least those currencies' rates of inflation. But what channel of economic action might drive this long-run relationship into equilibrium is not clear.

Levin *et al.* (2006) point to the gold miners as the force that should hold the relationship in place. They argue that gold mining costs would be driven by general inflation, and as the miner's costs go up they would demand a higher price for gold to maintain their profit margins.

But the argument seems to have a few weaknesses. The basket of goods used to estimate inflation would be quite different from the goods and services bought by gold miners. Additionally miners have the ability to exercise a real option to close expensive loss-making mines when prices fall, note Moel and Tuffano (2002). This was shown to be the case as average costs for miners fell dramatically after 2011 in response to falling gold prices. O'Connor, Lucey and Baur (2015) formally test the direction of causality between gold prices and gold mining costs. They find that gold prices drove mining costs both globally and in most individual countries examined. Based on this finding, miners are price-takers and therefore they cannot be what would hold the relationship in equilibrium.

Fortune (1987) suggests an alternative channel: an increase in expected inflation would encourage investors to buy gold and sell any assets that give a fixed nominal return (such as bonds.) This action drives up the price of gold in that currency, protecting savers and investors from falls in their purchasing power due to inflation. He finds a positive relationship between gold and inflation, but doesn't look at expected inflation so this channel remains untested.

Empirical Evidence on Gold and Inflation in the U.S.

There is plenty of research on whether there is a long-run equilibrium relationship between gold and inflation. Highlights for U.S. data will be discussed here; readers can consult O'Connor *et al.* (2015) for a full summary of available research.

Leven *et al.* (2006) use cointegration tests and find a 1:1 long-run relationship between the two in a World Gold Council study, pointing to gold as a good inflation hedge. Worthington and Pahlavani (2007) look at a longer period (1945 to 2006) with more advanced cointegration tests and again find a strong inflation hedging relationship. They allow for a change in the relationship at the closing of the gold window by President Nixon when gold's value was allowed to float in the 1970s due to higher inflation. Allowing for a change in the relationship at the closing of the gold window seems sensible, but higher inflation is the very thing gold is supposed to be protecting investors from: if gold is an inflation hedge, periods of higher inflation should *not* require special treatment. Taylor (1998) examined both the pre-World War II and post-1973 periods and again concluded in favor of gold as an inflation hedge. Bampinas and Panagiotidis (2015) take this research to the next logical step and use a 200-year dataset, starting in 1791, to assess whether gold is a truly long-run hedge for US dollar investors and find that it was.

Not all studies agree that the relationship exists however. Batten *et al.* (2014), for example, find no relationship between gold and U.S. C.P.I. using data from 1985 to 2012. They use 1985 as a start date to account for the finding that there was a significant statistical structural break in U.S. C.P.I., possibly due to the beginning of the so-called period of "Great Moderation." They also show that the relationship varies a lot through time with inflation's importance rising as interest rates fall.

An issue with all of these studies is that a finding in favor of cointegration is interpreted as gold being an inflation hedge. But cointegration does not mean that gold always protects an investor's wealth from inflation. It simply means that at times during the period under analysis, gold's price reached a point where investors in gold have neither gained nor lost any purchasing power. The following day prices may fall or rise and continue in that trend for long periods such that there can be long runs of time where investors have lost purchasing power (or vice versa.)

Cointegration points to occasional periods of equilibrium - not a permanent balance between gold and inflation. The half-life of the time spent in disequilibrium is estimated to be between 30 months by Levin *et al.* (1994) and 40 months by Levin *et al.* (2006). Long periods of imbalance are not uncommon when looking at inflation and asset prices. Rogoff (1996) shows a similar period of disequilibrium when surveying the literature on the theory of Purchasing Power Parity – the long-run equilibrium relationship between inflation and currencies. However, long periods where the two are not in balance does imply that not all who save in gold will have their wealth protected when they come to retire or draw down their savings.

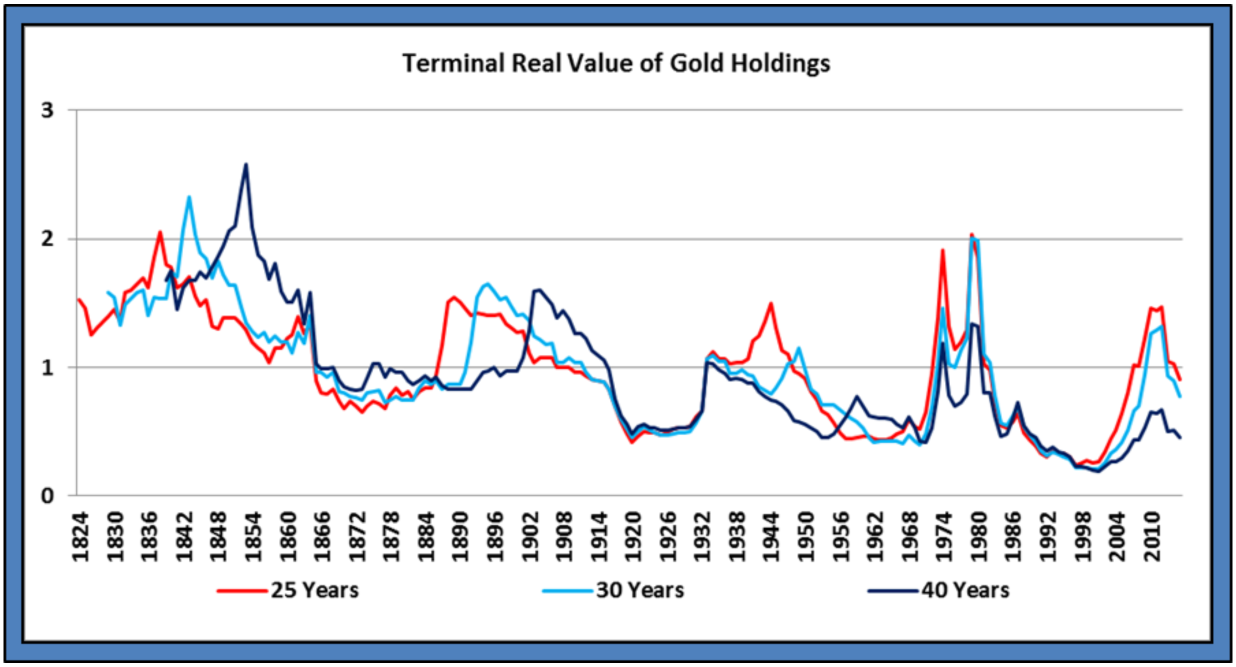
Inflation Hedging From the Perspective of a U.S. Dollar-Based Investor

This article adds to the debate on inflation hedging by looking at the real outcomes for U.S. dollar-based investors, who have saved in gold over various horizons during the last 217 years. We examine how gold has performed for such an investor within a single lifespan, laying aside a long-run statistical idea to focus on the real outcomes savers would have achieved if they had put their money in gold. In this study, the investor buys one unit of gold per year at the annual average price. This means that the investor buys evenly over his or her investment life. Three investment horizons are chosen: 25, 30, and 40 years. These horizons were chosen as they seem reasonable approximations of what individuals saving for a pension might do.

In order to assess the usefulness of gold as an inflation hedge, the real (inflation-adjusted) value of gold holdings at the end of each investment horizon is tabulated, providing the terminal real value for our hypothetical investors. Figure 1 on the next page shows how U.S. dollar-based investors would have fared between 1800 and now. If the value shown is 1 or greater, the gold portfolio's value has matched or beaten inflation. For example, a finding of 1.1 would indicate that the investor's purchasing power was 10% greater than it would have been if gold had merely kept up with inflation.

Each year in Figure 1 indicates the year that the hypothetical gold investing ended. So for example, investors who bought one ounce of gold per year starting in 1800, ending in 1824, and saved for 25 years would have beaten inflation by 53% and increased their purchasing power. Further, if investors had begun buying gold in 1829 and continued to save for 40 years through 1868, their investment would have maintained its purchasing power, meaning that they were almost exactly hedged against inflation. Any terminal real value greater than 1 is clearly a very successful inflation hedge since beating inflation would be better than merely matching it.

Figure 1



Source: U.S. Dollar Annual Average Gold Price and U.S. Inflation from measuringworth.com

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The average terminal real values of a gold saver's holdings over 25, 30, and 40 years are 0.98, 0.95 and 0.90 respectively. As all are close to 1, this seems to indicate that gold acts as at least a weak hedge against inflation.

The above tests of gold's hedging ability reflect the average of the terminal portfolio values, and this average seems biased upwards by some very large terminal real values for a small number of years - some showing a doubling of purchasing power as happened for investors who began saving around 1814. This seems to drag the average up and biases the results in favor of gold as an inflation hedge.

Another more practical way to look at the results for an investor is to see what the percentages of investors were that matched or beat inflation over the 217 years. Fifty percent of the 25-year investors matched or beat inflation through saving in gold; 40% of 30-year investors were successful; and only 29% of 40-year investors matched or beat inflation.

Even in the best case (with a 25-year holding period), only half of all savers over a 217-year period managed to match or beat inflation by saving in gold. Given that gold as an inflation hedge seems to have been a 50:50 bet, one could conclude that savers cannot rely on this precious metal to protect their purchasing power.

Looking at the graph, no saver with a 40-year horizon managed to beat inflation after 1980 (as a terminal year), and the average terminal portfolio value was only 0.42, a 58% loss in purchasing power. Notably, gold behaved better as an inflation hedge under the shorter-term holding periods.

These results are admittedly limited by their particular assumptions. This analysis assumes a smooth savings pattern of one unit of gold per year rather than an amount of dollars or a growing amount of money as income rises. This analysis also assumes that savers will liquidate their entire portfolio at the end of the period they were saving over rather than draw down their savings smoothly during their retirement.

The analysis also does not include transaction, storage or insurance costs, which would worsen the terminal real value of investors' portfolios. Additionally over time the costs and ways to hold gold would have varied considerably.

Another caveat is that we carefully referred to our investors as "U.S. dollar-based" rather than as U.S. investors *per se*. Recall that it was effectively illegal to own gold as an investment in America between 1933 and 1964.

Conclusion

There may be good reasons for an investor to hold gold, including portfolio diversification benefits and acting as a safe haven during major market crashes, but reliable inflation hedging properties does not appear to be one of them. This paper found that since 1800, U.S. dollar-based investors matched or beat inflation by buying gold every year in only 29% to 50% of three long-term investment horizons. This failure to reliably hedge investors against inflation shows that gold has not been a very effective way to protect the purchasing power of wealth, at least historically for US dollar investors.

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Fear and Heat in the Texas Power Markets: A Tail-Risk Example and Perspective

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ERCOT stands for the Electric Reliability Council of Texas and the main purpose of ERCOT is to operate the electric grid within the state of Texas. Per the Federal Energy Regulatory Commission (FERC),[1] various metrics on the ERCOT power market are shown on Table 1.

Table 1

ERCOT At A Glance	
Members	162
Generating Capacity (summer, MW)	75,964
Peak Demand (MW)	69,621 (2015)
Transmission Lines (mi)	46,500
GWh of Annual Energy	340,034
Annual Billings	$34 billion
States Served	1 (Texas)
Square Miles	~200,000
Population	24 Million

Abbreviations:
MW stands for megawatt while mi is an abbreviation for miles.

Source: FERC.

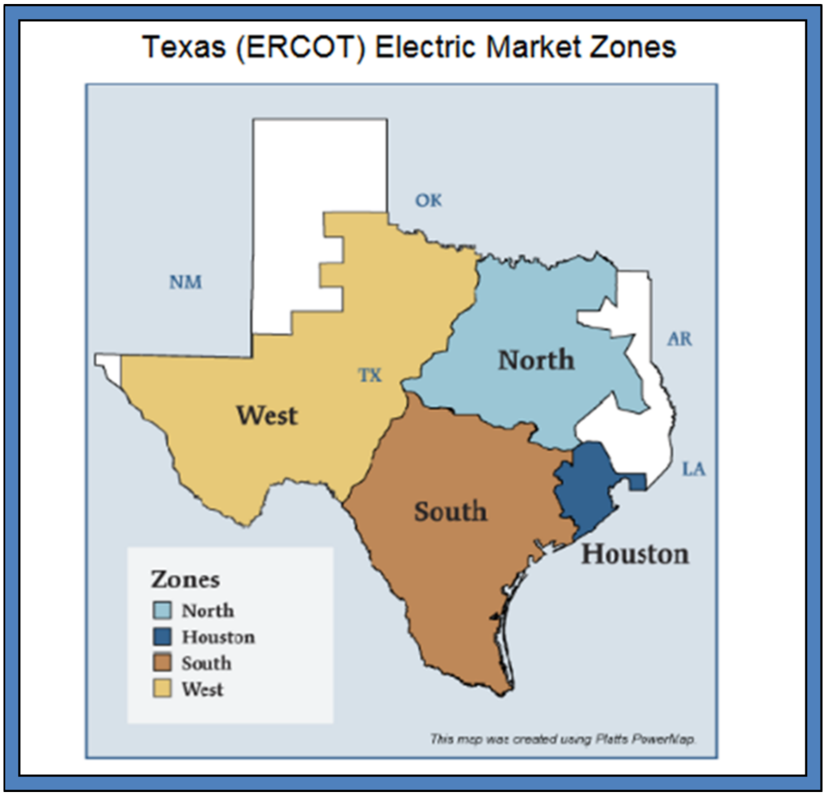
ERCOT power markets trade financially on the Chicago Mercantile Exchange (CME) and the Intercontinental Exchange (ICE) as well as over-the-counter (OTC). The market also trades physical products both OTC and on the Canadian exchange, NGX. Texas, on a state by state basis, is the largest producer of electricity in the country[2] and as such, attracts a number of traders, investors, electricity generators, and retail electric providers.

One of the main differences between ERCOT and other power markets in the U.S. is the lack of a capacity market. In brief, capacity markets are a type of forward market - power plants receive compensation for the ability to provide power at a future date. In regions where capacity markets exist, capacity commitments are a tool that allows the grid operator to ensure that reliability exists on the grid and to better plan for future years. Capacity markets provide signals for when longer-term investments in generation are required. Generators also of course receive compensation for the energy they produce. In Texas' case, energy is the primary means by which the generators make money. There is a difference though between generator income, which occurs in the present, and the capacity market, which is a type of expected forward compensation.

The lack of a capacity market in ERCOT is an important point to note due to the "peaker" impact on market pricing. When energy shortage or near shortage situations occur, various power plants that seldom run are called into action (called "peakers"). Peakers tend to set the marginal price of power in the market when they run. Peakers tend to have higher startup, operational, or overhead costs than cheaper or more efficient baseload plants; these peaker power plant operators target covering their costs based on shorter periods of operation or generation. Hence, these plants are, in a sense, betting on shortage or near shortage scenarios to meet their financial targets. ERCOT, like many grid operators, run auctions to determine which plants are dispatched and the generators bid at price levels for which they run. As such, peaker plants tend to bid high or higher than other generators to cover their higher cost structures. Peakers, like baseload plants, are not compensated by a capacity market in ERCOT; sales from energy are their main means of revenue. The market structure in ERCOT, leaning on the use of peakers to cover demand/supply equilibrium in times of high demand or periods of shortage, means that energy prices tend to be higher during shortage or near shortage scenarios. Having an energy-only market leaves only one mechanism by which generators in ERCOT can rely on for their financial success, and this market design has a direct impact on the resulting energy prices.

In the ERCOT power market, electricity trading is bucketed into peak or off-peak exposure. For "peak hours," traders agree to buy or sell power for hours ending 7am to 10pm for weekdays for a fixed price with the floating leg settling against the ERCOT published price for the corresponding hours. "Off peak" is generally considered nights and weekends. Power trading for ERCOT is also primarily traded in zones, per the following FERC map,[3] shown in Figure 1 on the next page.

Figure 1



Source: FERC.

Market liquidity seems to lie in the North Zone (or the area around Dallas). The ERCOT power market trades daily/weekly or monthly products, depending on the activity set of traders and hedgers. Market liquidity also seems to increase as positions approach settlement or delivery.

Power is a physical commodity that goes to delivery and is consumed; it is not a commodity that can be readily stored in stockpiles like coal or stored in tanks like oil. As such, when there is not enough power, prices increase to (usually) balance supply and demand, but as demand does not always react to price, shortages or blackouts, as they are more commonly known, may result. For reference, wholesale prices for ERCOT are capped at $9,000/MW;[4] for comparison, the average retail price for all market sectors in Texas for 2015 was approximately $87MW.[5]

In summary, regarding the power markets and ERCOT in particular, the background section of this article explained:

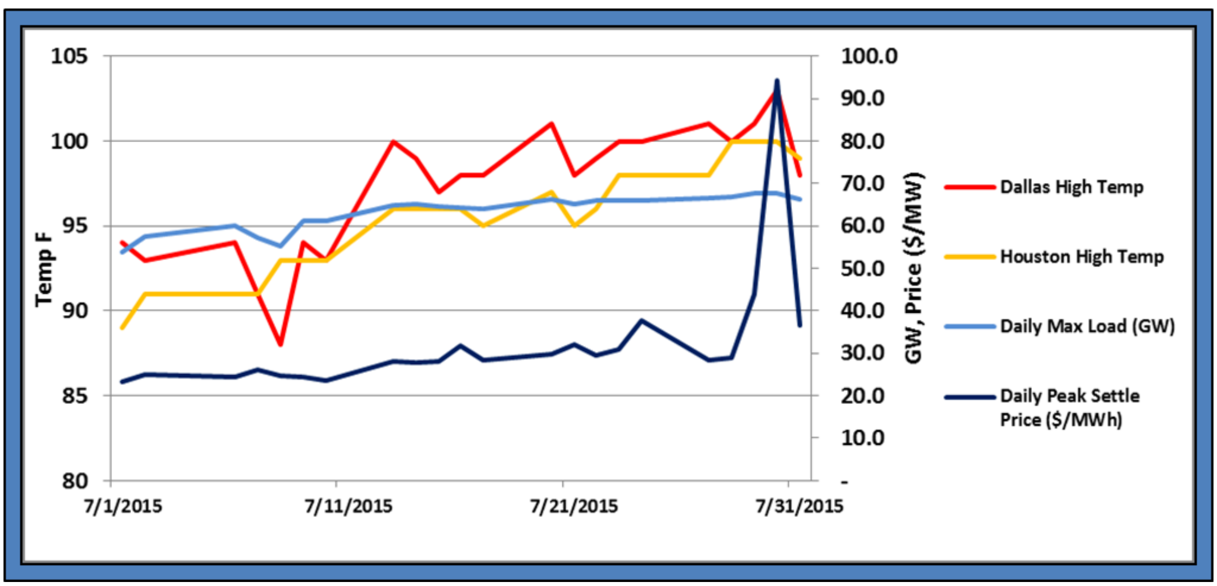
- power is a physical commodity and must be consumed or lost: it cannot be stored;
- there is no capacity market in ERCOT, thus generators are paid for what they produce in current time; and
- peaker unit pricing can significantly drive up power prices in ERCOT as operators attempt to cover costs using these 'reserve units'; peaker usage may produce spikes in power prices at time of use due to the economics of the plant.

With this background in mind, this article will now cover a case study, which brings up important risk-management questions and lessons.

Case Study from the Summer of 2015

June and July of 2015 were shaping up to be fairly benign months. As Figure 2 shows, temperatures had been in the 100s F in both Dallas and Houston, but both North peak settlement prices and load in ERCOT remained far from reaching record levels.

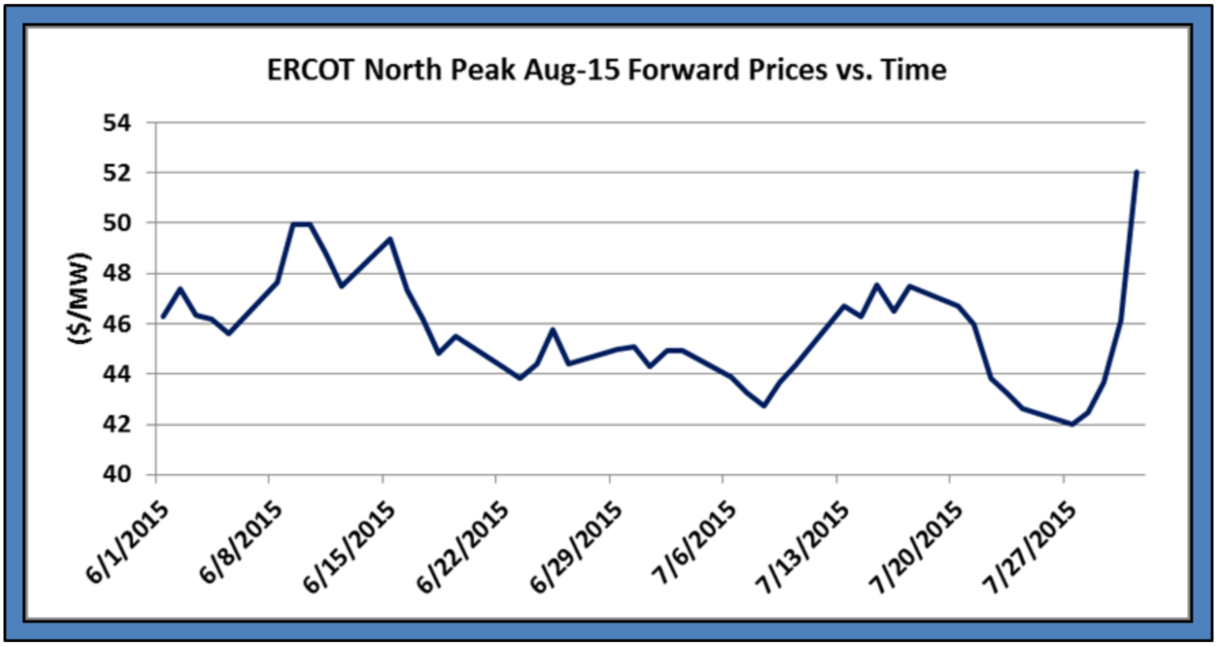
Figure 2



Temperatures did reach 103 F on July 30, and settlement prices for the day did reach $94/MW (with a peak hourly price of $430/MW) based on an average peak load for the day of 58.1 gigawatts (GW), with a peak load of 67.6 GW. The price spike was attributed to both heat and a lower-than-average wind generation contribution for certain peak hours. The 67.6 GW load for the day was not too far from the previous record load of 68.3 GW on August 3 of 2011;[6] but of note, the overall generation capacity available to the grid had increased by about 5 to 6 GW, net of retirements, since August of 2011.

Generally, forward prices for August were flatlining to decreasing since the beginning of June. However, on Friday July 31, the market closed up about $6 or about a 2.2 sigma move, as illustrated in Figure 3.

Figure 3



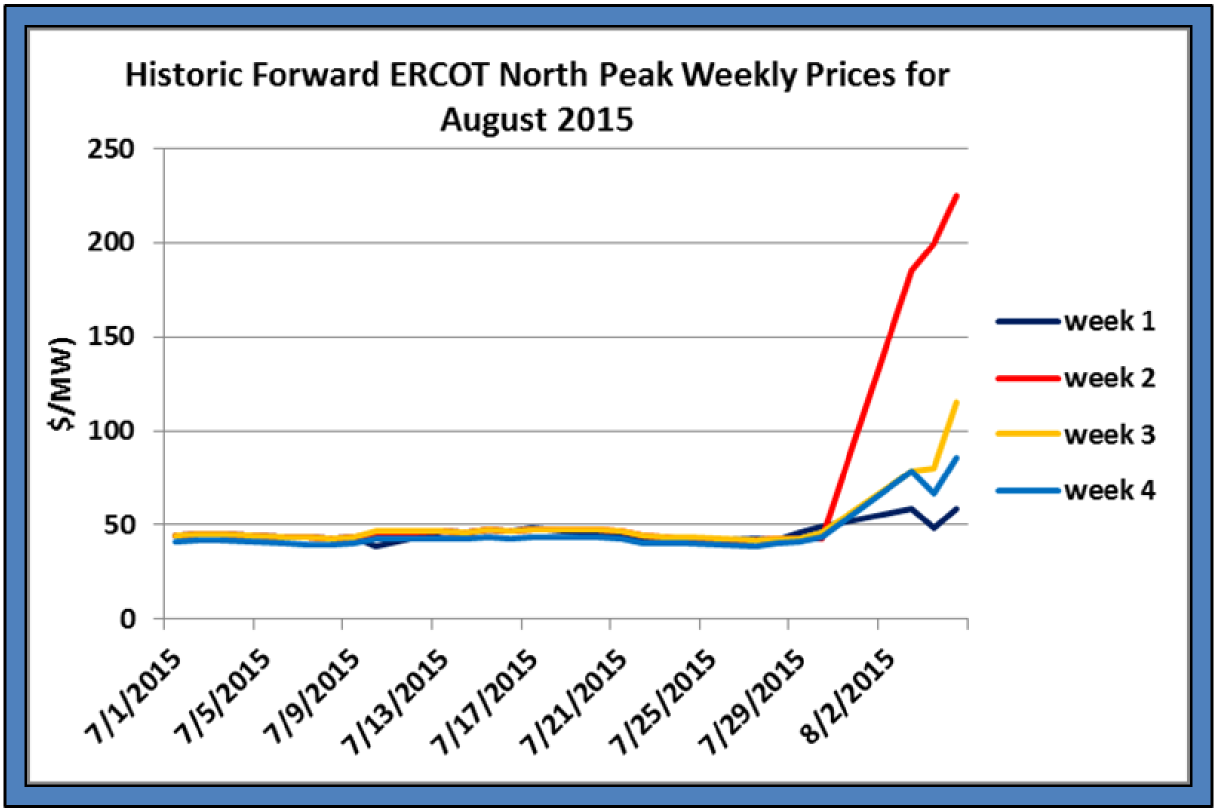
Forecasts were calling for high 90s to low 100 degree temperatures in Texas over the next couple weeks, which is not out of the ordinary for a Texas summer and nothing substantially different than what had been happening during most of July.

And then things changed.

Over the weekend, when the market was closed, weather models shifted to higher heat in Texas by 2 – 4 degrees F, forecasting temperatures up to 105 F in Dallas during various days of the first and second weeks in August. While the actual temperature forecast increase was only a couple degrees warmer, the shift was significant. As temperatures increase, the risk or potential risk of the load surpassing generation also increases. If load exceeds generation, the locational area has a potential for blackouts. As the heat increases, the power load driven by air conditioning demand increases. Generally, air conditioning runs more when it's very hot outside and power load correspondingly increases.

When the market opened on Monday morning, prices for weekly electricity strips (timeframes) gapped up and settled per Figure 4 on the next page.

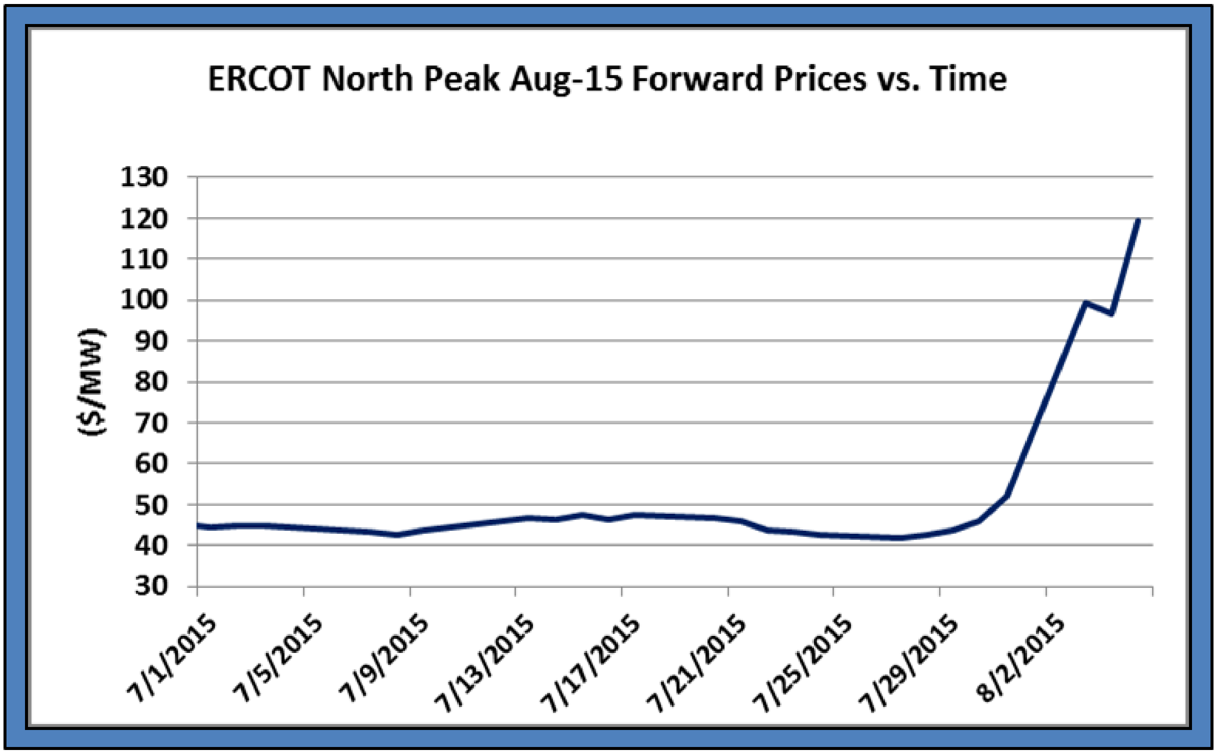
Figure 4



The second-week peak prices gapped up about $45/MW[7] on open and settled from Friday's close of $55/MW to $185/MW (an approximately 20-sigma move) before reaching a peak of $225/MW on August 5. So, prices basically tripled to quadrupled overnight and over a few days, respectively. Bid-ask spreads had gone from the usual dollar to a few dollars per MW wide to, at one point, several hundred dollars per MW wide. The gap up in energy prices can be seen as the expectation that peaker plants would likely be called into action to cover the demand/supply scenario. In other words, the gap up in market prices signals a shift from more baseload power generation to the usage of more costly peaker units.

The prices for the full month of August gapped up from $52/MW to about $99/MW (an approximately 21-sigma move), eventually peaking around $119/MW, as seen in Figure 5 on the next page.

Figure 5



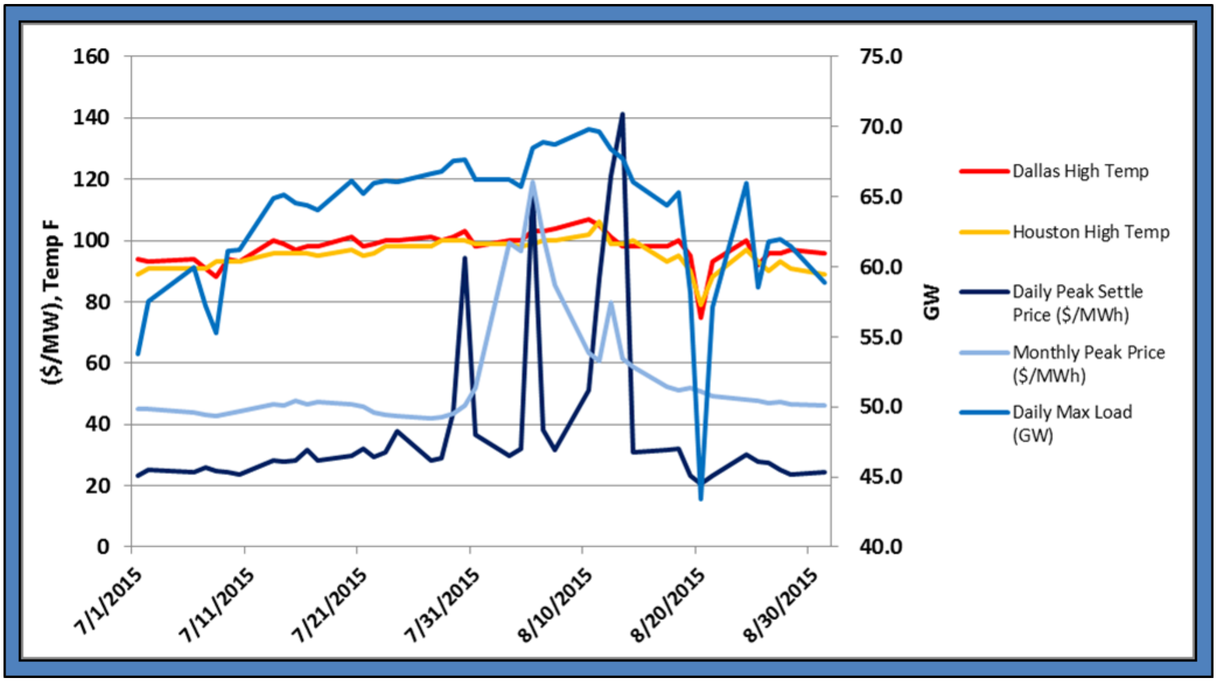
As a risk manager, price-gap scenarios are obviously a difficult situation, if not impossible to address, at the time of the market move. While it is no secret that the ERCOT market has the potential to make these types of price moves (after all, it does get hot in Texas during the summer and people do run their air conditioners), traditional risk measure and models such as Value-at-Risk (VaR) are not intended or designed to provide risk measures for this type of price-gap scenario. Most users of VaR employ a 95% or a 99.5% confidence interval based upon historic forward price volatilities and correlations. None of those measures, which are used to produce ranges of potential outcomes, would have been useful for forecasting what actually happened in the ERCOT market during the summer of 2015.

Unfortunately, a risk manager cannot use option market data as a predictor for market volatility since the availability of option price data is limited. The option market is not very transparent as it trades primarily OTC and as a result, insight or transparency into implied volatility is limited. The available data did suggest an annualized forward implied volatility, which even at a three sigma move, would still leave the estimate of possible outcomes far short of the actual market outcome at the time. In other words, the other market data that could provide a signal of some expected price jump or volatility was not signaling a jump either.

The Aftermath

Outright temperatures in Dallas and in Houston exceeded the 105 F mark during that second week of August. The ERCOT North Hub peak prices, load,[8] and temperatures of the time are shown on Figure 6 on the next page.

Figure 6



Peak prices for daily power rose to the $140/MW range in the second week of August, and the week averaged $86/MW. Peak power for the month finished with an average of about $46/MW, far from the peak that power traded at during the first few days in August (at/near $140/MW). Note that all power prices in this region decreased considerably from the highs that occurred during the initial "shock" period. Power prices are generally mean-reverting over time, but the difficulty for the risk manager is figuring the length of the mean-reversion process.

An interesting point is illustrated in Figure 6, concerning August 13, when prices spiked while temperatures were down from the high and down from the previous day. This unexpected price spike is believed to be due to the volume of wind generation contribution to the grid being far less than anticipated (which is similar to what happened on July 30), leading to the use of higher priced peaker plants. Loss of wind generation capacity can substantially alter the demand/supply equilibrium, invoking peaker usage and subsequent higher energy prices.

Lessons Learned

From a risk perspective, managing extreme tail risk in ERCOT can be quite challenging:

- the market can gap on open and bid-offers can widen (which does not generally appear in traditional risk models);
- the market can move faster than traders can respond;
- stop-loss limits can be hit during market gaps; and
- traders may try to hold rapidly losing positions and attempt to withstand the price jump (since they assume a mean reversion in price will eventually occur), and in the meantime, stressing previously established risk limits.

In theory, traders should be able to short a market to take advantage of situations where they believe the market to be overvalued. However, taking short positions into summer or winter in ERCOT exposes positions to extreme tail risk (or market gap pricing).

While not the subject of this article, ERCOT on occasion has had moments during the winter where extremely cold weather has led to spikes in gas prices. During extremely cold weather, there can be freeze-offs on gas wells and gas distribution systems (which produce a lack of natural gas on the market). At the same time, there would be high demand for residential/commercial heating, which would compete with fuel for power plants. All these factors taken together can then led to price spikes in the winter.

So how does a risk manager ensure an ERCOT trader is allowed room to operate and take short positions without putting a whole company at risk? In short, a risk manager must correspondingly ensure that a single position loss is not greater than the company can sustain.

There are several methods to attempt to mitigate an extreme financial loss to the company when exposed to periods of extreme tail risk, including:

- setting seasonal short position limits for positions carried over a weekend;
- attempting to quantify the real risk taken by a trader during these periods;
- quantifying holding periods or loss levels for carrying positions over gap periods to try to capture market mean reversion; or
- setting aside a financial pool or reserve to cover gap pricing risk due to extreme tail events.

A rational approach to managing Monday market gaps is to set seasonal short position limits on positions carried over the weekend when the market is dormant. Weekend position limits are a simple approach to help mitigate this type of tail risk. Finding the volume limit is an exercise in management decision-making. For instance, limit the trader to short no more than 500 MWs during the summer in ERCOT over the weekend. In terms of dollars, on a monthly peak power basis, the 500 MWs would equate to approximately an $8 million dollar loss in this scenario (500MW x 21 peak days x 16 peak hours/day x $47 price move). If this loss is unpalatable to management, then lower the volume limit. Trading management should be very aware of gap pricing risk during these potentially high volatility seasons, and risk managers should peg short position limits to potential price-gap scenarios. If the potential dollar loss of a gap-risk scenario is unappealing, then one may want to consider not taking short positions at all or limiting shorts to just daily or weekly products for instance. But with the $9,000/MW cap in mind, even taking a 100 MW short at $100 into a peak one-day market equates to a loss of $14 million ($9000-$100 * 16 hours * 100 MW = $14.2 million) in a worst-case scenario. While the $9000 cap is quite unlikely to be reached and quite unlikely to last for an extended period (since one of the primary roles of the Independent System Operator is to maintain reliability and prevent such scenarios), shorting power in ERCOT can obviously be quite a dangerous proposition. One small volume position taken by a trader could cause the financial stop-loss limit of the whole book to be triggered.

A second approach to protect against a severe move is to try to quantify the real risk being taken by a trader. One might (a) use scenario analysis or stress tests, (b) modify VaR for bid-ask spreads or liquidity, or (c) adjust VaR volatilities for jumps in order to improve the quantification of the risk of short near-term ERCOT positions. There is a counter argument to this approach: these methods will likely result in a VaR type calculation or risk figure that is far greater than a trader or firm's limit. The result of these calculations may be that a trader is restricted from any short trades at all.

Conclusion

The best way to protect against a severe price move may be to adopt one of the following approaches: (1) take a dollar reserve against a tail move, (2) limit the positions that can be taken, (3) restrict carrying positions over the weekend, or (4) simply do not trade this market during the seasons of extreme weather patterns. Restricting short positions during seasons of extreme weather patterns will be unpopular with traders and may significantly impact the flexibility of the trader to exploit opportunities in the market, but in the long term this may lead to a more sustainable business model.

A final interesting point is that the market reacted quite bullishly to the forecasted weather change in the beginning of August 2015, yet prices actually settled not far from where they were prior to that initial jump. In this case, the fear of the grid being overloaded was far from the reality. While it can be difficult to swallow mark-to-market losses on a short position going into an extreme price move, holding the short through the potential weather shock in retrospect would have been far better than exiting on the initial run up in this particular case study.

Endnotes

1 https://www.ferc.gov/market-oversight/mkt-electric/texas/elec-texas-glance.pdf

2 http://www.eia.gov/state/rankings/?sid=TX#series/51

3 https://www.ferc.gov/market-oversight/mkt-electric/texas/2007/01-2007-elec-tx-archive.pdf via Platts PowerMap

4 https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.505/25.505.pdf

5 http://www.eia.gov/electricity/data/browser/#/topic/7?agg=0,1&geo=0000000002&endsec=g&linechart=ELEC.PRICE.US-ALL.A~ELEC.PRICE.US-RES.A~ELEC.PRICE.US-COM.A~ELEC.PRICE.US-IND.A&columnchart=ELEC.PRICE.US-ALL.A~ELEC.PRICE.US-RES.A~ELEC.PRICE.US-COM.A~ELEC.PRICE.US-IND.A&map=ELEC.PRICE.US-ALL.A&freq=A&start=2001&end=2015&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=ELEC.PRICE.US-ALL.A~ELEC.PRICE.US-RES.A~ELEC.PRICE.US-COM.A~ELEC.PRICE.US-IND.A~ELEC.PRICE.US-TRA.A~ELEC.PRICE.US-OTH.A

6 http://www.ercot.com/news/press_releases/show/73057

7 Courtesy of Intercontinental Exchange

8 Courtesy ERCOT

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LNG Markets in Transition

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In its 52-year history, the Liquefied Natural Gas (LNG) industry has experienced its fair share of bumps in the road. Recent developments, however, suggest even more radical changes that could have been envisaged as far back as two years ago. The energy industry is going through the largest increase in LNG capacity ever, built over a period of six years: 157 million tonnes per annum (mtpa) – equivalent to twice the LNG export capacity of Qatar. These new supplies are arriving in a market environment significantly different from what the industry anticipated when investment decisions were taken. In aggregate, more capacity is being built than any sponsor expected, and LNG demand in the premium Asian market dropped in 2015 while oil and gas prices have halved compared to their original levels. Beyond these market fundamentals, other changes are already visible through stakeholders' behavior. New players are challenging existing ones in different parts of the LNG value chain, bringing new ideas and developing new business models, which could profoundly transform the way LNG is produced, traded and sold to end-users.

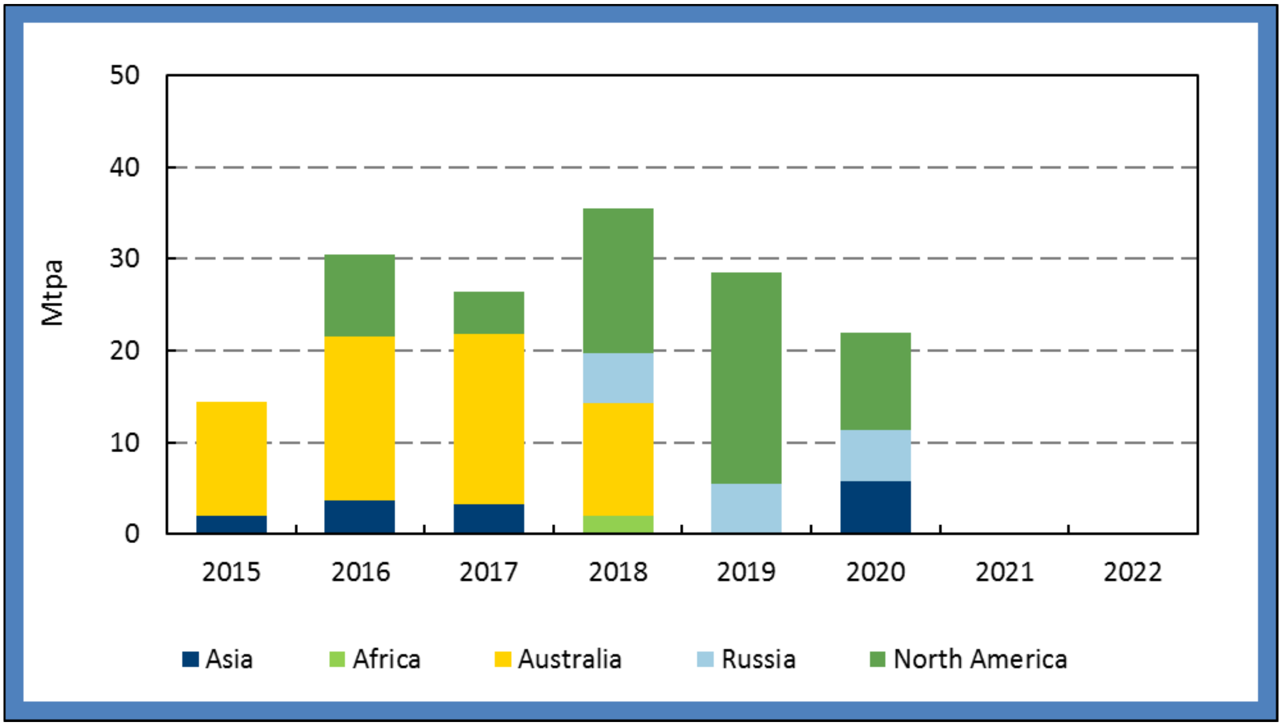
This should have been a happy story. As of June 2014, the gas industry was expecting that the large expansion of LNG export capacity would enable it to increase its share in the global primary energy mix, challenge coal in Asia, bring the advantages of a cleaner burning fuel to new LNG importing countries and help tackle energy poverty issues. It counted on Asian countries to be ready to pay a premium – at least prices close to those achieved in 2011-14 – for supply security and better air quality. A year before COP21, gas once again presented itself as the ideal partner for intermittent renewables. But despite its clear advantages, natural gas is still a fossil fuel. Most of the Intended Nationally Determined Contributions (INDCs) presented at COP21 do not consider it as a long-term solution, with the exception of those presented by gas producing countries. Ironically, coal is often preferred as a cheaper – often domestic – source of electricity. The externalities of coal-fired generation are rarely taken into account in developing countries. Many Asian countries such as Malaysia, Indonesia and Vietnam are building large coal-fired fleets. Besides, lasting high prices have given gas the label of an expensive fuel in the eyes of many importers. Consequently, the future of natural gas – and LNG – appears uncertain at this stage.

Yet, the storm clouds brewing on the horizon did not prevent LNG supply investments. As of June 2014 – a couple of months before oil prices started to drop and the Chinese economy began to show signs of weakness, around 100 mtpa had already been sanctioned to start in 2015-20. Interestingly, only one U.S. project – Cheniere's Sabine Pass trains 1 to 4 – belonged to that group. But additional U.S. LNG projects joined the herd on the heels of Cheniere, attracted by the large arbitrage between Asian and U.S. gas prices that could be captured by feeding increased Asian demand. Between August 2014 and late 2015, five additional projects and one project expansion, representing around 47 mtpa, were approved. Such large capacity additions would not be a problem if there were a market to absorb them. But even though gas prices plummeted, gas-fired plants remained largely uncompetitive against coal in the absence of a carbon price or tax. Additionally, low crude and oil product prices meant that these fuels remained competitive in the industrial, transport and power sectors, reducing the incentive to switch from oil to gas.

As new LNG projects started operating during 2015 and 2016, the dynamics of the global gas markets suddenly changed and started to reflect the oversupply. LNG supply did increase in 2015, albeit only by 6 mtpa due to outages in existing LNG plants and startup delays of new plants. Stronger growth is expected with around 35 mtpa of new LNG capacity starting operations (including the restart of Angola LNG). 2016 will certainly be remembered as the year of the first LNG cargo shipped from the U.S. Lower 48, but also a time when gas prices in Europe and Asia started to move in tandem again, dropping to around $4/MMBtu in spring. These two trends – rising supply and lower gas prices – are prompting sellers to search for new markets and countries to consider the LNG option with renewed interest. The latter trend became visible in 2015 as Jordan, Egypt and Pakistan started importing LNG. In 2016, new floating storage and regasification units (FSRUs) and floating storage units (FSUs) were commissioned in Colombia, Jamaica, Malta and Abu Dhabi. Looking ahead, countries with undeveloped and nascent gas markets could start importing LNG. These include Latin America (Costa Rica, Panama, El Salvador, Cuba); Southern Africa (Namibia and South Africa); West and North Africa (Morocco, Ivory Coast, Ghana, Benin, Senegal); and Asia (Myanmar, the Philippines). Such markets pose a different problem to investors: the transport infrastructure is limited, demand centers are small, creditworthiness is low and there is a need for anchor customers and project finance. They are also small, at least in the early stages, which means that they will contract to buy small volumes of LNG, multiplying the negotiating efforts of sellers. They are also extremely price sensitive: while there is a lot of interest in LNG at prices around $4-6/MMBtu, what will happen if and when prices rebound to higher levels?

A potential market squeeze beyond 2020 is currently the greatest worry of investors and buyers alike. Up to 2020 the pipeline of new LNG projects is very healthy. (See Figure 1 on the next page.) But with only two Final Investment Decisions in 2016 – train 3 of Tangguh in Indonesia and Woodfibre LNG in Canada, the LNG supply outlook beyond 2020 is very thin. The start date of a few projects will probably slip by about one year compared to the initial announced date. Delayed commissioning were seen in Australia and the United States. Some were due to technical difficulties, such as those experienced by the Gorgon LNG project in Australia, but project sponsors may have delayed the start of others in order not to worsen existing oversupply. As prices have dropped and future LNG demand is uncertain, LNG projects are struggling to move forward. Only the most competitive ones will be able to move ahead, brownfields such as Tangguh or those able to bring a competitive advantage including Woodfibre. It is notable that these projects are small (3.8 mtpa and 2.1 mtpa, respectively), which is a far cry from the 15 mtpa Gorgon or 22.5 mtpa Sabine Pass plants. They may also suit market needs better as buyers hesitate to commit for large volumes and long durations.

Figure 1
LNG Capacity Additions, 2015-22



Buyers have become more demanding about what they are ready to accept in terms of contractual conditions. Contract renegotiations in Asia have been relatively unusual compared to Europe, where pricing and flexibility elements were renegotiated in many long-term contracts after the 2009 oil price collapse. Some Asian utilities, on the other hand, sustained heavy losses during the period 2011-14. Their demands as such focus on three different aspects: 1) pricing mechanisms, 2) flexibility and 3) final destination clauses. Asian buyers want gas to be more competitive. While Petronet, the Indian company set up to import LNG, is asking for a 10 percent supply reduction from Gorgon LNG in Australia, there is also a general push from Japan, Singapore and China to index LNG prices on an Asian hub that would better reflect the region's supply/demand dynamics but this has yet to be created. Current market conditions are pointing to a five to 10-year period from 2017 onward where oil indexation will coexist along with Henry Hub plus netbacks based on European spot prices and regional indices such as Platt's Japan/Korea Marker. Creating a transparent and liquid hub could take a decade. However, a transition to hub pricing could accelerate if term and spot prices diverge significantly; for example, if oil prices rebound and spot gas prices remain low due to LNG oversupply. There are still some crucial elements that need to be put in place in many of these markets, including pricing liberalization and access to LNG terminals, except for in Singapore.

The need for flexibility is driven by increasing uncertainties on future demand, both at a country and company level. For example, a Japanese buyer would be struggling to forecast Japan's future LNG demand, which depends on policy decisions on nuclear, renewables, energy efficiency and the relative competitiveness of gas and coal. Additionally, the liberalization in the gas and power sectors means that such a buyer has to be more competitive than its peers. Meanwhile, the increase in spot and short-term LNG trade seems almost inevitable. It accounted for 28 percent of global LNG trade in 2015, and could represent up to 43 percent by 2020. This increase will be driven by additional quantities of uncommitted LNG, portfolio LNG, flexible U.S. LNG, Qatar LNG and limited extension of expiring contracts. Added together, these elements point to a more challenging environment for long-term contracts as buyers hesitate to commit for the usual 20 years and ask for shorter durations.

Final destination clauses from long-term contracts are another area of discontent. They are seen as an obstacle to the free movement of LNG and to the creation of trading hubs. Japan is particularly active on that specific issue and its Fair Trade Commission has been investigating whether such clauses are impeding free trade of LNG. They are likely to be the first ones to be removed from contracts.

Sellers are increasingly worried that buyers' demands have become too one-sided and how far negotiations could go. LNG is a capital intensive and cyclical business. Long-term commitments from buyers are still regarded as essential for projects to move ahead, notably because banks regard these elements as an essential part of project financing. But creditworthy buyers with long-term visibility are becoming a rarity and while new companies in existing markets and new would-be LNG importing countries are emerging, they do present a risk due to a potential lack of financing, payment issues and inadequate infrastructure. New markets and additional demand in developing markets are the hope of the LNG industry, but would contracts with such buyers convince lenders? Or does that lead to the inevitable rise in portfolio players who would directly secure LNG supplies from new facilities and then sign secondary sales contracts. This effectively transfers the risk to portfolio players, which could end up being long in supply at a time of market surplus. Such players have already taken an increasing role in the LNG business. Half of the long-term contracts signed in 2015 and most of the short-term contracts had "portfolio" as the origin, which means they were not attached to a specific LNG export plant.

Beyond that, sellers fear that contract sanctity itself could be at risk. So far very few contracts have been canceled in the LNG industry. During renegotiations, buyers and sellers strive to find an acceptable solution. One key development to watch will be the U.S. LNG export plants where the off-takers have to pay the liquefaction fee regardless of whether they take the LNG or not. So far, low market prices in Europe and Asia mean that off-takers have to consider the liquefaction fee as a sunk cost. Should this situation continue, the weakest off-takers may have difficulties sustaining multimillion dollar losses and may seek to renegotiate or cancel their contracts. This would have far-reaching consequences as banks would begin to look at buyers and the sanctity of contracts in a totally new light.

Endnotes

This article is based on the main findings of the KAPSARC/OIES book: LNG Markets in Transition: the Great Reconfiguration, (Oxford University Press, 2016).

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Prior to this assignment, Ms. Corbeau worked at IHS CERA (Cambridge Energy Research Associates) as Associate Director of the European Gas team. As a specialist in European gas market fundamentals and demand forecasting, she was responsible for updating the short- and long-term market outlooks for natural gas supply and demand, and prices in Europe. Prior to joining CERA, she worked in the fuel cell area.

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The New Administration and the Coming Resurgence in Commodities

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Introduction

Commodities are hard assets. Raw material production occurs in specific areas of the world. Crude oil and natural gas are present in the crust of the earth, but the economics of extracting the energy commodities differs by region. Metals and minerals are only present in certain areas around the globe. Crops require fertile soil and some agricultural commodities depend on certain climates. Commodity output is a highly localized affair, but consumption is ubiquitous.

Forecasting commodity prices is like a jigsaw puzzle: there are so many pieces to consider. Supply and demand factors are at the forefront when it comes to the path of least resistance of price for individual raw materials, but herd behavior in markets can also move the price of a raw material asset. Commodity prices tend to be highly volatile; the asset class tends to have a higher variance than stocks, bonds and currencies. Meanwhile, exogenous events like weather and political developments around the world can influence commodity prices. As we move forward this year, it is likely to be the political change sweeping across the western world that will impact availability and demand for many commodities.

Surprises in 2016

On the political front, 2016 was a year of surprises, and a year that marks the hallmark of a change from the status quo. The Brexit vote in the United Kingdom will lead to a British divorce from the European Union in the months ahead. The Italian referendum in early December was another example of a rejection of globalism; and elections in France, Germany and the Netherlands in 2017 could further debilitate an already weakened E.U.

Meanwhile, perhaps the most significant change in the world order occurred with the election of Donald J. Trump as the forty-fifth President of the United States on November 8. The U.S. election was perhaps the most contentious affair in history. A victory in the Electoral College despite a loss in the popular vote has vaulted the businessman and media star to the highest office in the richest nation on earth. On January 20, President Trump pledged to make many changes that will impact not only the United States but the world at large.

A New Approach to Business

President Trump will be the first leader of the U.S. since Herbert Hoover who comes from a business background and the first since Ronald Reagan who has been a star in his former career. On the campaign trail Mr. Trump promised to make America great again by renegotiating trade agreements, putting the nation's citizens and businesses first to create and save jobs and spur economic growth. In the days following the election, the (then) President-elect cut a deal with an air-conditioning manufacturer preparing to export U.S. jobs to Mexico. The new leader of the United States won the election on a promise to be the dealmaker-in-chief.

Energy Independence

One of the hallmarks of the new administration will be to create a regulatory environment that promotes energy independence. The United States has massive reserves of oil and natural gas. The nation is among the top three oil producers in the world alongside Russia and Saudi Arabia. The election of the new leader could be one of the reasons that the international oil cartel, OPEC, agreed to cut production and abandon a strategy of flooding the market with crude to make North American shale output uneconomic.

The new administration will eliminate certain regulations that had increased compliance, drilling and exploration costs for shale oil. Fewer regulations will result in a reduction of the production cost for all energy commodities including oil, gas and coal. The lower cost of goods sold for energy together with fewer regulations will result in more energy output for the U.S., which will likely increase the number of jobs in the energy industry. When it comes to price, it will depend on whether OPEC sticks to their production cuts and the overall health of the global economy.

Reworking Dodd-Frank

On the campaign trail, the new President said that for every new regulation his administration would get rid of two existing regulations. When it comes to commodity and financial markets, the Dodd-Frank Act is likely to change dramatically. There are many issues facing Congress and the regulatory agencies when it comes to the legislation passed in 2010. One of the most important issues for the futures markets will be position limits. There have been discussions in Washington about limiting any market participant from taking a position that is greater than 25% of the open interest in a futures contract. The agencies have focused on available supply but supply is often a function of price. It is likely that position limits will revert to the Exchanges, which will only put limits on the spot and perhaps active month contracts.

If the intention of the administration is to achieve energy independence, commodity producers in the U.S. will need the opportunity to use the futures and swap markets to hedge future production when price opportunities present themselves. With the price of crude oil around the $50 per barrel level any rallies will likely see an increase in hedging activity from shale producers. Additionally, after watching natural gas fall to lows of $1.6110 in March of 2016, it is likely that gas producers will look to hedge with prices much higher in late 2016. The new President and his appointees will change the regulatory framework in Washington to allow regulators to work for and support businesses rather than the opposite, which has been the trend since the enactment of Dodd-Frank.

Infrastructure Building and National Security

One of the other major initiatives of the Republican President, with support from both Houses of Congress, will be the biggest infrastructure building project in the United States since the Eisenhower Administration in the 1950s. Roads, bridges, tunnels and airports across the nation have aged and are in need of updating. Additionally, the construction of a security wall along the southern border of the United States will be a major infrastructure undertaking. Commodities, including metals, minerals and energy, are the basic building blocks of infrastructure. Therefore, it is likely that the demand for industrial commodities will increase. At the same time, the U.S. central bank has warned that monetary policy alone will not spur economic growth. The Fed has stated, on many occasions, that fiscal stimulus goes hand in hand with the tools used by the central bank since the 2008 financial crisis. If the U.S. economy begins to grow at a faster pace, we may see other governments around the world follow the fiscal stimulus example. Just like Europe followed the U.S. by employing quantitative easing to stabilize the economy over recent years, they are likely to follow the U.S. on a path towards fiscal stimulus if they see positive results in America.

Finally, the new President has called for a return of businesses to the United States. Over past years, commodity merchant businesses have left the shores of the U.S. for jurisdictions with lower taxes and fewer regulations. As the new government also intends to lower taxes, some commodity merchant business may return to the U.S. and other new businesses are likely to open to support the infrastructure building and take advantage of a friendlier business environment.

Moreover, the flow of commodities around the world has always been a strategic imperative when it comes to national security. Agencies like the CIA include data about commodities when modeling economic conditions existing in other countries such as Russia and China. The departure of many commodity businesses from the U.S. over the years has decreased the transparency for these agencies and attracting commodity business back to the nation will only improve the availability of data.

The commodities business will undergo a renaissance in the United States, given the policy goals of the new administration. For producers of raw materials, an exciting period could be just around the corner. For consumers, understanding the fundamentals of commodities they require on a daily basis will become of paramount importance.

Endnote

The opinions expressed in the *GCARD* are those of the individual authors.

Author Biography

ANDY HECHT
Subject Matter Expert, "Foundations for Commodities" Professional Education Program, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

Mr. Hecht spent nearly thirty-five years on Wall Street, including two decades at the trading desk of Philipp Brothers (which became Salomon Brothers and which later, in turn, became part of Citigroup before ultimately being spun off to Occidental

Petroleum.) Mr. Hecht has unique insights into the commodity markets that are a result of his rich and varied Wall Street experience: he's booked vessels, armored cars and trains to transport and store a wide range of commodities as well as having worked directly with the United Nations.

Interview with Dr. Vince Kaminski, Ph.D.

Professor in the Practice of Energy Management, Jesse H. Jones Graduate School of Business, Rice University; and Member of the J.P. Morgan Center for Commodities' (JPMCC's) Research Council at the University of Colorado Denver Business School

Dr. Vince Kaminski, Ph.D., Professor in the Practice of Energy Management, Rice University, presenting on "The Involvement of Financial Institutions in the Commodity Markets" at the September 30, 2016 JPMCC Research Council meeting. Dr. Kaminski is also a member of the JPMCC's Research Council.

In the Spring 2017 issue of the *GCARD*, we are honored to interview Dr. Vince Kaminski, Ph.D., Professor in the Practice of Energy Management, Rice University and an inaugural member of the JPMCC's Research Council. In this issue's interview, Professor Kaminski discusses his motivation for joining the Research Council and the value that the JPMCC can bring to commodity market participants. He also elaborates on his metaphor of comparing the various parts of the commodity complex to a Rubik's Cube, which he had proposed at the JPMCC's April 2015 Research Council meeting. In addition, Dr. Kaminski generously summarizes his September 2016 Research Council presentation on the involvement of financial institutions in the commodity markets. Dr. Kaminski's interview also includes how he came to specialize in the commodity markets, and he offers advice to students and young professionals whom are interested in potential careers in the commodity markets. His interview also covers his newly published and updated reference textbook, Managing Energy Price Risk, which is now in its 4th Edition at

Risk Books, and he concludes with suggestions on what topics should be covered in future issues of the *GCARD.*

Interview with Dr. Vince Kaminski, Ph.D.

What was your motivation for joining the JPMCC's Research Council?

Over the last 25 years I have observed the efforts of many business schools to create energy specializations and energy research centers and many of those efforts were not very successful. I think that the JPMCC has the right recipe for commodity oriented research, which calls for a balanced mix of practitioners and academics and covers a wide spectrum of different markets across various types of commodities and across financial and physical markets. I shall elaborate later why I think this is the right model.

What unique value can the JPMCC's Research Council provide to commodity market participants?

The JPMCC provides a meeting place and a platform facilitating interactions between academics and practitioners. Academics often concentrate on solving problems for which they have publicly available data and which can be solved using existing tools, and which produce elegant but often irrelevant solutions. The practitioners complain that the analytical tools are not very practical, are based on highly stylized representations of reality and are difficult to calibrate, given the paucity of market information. The theoretical models often ignore many dimensions and complexities of the problems practitioners face. This problem can be only addressed through frequent interactions between the producers and users of theoretical models. The JPMCC provides a venue for discussion and brainstorming for different participants in the commodity markets. The meetings that I have participated in were not only very interesting but also intellectually stimulating.

What were the highlights of the Research Council meetings that you have attended and presented at?

It would be a disservice to the contributors to come up with a list of a few presentations I liked most. It would be also impossible, given the exceptionally high and even caliber of lectures and panel discussions that I was privileged to listen to. The real highlight was the opportunity to meet in person the many guiding lights of industry and academia whose papers and books I have read and used over the many years that I have spent in industry as well as the professionals whose accomplishments I followed.

At the April 2015 Research Council meeting, you had compared the commodity markets to a Rubik's Cube with different dimensions and layers. Can you elaborate on this metaphor?

I approach the commodity markets as a complex system which consists of three layers:

a. The physical layer of operations and assets related to production, transportation, storage and the distribution of different commodities.

b. The financial layer of market transactions supporting the transfer of commodities from producers to end-users and facilitating capital flows to the industry.

c. The socio-political layer of laws, conventions, regulations, and international treaties, which create a framework for physical and financial activities in the commodity markets.

All the three layers are connected through many constantly evolving channels transmitting shocks from one layer to another. Once we recognize additionally that the three layers are composed of many grey boxes (not white and not black boxes, but the boxes we understand to some extent but almost never have full information about them) we get a very complex system that can be compared to a Rubik's Cube, which is being constantly redesigned as we try to solve it. Anybody familiar with the *New York Times* bestsellers list knows that there are many shades of grey, and there will never be a shortage of research topics for intellectually curious academics and business solution challenges for the practitioners.

At the September 2016 JPMCC Research Council meeting, you had presented on the involvement of financial institutions in the commodity markets. Given your unique vantage point as a leading commodity practitioner and researcher, could you please summarize the key points of your presentation for our practitioner readership?

Historically, under U.S. laws, banking was separated, for multiple reasons, from commercial activities. The barrier between these lines of business was lowered, though not completely eliminated, through the enactment by Congress of the Gramm–Leach–Bliley Act (GLBA), also known as the Financial Services Modernization Act of 1999. Under this Act, the Federal Reserve Board allowed a number of systemically important financial institutions to engage (with some restrictions) in physical activities in the energy and metals markets. These institutions included Citigroup, UBS, Barclays, Deutsche Bank, Fortis, Société Générale and several other banks. The Federal Reserve Board has recently signaled its intention to revisit this issue by increasing capital requirements for physical commodity-oriented businesses. I updated members of the JPMCC's Research Council on the status of new rules proposed by the Federal Reserve.

What originally led you to specialize in the commodity markets?

As many decisions in life, it was purely accidental. After many years spent on Wall Street in the financial markets, I wanted to improve my quality of life and get away from long hours and weekends in the office, many hours spent commuting to and from work, and the unrelenting pressure to generate more business. I thought that moving to a place with better life/work balance would benefit my family and me personally. I accepted an offer from a company based in Houston, which was expanding its presence in the energy markets and was looking for people with trading and quantitative finance skills. The name of the company was Enron, and I did not get exactly what I expected. On the positive side, I was given a unique opportunity to observe the evolution of many commodity markets from very early stages of development, and I could transfer skills acquired on Wall Street to a new industry.

Your edited book, Managing Energy Price Risk, is now in its 4th edition. What are the unique insights in your latest work?

Managing Energy Price Risk has become over the last 20 years a standard reference for energy trading and risk management. I measure the success of the book by the number of Xerox copies I see in the many companies I visit. Each edition of the book is practically a new publication addressing recent market and regulatory developments. A few of the most important papers are carried from one edition to another, but most chapters are either revised or replaced. I think that all the four editions are still quite useful to industry practitioners. The most recent edition covers the earth-shattering developments of the last 10 years, since the 3rd edition hit the shelves. The book reflects my fundamental vision of the commodity markets – the need for an integrated, holistic approach, across the different layers of the industry I have mentioned above.

The developments of the last 10 years were nothing short of a revolution. If somebody predicted the shale revolution, financial markets disruptions, geopolitical changes (correctly I should say) 10 years ago, one could have ended up in a well-padded room with around-the-clock medical help. But all this happened and, hopefully, the book offers a convenient way to catch up with all the different developments that took place in the industry over the last decade.

What advice could you give to students and young professionals interested in the commodity markets?

I start my overview of the energy industry class with a few slides demonstrating the importance of energy to our standards of living and national security, followed by historical data illustrating the change in U.S. energy consumption structure over time. Each major restructuring of the energy industry was associated with a wave of wealth creation and exceptional job opportunities. I tell the students that one cannot go wrong by choosing a career in the energy industry, in spite of high volatility and frequent booms and busts. I warn them, however, that one cannot succeed on the cheap by learning a few buzz words and hoping that fast talk and crowded PowerPoint presentations will be a substitute for solid knowledge and strong technical skills. One has to make an investment to learn the business or try one's luck in a different industry.

What topics do you think we should cover in future issues of the "Global Commodities Applied Research Digest," given its practitioner focus?

One critical issue to the energy industry is the interaction between the financial and physical markets. Price formation and discovery for physical commodities increasingly happens on the exchanges, such as ICE and CME, and the dynamics of these processes are not well understood. Another critical and related issue is the decreasing participation of market participants in reporting transactions to index publishers such as Platts and Argus. This means that an increasing volume of transactions is priced through a shrinking volume of trades that are included in index calculations. This trend is very troubling and has been recently receiving a lot of attention from regulatory agencies and traders.

Thank you, Dr. Kaminski, for this opportunity to interview you.

VINCE KAMINSKI, Ph.D.
Professor in the Practice of Energy Management, Jesse H. Jones Graduate School of Business, Rice University

Dr. Vincent Kaminski spent 14 years working in different positions related to quantitative analysis and risk management in the merchant energy industry. The companies he worked for include Citigroup, Sempra Energy Trading, Reliant Energy, Citadel Investment Group, and Enron (from 1992 to 2002) where he was the head of the quantitative modeling group. Prior to starting a career in the energy industry, Mr. Kaminski was a Vice-President in the Research Department, Bond Portfolio Analysis Group, of Salomon Brothers in New York (from 1986 to 1992).

In September 2006, Dr. Kaminski accepted an academic position at Rice University as a Professor in the Practice of Energy Management at Rice's Jesse H. Jones Graduate School of Business. He teaches M.B.A. level classes on energy markets, energy risk management and the valuation of energy as well as classes in the executive education program.

Dr. Kaminski holds an M.S. degree in international economics, a Ph.D. degree in theoretical economics from the Main School of Planning and Statistics in Warsaw, Poland, and an M.B.A. from Fordham University in New York. He is a recipient of the 1999 James H. McGraw award for Energy Risk Management (Energy Risk Manager of the Year). Dr. Kaminski has published a number of papers, and contributed to several books, on the energy markets, including the most recent 4th edition of the industry standard textbook, Managing Energy Price Risk (Risk Books).

Dr. Kaminski is also a member of the J.P. Morgan Center for Commodities' Research Council at the University of Colorado Denver Business School.

New Directions in Commodities Research
August 10-11, 2017

Ajeyo Banerjee, Ph.D., CMA
Executive & Faculty Director, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

Professor Graham Davis, Ph.D., Colorado School of Mines, soliciting ideas from the JPMCC's Research Council on the forthcoming "New Directions in Commodities Research" international symposium. Professor Davis discussed the conference, of which he is a co-organizer, during the final session of the Research Council's September 30, 2016 meeting. **Dr. Ajeyo Banerjee**, Ph.D., Executive & Faculty Director of the JPMCC, is also an organizer of the symposium.

Registration is now open for the International Commodities Symposium, "New Directions in Commodities Research," being held at the J.P. Morgan Center for Commodities (JPMCC), University of Colorado Denver on August 10-11, 2017.

The objective of the Symposium is to bring together eminent global thought-leaders and prominent stakeholders in commodities, from both the academic and practitioner communities, to discuss their critical thinking and share their insights regarding new research in commodities. The Symposium organizers are Ajeyo Banerjee, Ph.D., Associate Professor of Finance and Risk Management, Executive & Faculty Director, JPMCC and Graham Davis, Ph.D., Professor of Economics, Colorado School of Mines and Member of the JPMCC's Research Council. The Technical Committee for the Symposium consists of members of the Research Council of JPMCC, with Graham Davis as Chair. The CME Group Foundation and the Payne Institute of Earth Resources are sponsoring the Symposium.

Selected and solicited papers and presentations are limited to outstanding, reviewed research, of sufficient rigor and quality. In accordance with the goals of JPMCC and the Research Council, the focus of the Symposium remains real-world relevance, applicability and impact of research, with an orientation toward the immediate and near-term future. Contributors to the Symposium include both academics and practitioners, and the presentations and discussions should be of interest to everyone interested in commodities.

For the detailed program of the Symposium, and to register, please go to the International Commodities Symposium link at business.ucdenver.edu/commodities.

For more information, please contact Matt Fleming, Event Planner, at Matthew.Fleming@ucdenver.edu. Mr. Fleming is also the Project Manager for the JPMCC.

GLOBAL COMMODITIES
APPLIED RESEARCH DIGEST

The *Global Commodity Applied Research Digest* is produced by the J.P. Morgan Center for Commodities (JPMCC) at the University of Colorado Denver Business School. The JPMCC is the first center of its kind focused on a broad range of commodities, including agriculture, energy, and mining. Established in 2012, this innovative center provides educational programs and supports research in commodities markets, regulation, trading, financial fundamentals, investing, and risk management.

In addition to its education mission, the J.P. Morgan Center for Commodities' aim is to become a focal point for worldwide research on commodities.

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