Commodity Portfolio Management: Strategy Structuring Considerations

Vito Turitto
Lead Quantitative Analyst, S&P Global Platts, U.K.

This article expands on research into commodity portfolio management that was published in the Winter 2019 edition of the Global Commodities Applied Research Digest. Commodity markets are often used to diversify portfolio risk and as a hedge against inflation but, in order to maximize returns and hedging effectiveness, it is necessary to develop an approach that examines each commodity market separately. Accordingly, this article analyzes individual commodity returns and provides guidance on how extreme returns can impact commodity portfolio strategies.

Introduction

Diversifying an investment portfolio as well as hedging against inflation using commodity markets is a well-established need within the portfolio management industry; nevertheless, citing the Winter 2019 *GCARD* article on "Commodity Portfolio Management," "it is crucial to point out that for commodities, metrics such as volatility and seasonality deserve to be addressed specifically and separately: an equity-style approach would ignore the strong idiosyncratic features characterizing each commodity, inevitably leading to inefficient portfolio construction and to a suboptimal allocation of resources."

The present research is entirely based, for consistency purposes, on the same commodities that were analyzed in the previous *GCARD* article. Specifically, the data is drawn from liquid, exchange-traded (Intercontinental Exchange and Chicago Mercantile Exchange Group) commodity futures contracts and includes three different commodity sectors: energy (which can be further subdivided into crude grades and petroleum products), agriculture, and metals (which can be further subdivided into precious and base metals.) The time period of this dataset ranges from January 2010 to January 2020. The study's three commodity sectors contain the following sets of futures contracts:

1. Energy: Brent Crude, West Texas Intermediate (WTI) Crude, European Low Sulphur Gasoil (diesel), New York Reformulated Blendstock for Oxygenate Blending (RBOB) Gasoline, and Dutch Title Transfer Facility (TTF) Natural Gas;

2. Agriculture: U.S. Sugar Number 11 and White Sugar - Europe; and

3. Metals: Gold, Silver, and Copper.

This article will cover the nature of return fluctuations in different commodity markets in order to provide insights that may be useful for the efficient structuring of commodity portfolio strategies. This research will be subdivided into two sections: (a) the returns in commodity markets and (b) the "fat tails" in commodity returns.

Returns in Commodity Markets

This section includes the calculation of the various commodity markets' log-normal returns and, in order to simplify and facilitate the comparative analytics, the results will be discussed in the following subgroups:

1. Brent, WTI, and Dutch TTF;
2. Gold, Silver, and Copper;
3. Intercontinental Exchange (ICE) Gasoil and RBOB Gasoline; and
4. White Sugar - Europe and U.S. Sugar Number 11.

Brent, WTI, and Dutch TTF Futures Returns

Brent, WTI, and Dutch TTF are the most liquid and well-established commodity futures markets within the energy space. Those who trade these markets are not just speculators such as hedge funds, asset managers, and pension funds but also commercials (such as energy producers, refiners, and miners.) Hence, the returns generated in these markets result from the price discovery process among the aforementioned counterparties. The daily return series for these three contracts are shown in Figure 1.

Figure 1
Daily Log-Normal Returns (in %) for Brent, WTI, and Dutch TTF Futures Contracts (January 2010 through January 2020)

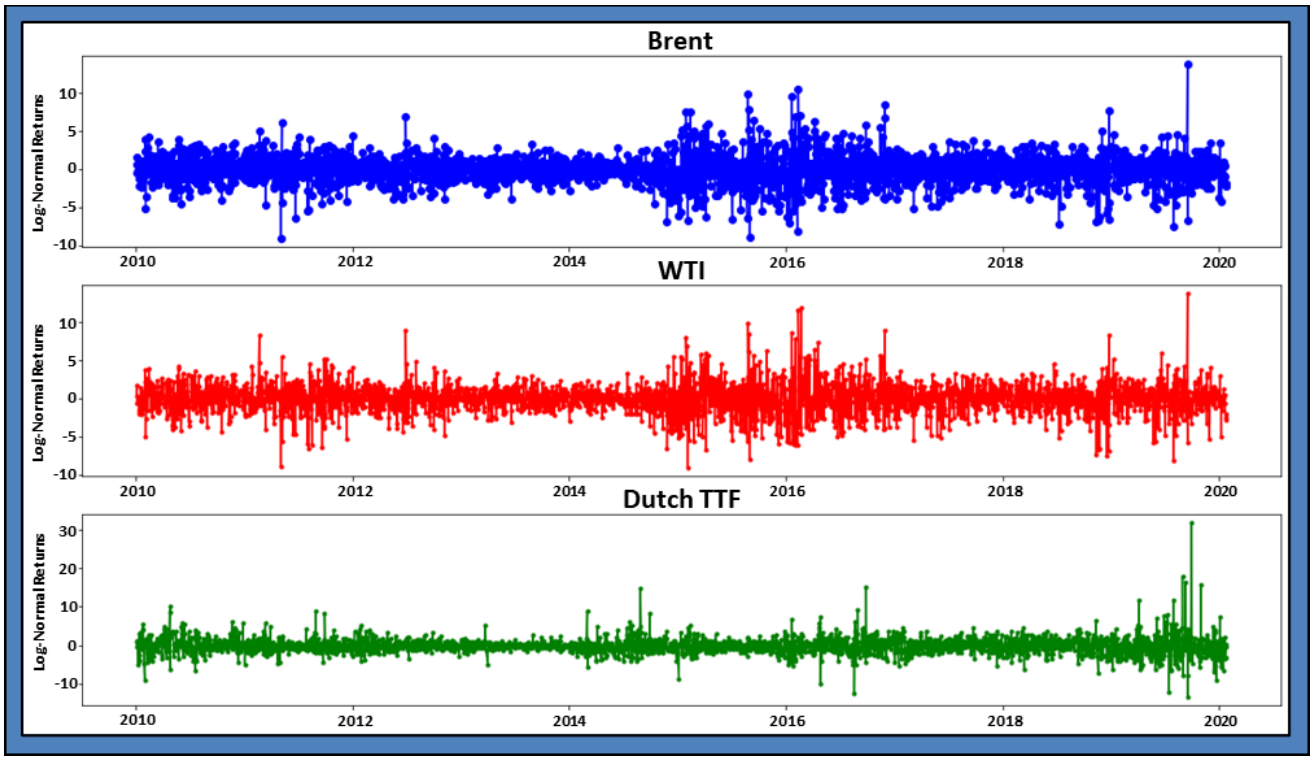


Table 1 compares the returns in each of the three energy markets. In this article, we are using the convention of the higher the returns, the higher the quartile metric is. Correspondingly, we are using the convention of the lower the returns, the lower the quartile metric is. This convention is also used in Tables 2 through 4.

Table 1
Median, 3rd Quartile and 1st Quartile Returns for Brent, WTI, and Dutch TTF Futures Contracts (January 2010 to January 2020)

	Median Daily Futures Returns
Brent	0.04%
WTI	0.03%
Dutch TTF	-0.01%
	3rd Quartile Daily Futures Returns
Brent	0.93%
WTI	1.06%
Dutch TTF	0.93%
	1st Quartile Daily Futures Returns
Brent	-0.93%
WTI	-1.09%
Dutch TTF	-1.03%

Over the time horizon of this study, Brent had the highest median daily returns while the Dutch TTF contract had the lowest median daily returns, which, in turn, were negative. The WTI contract had the highest difference in returns across the 1st and 3rd quartiles.

Gold, Silver, and Copper Futures Contracts

The daily return series for Gold, Silver, and Copper futures contracts are shown in Figure 2.

Figure 2

Daily Log-Normal Returns (in %) for Gold, Silver, and Copper Futures Contracts (January 2010 through January 2020)

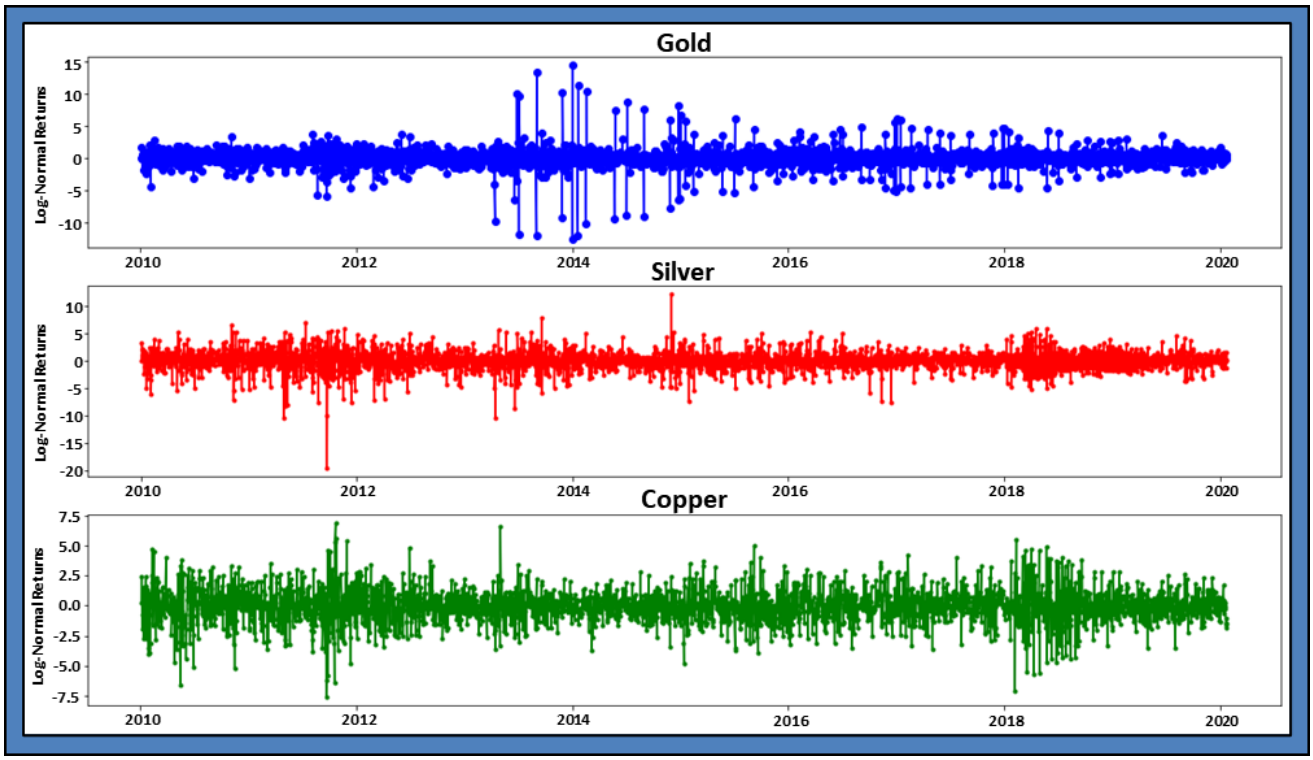


Table 2 compares the returns in each of the subgroup's three metals markets.

Table 2

Median, 3rd Quartile and 1st Quartile Returns for Silver, Gold, and Copper Futures Contracts (January 2010 to January 2020)

	Median Daily Futures Returns
Silver	0.05%
Gold	0.01%
Copper	0.00%
	3rd Quartile Daily Futures Returns
Silver	0.83%
Gold	0.52%
Copper	0.76%
	1st Quartile Daily Futures Returns
Silver	-0.74%
Gold	-0.45%
Copper	-0.71%

Over the time horizon of this study, Silver had the highest median and 3rd quartile returns while Gold had the lowest difference in returns across the 1st and 3rd quartiles.

Intercontinental Exchange (ICE) Gasoil and RBOB Gasoline Futures Contracts

The daily return series for ICE (European) Gasoil and RBOB (American) Gasoline futures contracts are shown in Figure 3.

Figure 3

Daily Log-Normal Returns (in %) for ICE Gasoil and RBOB Gasoline Futures Contracts (January 2010 through January 2020)

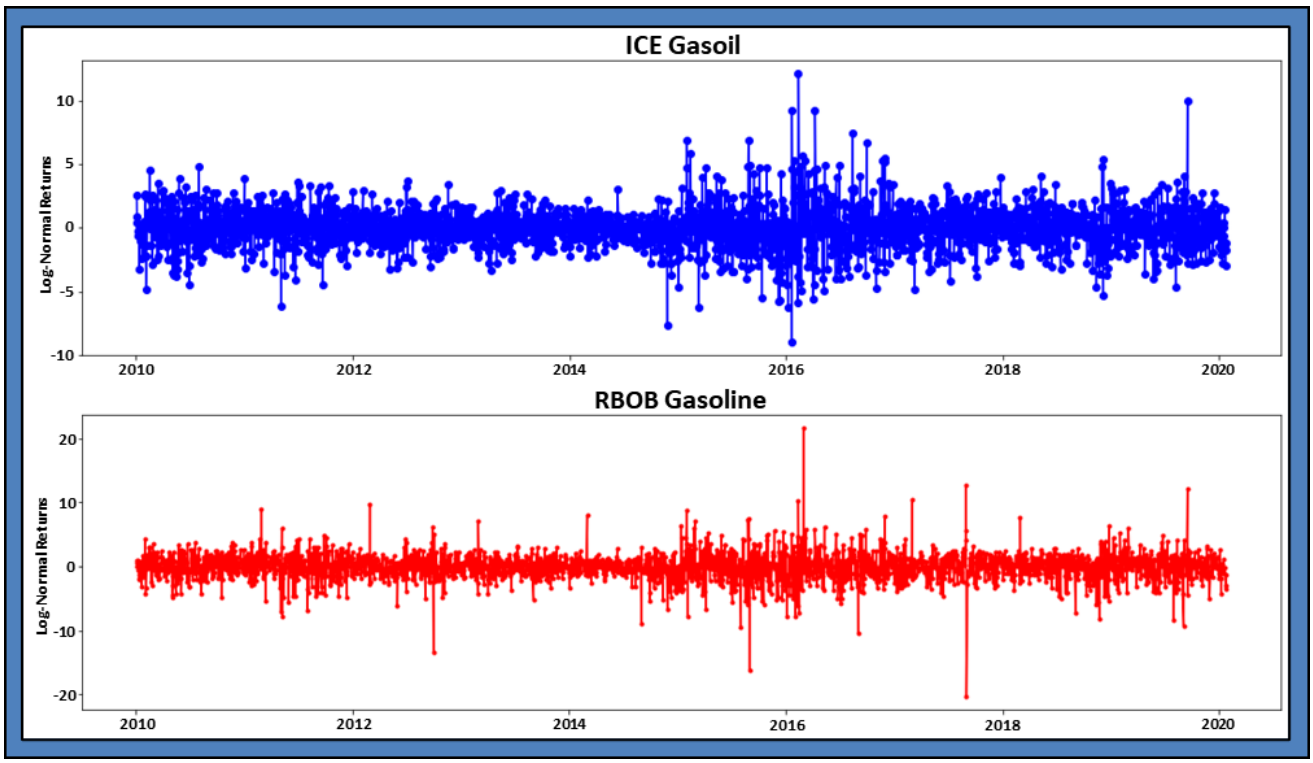


Table 3 compares the returns in the subgroup's two crude oil product contracts.

Table 3
Median, 3rd Quartile and 1st Quartile Returns for ICE Gasoil and RBOB Gasoline Futures Contracts (January 2010 to January 2020)

	Median Daily Futures Returns
ICE Gasoil	0.00%
RBOB Gasoline	0.02%
	3rd Quartile Daily Futures Returns
ICE Gasoil	0.81%
RBOB Gasoline	1.14%
	1st Quartile Daily Futures Returns
ICE Gasoil	-0.82%
RBOB Gasoline	-1.12%

In terms of median returns, the two underlying crude contracts, Brent and WTI, outperformed the product returns of ICE Gasoil futures and RBOB Gasoline futures contracts.

White Sugar – Europe and U.S. Sugar Number 11 Futures Contracts

The daily return series for White Sugar – Europe and U.S. Sugar Number 11 futures contracts are shown in Figure 4.

Figure 4

Daily Log-Normal Returns (in %) for White Sugar – Europe and U.S. Sugar Number 11 Futures Contracts (January 2010 through January 2020)

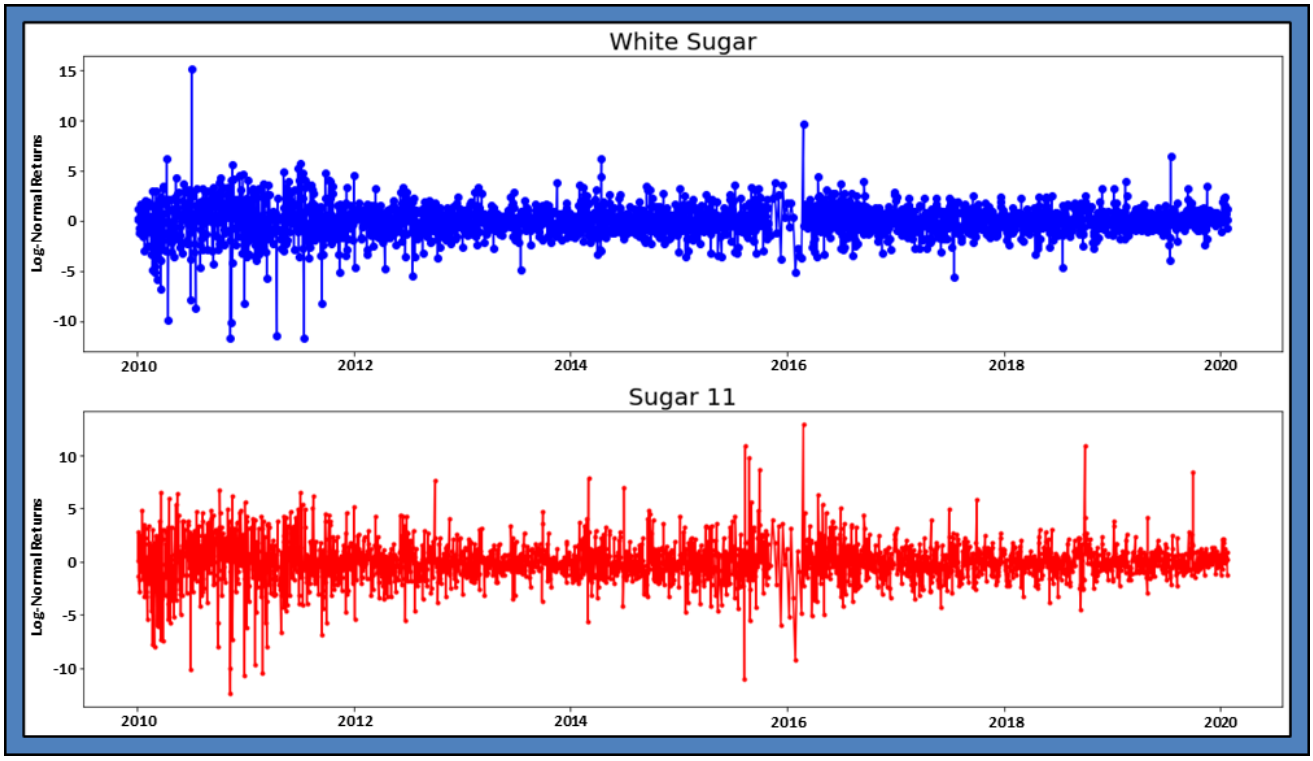


Table 4 compares the returns amongst the two sugar futures contracts.

Table 4

Median, 3rd Quartile and 1st Quartile Returns for White Sugar – Europe and U.S. Sugar Number 11 Futures Contracts (January 2010 to January 2020)

	Median Daily Futures Returns
White Sugar – Europe	0.00%
U.S. Sugar Number 11	-0.05%
	3rd Quartile Daily Futures Returns
White Sugar – Europe	0.71%
U.S. Sugar Number 11	0.90%
	1st Quartile Daily Futures Returns
White Sugar – Europe	-0.77%
U.S. Sugar Number 11	-0.98%

Over the time horizon of this study, the White Sugar – Europe contract outperformed the U.S. Sugar Number 11 contract in terms of median returns while the U.S. Sugar Number 11 contract had the higher difference in returns across the 1st and 3rd quartiles.

Section Summary

The main takeaways from this section are as follows:

- Silver futures contracts provided the highest median returns;
- The Dutch TTF and U.S. Sugar Number 11 futures contracts had negative median returns; and
- RBOB Gasoline futures had both the highest 3rd quartile returns and the lowest 1st quartile returns.

"Fat Tails" in Commodity Returns

Commodity returns frequently do not follow a normal distribution, and this is a well-documented phenomenon in finance. In the previous section, we solely calculated the returns that range between the 1st and the 3rd quartiles. One should also review how "fat tailed" a commodity futures market's distribution is, where 3-sigma, 4-sigma or even 5-sigma events occur more frequently than one would expect under a standard normal distribution. (Here, sigma means standard deviation.) The dispersion in market returns can quite quickly and aggressively skew investment performance. To understand how aggressive such moves can be in individual commodity markets, one needs to calculate the dispersion of daily returns, and, in particular, document each market's extreme returns. We will examine the same commodities as in the previous section and use box plots to provide a visual summary of the kind of extreme moves that have occurred in our dataset's commodity markets.

Box Plots

Box plots are a great way to visualize and compare the distribution of different market returns and this is particularly true when outliers are considered. Furthermore, box plots provide a clear and concise way to summarize large quantities of data. In particular, the analyst can readily compare financial time series even if they have different distributions, and they provide an easy-to-understand way to understand how "fat" the distribution tails can be, no matter how far-from-the-median returns may be.

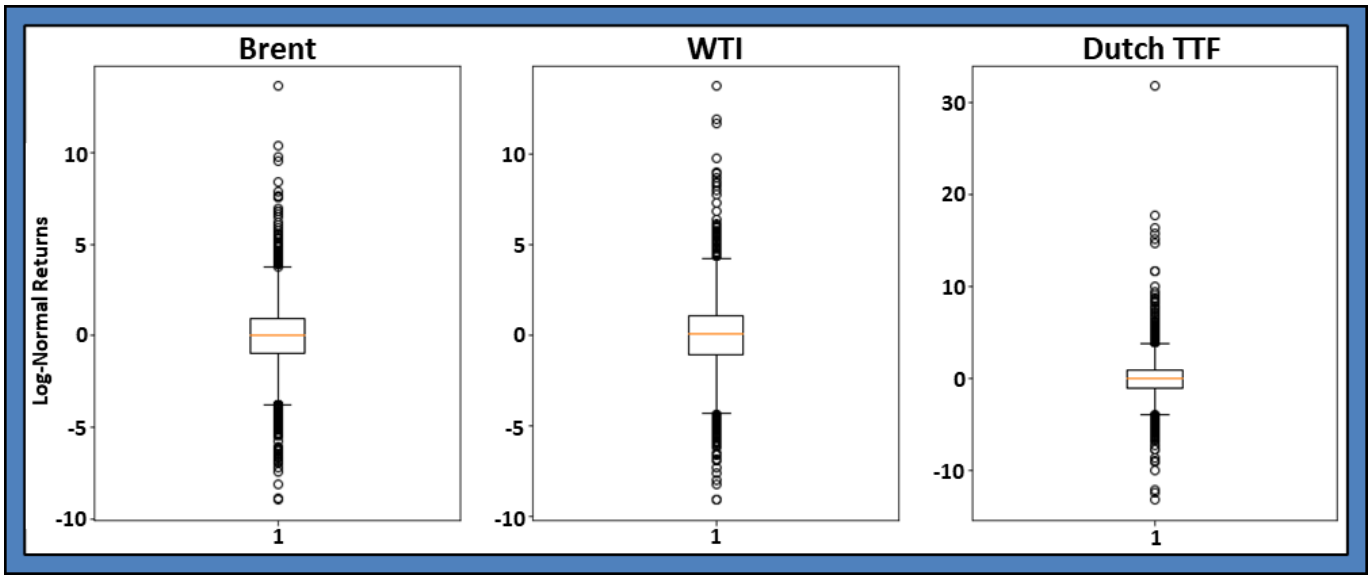
The box plots in Figures 5 through 8 use the following conventions. The red horizontal line is the median return. The box demarcates the 1st and 3rd quartile of returns. The interquartile range is calculated as the 3rd quartile of returns minus the 1st quartile of returns. The top horizontal line (the top "whisker") is arrived at by adding 1.5 times the interquartile range to the 3rd quartile of returns and identifying the largest return within that distance. The bottom horizontal line (the bottom "whisker") is arrived at by subtracting 1.5 times the interquartile range from the 1st quartile of returns and identifying the lowest return within that distance. The circles outside the "whiskers" are the outliers in the data and include the highest and lowest returns observed in the data.

Brent, WTI, and Dutch TTF Futures Returns

Despite the interconnections between energy markets, the Dutch TTF futures contracts have exhibited the wildest fluctuations between the minimum and maximum returns. See Figure 5.

Figure 5

Box Plots of Daily Log-Normal Returns (in %) for Brent, WTI, and Dutch TTF Futures Contracts (January 2010 to January 2020)



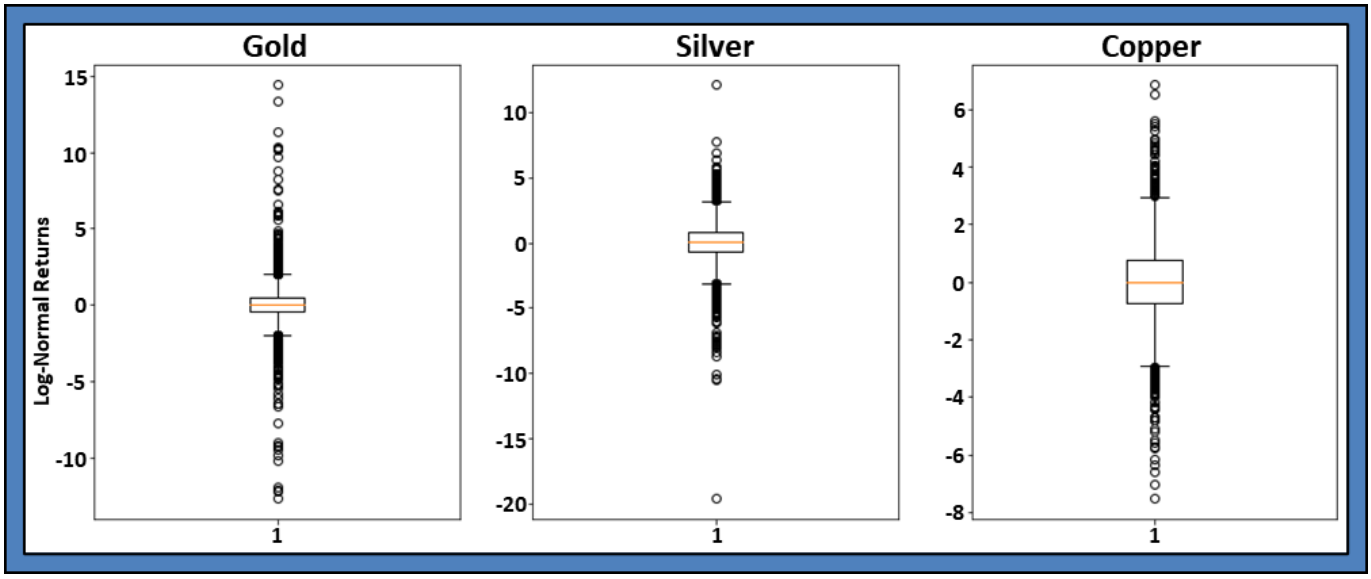
Specifically, the highest daily return in Dutch TTF futures was a staggering 31.7% while the lowest ever return recorded, within the time frame of the present analytics, was -13.2%. In comparison, the highest returns for Brent and WTI futures contracts were 13.7% for both markets while the lowest returns amounted to -9.0% and -9.1%, respectively. Overall, at least historically, it would have been much easier to manage a portfolio of both crude grades rather than including Dutch TTF futures which, despite the extremely high returns they could potentially yield, have carried substantial downside risk.

Gold, Silver, and Copper Futures Returns

Dispersion has historically been different in the metals. None of the metals markets in our study experienced positive returns as high as observed in the Dutch TTF market, and the highest positive performance is no higher than 14.4% (in Gold futures.) See Figure 6.

Figure 6

Box Plots of Daily Log-Normal Returns (in %) for Gold, Silver, and Copper Futures Contracts (January 2010 to January 2020)



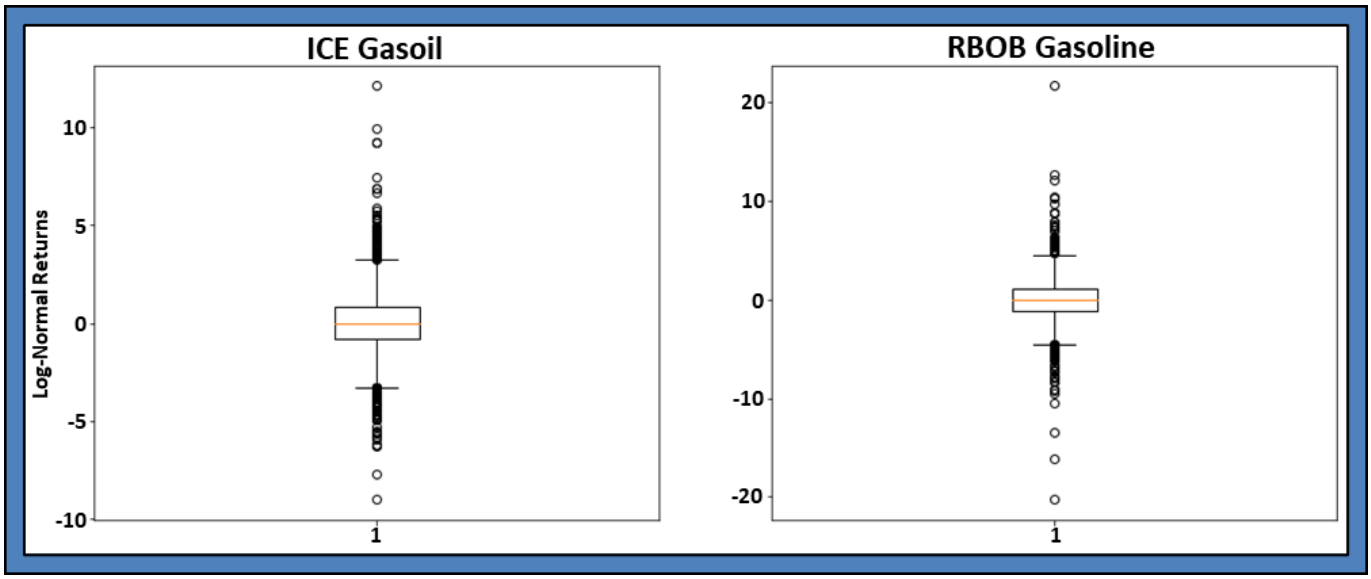
The highest return in the Silver market was around 12.0% while Copper futures did not experience as aggressive buying pressure; Copper's highest return is just 6.8%. Conversely, the lowest return recorded in our dataset's metal markets was achieved by Silver futures (-19.6%), followed by the Gold market (-12.6%) and then the Copper market, whose most negative return amounted to -7.5%.

Intercontinental Exchange (ICE) Gasoil and RBOB Gasoline Futures Returns

RBOB Gasoline futures experienced minimum and maximum returns as extreme as -20.2% and +21.7%, respectively. See Figure 7.

Figure 7

Box Plots of Daily Log-Normal Returns (in %) for ICE Gasoil and RBOB Gasoline Futures Contracts (January 2010 to January 2020)

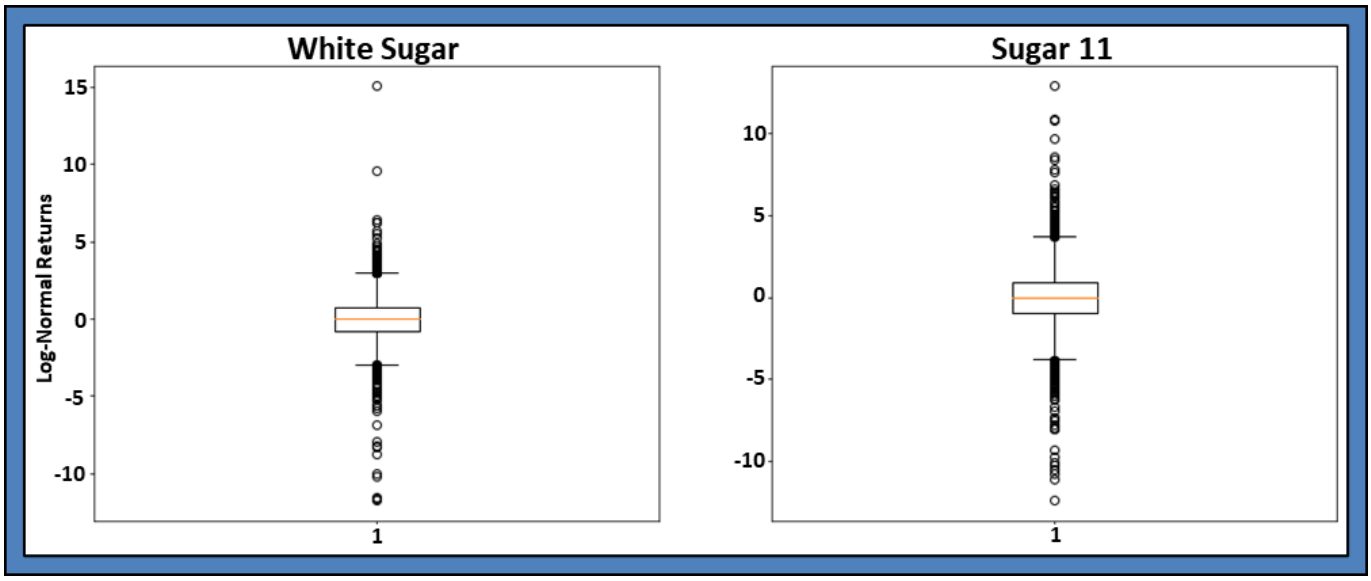


ICE Gasoil futures experienced positive returns of no higher than 12.1% while the downside risk was almost identical to the returns observed for Brent, the global crude benchmark (-9.0%).

White Sugar – Europe and U.S. Sugar Number 11 Futures Returns

The European and American sugar markets were similar when it comes to extreme returns. Their lowest returns were around -12.0%. The buying pressure on European white sugar futures was more aggressive with the highest return at 15.0% while the American sugar market's highest return was 13.0%. See Figure 8.

Figure 8
Box Plots of Daily Log-Normal Returns (in %) for White Sugar – Europe and U.S. Sugar Number 11 Futures Contracts (January 2010 to January 2020)



Section Summary

The main takeaways from this section are as follows:

- RBOB Gasoline futures experienced the lowest one-day return in the entire portfolio of examined futures contracts;
- The highest, positive return ever recorded, in the examined time period, was observed in the Dutch TTF market; and
- The second highest, positive return was observed in the RBOB Gasoline futures market.

More generally, the dispersion of returns differs markedly from one commodity to another and can drastically alter the outcome of an investment strategy, if overlooked. In addition, there are additional analyses that one can undertake that show how important seasonality and idiosyncratic returns are within the commodity futures markets.

Conclusion

The primary goal of this straightforward study is to provide a simple yet important reminder that commodity markets should be treated with care because an equity-style investment approach can easily yield returns orders of magnitude below expectations.

Further, the summary statistics of this paper reinforce the need, already identified in the Winter 2019 article on "Commodity Portfolio Management," to view each commodity market as quite idiosyncratic. Therefore, a deep focus on each commodity market is crucial to understanding how changing the portfolio weights on individual commodities can impact portfolio stability and risk exposures.

Our next *GCARD* article will further explore commodity strategy structuring themes.

Author Biography

VITO TURITTO
Lead Quantitative Analyst, S&P Global Platts, U.K.

Mr. Vito Turitto joined the S&P Global Platts Commodity Risk Solutions team in 2015. Prior to joining Platts, he started his career in the City of London trading options on crude oil and other energy markets and went on to build HyperVolatility Ltd., a boutique quantitative investment consultancy. Mr. Turitto's field of expertise is in volatility trading, analysis, and modeling. Mr. Turitto holds a B.A. in International Economics Relations from the University of Rome "La Sapienza" and received his Master of Science in International Finance and Investment from London South Bank University after completing a dissertation on forecasting volatility in the American crude oil market via stochastic volatility models.