

A network diagram consisting of numerous grey dots of varying sizes connected by thin grey lines, creating a complex web-like structure that fills the upper half of the page.

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QUANTICA¹CAPITAL

QUARTERLY¹ INSIGHTS

ROLLING DOWN THE CURVE

The benefits of trend-following in harvesting commodity yield carry

#7 | 8 SEPTEMBER 2021

Executive summary

Holding a long-only allocation to a diversified basket of commodity futures has delivered an impressive return of around 46%¹ in the twelve months following the COVID-19 pandemic. In contrast, the long-term performance of such strategic long-only allocation over the past 26 years has been rather weak and amounted to +1.4%² p.a. in excess of any risk-free return.

In this note, we focus on analyzing the key return drivers of commodity futures and the challenges to generate attractive risk-adjusted returns with commodity investments. We show that the “roll-yield” (aka carry), an intrinsic and essential characteristic of commodity futures markets, has eroded the return on a diversified portfolio of commodity futures by a surprisingly high 5.5% per annum since 1994, offsetting almost any gains originating from rising spot commodity prices (+6.2% per year over the same period). We further show that this “cost of carry” may be reduced by up to 50% (before implementation costs) trading more back-dated contracts with longer times to expiry instead of the front-end of the curve. However, this yield enhancement is not a “free lunch” and comes at the cost of a significant reduction in the liquidity characteristics of the portfolio, which makes its net benefits questionable.

This led us to investigate the return characteristics of a more dynamic and opportunistic systematic investment approach, that also takes advantage of short positions and preserves the attractive liquidity profile offered by the front-end of the futures market: systematic trend-following.

We demonstrate that unlike in a static long-only allocation approach, a generic trend-following approach can indeed harvest a *positive* long-term yield carry. In fact, roll-yield is the key factor driving commodity futures returns in such a generic trend-following approach. More specifically, our generic trend-following strategy targeting an annualized volatility of 12% has been able to capture a (backtested and hypothetical) positive commodity roll-yield of 6.5% per year over the past 26 years. This compares to a negative roll-yield of -5.5% per year for a long-only allocation with similar risk characteristics. Noteworthy: With roughly one third of a trend-follower’s commodity carry coming from long positions, the positive yield carry contribution is not due to a systematic short bias in the portfolio.

Ultimately, it is the ability of a trend-following approach to effectively and dynamically capture the intrinsic roll-yield of individual commodity futures and to take advantage of successive periods of contango and backwardation through opportunistic long and short positions that allows it to generate superior and uncorrelated risk-adjusted returns compared to long-only commodity index solutions. Trend-following hence represents a cost-effective solution to take advantage of the diversification benefits and inflation protection characteristics of commodities without incurring the historically high cost of carry of a static long-only allocation to commodities.

¹ Bloomberg Commodity (BCOM) Index return between 1 June 2020 and 31 May 2021. *Source:* Bloomberg.

² Bloomberg Commodity (BCOM) Index annualized return between 1 January 1994 and 31 July 2021. *Source:* Bloomberg

Introduction

A diversified basket of commodity futures has returned more than 40% between June 2020 and May 2021.

Commodity markets have returned to the center of investor attention following a continued surge in prices in the wake of the COVID-19 pandemic. The Bloomberg Commodity (BCOM) Index³, a widely tracked investable benchmark for the commodities market and currently composed of a diversified basket of 23 exchange-traded futures contracts on physical commodities, has returned 46% in the twelve months following the COVID-19 pandemic between 1 June 2020 and 31 May 2021 (see Figure 1). This translates into an outstanding Sharpe ratio of 3.8. In addition, as we have highlighted in our last Quarterly Insights publication (Quantica Capital, May 2021)ⁱ, a long exposure to a diversified portfolio of commodity futures has historically provided a strong price inflation hedge, as commodities are an integral part of any price inflation metric. Our long-term analysis also highlighted this by showing that, historically, the higher the level of inflation, the more positive the commodity inflation beta. Therefore, the recent sharp rise in the US headline YoY CPI, printing most recently at 5.4%⁴, a level not reached in more than two decades, has fueled additional interest in the asset class.

While the strong recent performance and inflation hedging characteristics of commodities look appealing, a static long-only allocation to commodity futures is not a free lunch. We demonstrate in this note that a commodity future’s roll-yield or carry, a key driver of its return, may cause significant headwind to its performance in the long run. We compare the

cost of carry across different commodity subsectors and quantify the drag on a typical diversified long commodity futures allocation it has represented in the past 26 years. We further illustrate how a popular “enhanced” long-only strategy may reduce the cost of carry, keeping in mind the cost of lower liquidity. Finally, we analyze and compare the risk-adjusted return and roll-yield characteristics of a generic systematic trend-following strategy, which offers a more opportunistic and dynamic approach to trading commodity futures.



Figure 1: Cumulative returns of Bloomberg Commodity Index (BCOM Index) from 1 June 2020 to 31 May 2021. Source: Bloomberg.

Understanding the roll-yield component of commodity futures returns

The return⁵ of a commodity future position may be decomposed into a roll-yield (or carry) and a spot return as follows:

$$\text{Futures return} = \text{roll-yield} + \text{spot return}$$

The roll-yield reflects the term structure characteristics of each commodity future and corresponds to gains / losses generated solely from the future “rolling down or up” its term structure curve when holding on to the position. If the term structure is downward sloping (i.e., is

³ Formerly known as the Dow Jones-AIG Commodity Index, launched in 1998 with historical information dating back to 1960

⁴ As of July 2021; Source: U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers

⁵ In this note, we are referring to futures returns as unfunded returns of a futures position, which do not include any interest earned on funding or collateral.

in a state of backwardation), a long future position will benefit from its price “rolling up” towards the higher spot price. Inversely, if the term structure is upward sloping (i.e., is in a state of contango), a long future position will suffer from its price “rolling down” towards the lower spot price.

Typically, if not held until expiration, a future has to be rolled from a near to a more distant contract on the curve. The expected roll-yield of a commodity future position therefore depends on the two maturities of the curve from and to which the contract is rolled. As futures liquidity is typically concentrated in the first two nearest-to-expiry contracts, the most straight-forward approximation of a commodity future’s roll-yield is the relative price difference between the two nearest-to-expiry contracts:

$$\text{Roll-yield} = (\text{Nearest contract price} - \text{Second-nearest contract price}) / (\text{Nearest contract price})$$

The roll-yield of a commodity future may therefore be estimated from the future’s price term structure. However, any implied gains or losses are only hypothetical and may only be realized if the term structure remains constant over time, i.e. if the volatility of the roll-yield itself is low. Once a commodity future’s roll-yield has been calculated, its associated spot return is then by definition simply implied from subtracting its roll-yield from its exchange-traded excess return.

The average long-term roll-yield has been negative across all commodity subsectors in the past 26 years

To illustrate the above concept, we introduce a universe of 17 liquid commodity futures, which are representative of four major commodity subsectors: energy, agriculturals (grains and softs), metals and livestock (see Table 1).

Energy	Agriculturals	Metals	Livestock
Crude	Corn	Gold	Live cattle
Brent crude	Wheat	Copper	Lean hogs
Heating oil	Soy beans	Silver	
Gasoline	Sugar	Platinum	
Gasoil LS	Coffee		
Natural gas			

Table 1: List of 17 commodity futures across the four subsectors energy, agriculturals (grains & softs), metals and livestock.

To gain an understanding of the roll-yield impact of commodity futures, we construct a hypothetical portfolio for each of the four subsectors introduced above, composed of their respective constituents. Every portfolio constituent is risk-weighted by an equal annualized target volatility and all constituents are scaled to meet a portfolio volatility target of 12% p.a. Each portfolio’s aggregate roll-yield is then simply the weighted sum of its constituents’ individual roll-yields. Figure 2 provides an overview of each of the four commodity subsectors’ aggregate roll-yields since 1994. Table 2 shows the mean, median and standard-deviation of the roll-yields for each commodity sub-group across time.

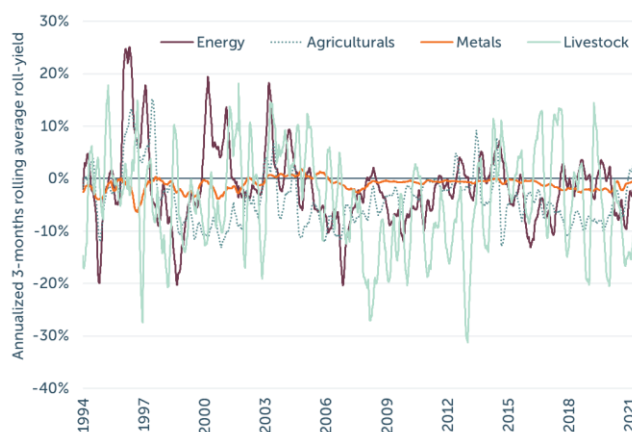


Figure 2: Historical annualized 3-months rolling average roll-yield from 1994 to 2021 for four commodity subsector futures portfolios (energy, agriculturals, metals, livestock), each targeting an annualized volatility of 12% p.a. with each individual constituent weighted to target an equal amount of risk. Please refer to Table 1 for the full list of constituents for each of the four portfolios. Source: Bloomberg/Quantica.

	Energy	Agriculturals	Metals	Livestock
Mean	-1.6%	-3.9%	-1.1%	-4.1%
Standard deviation	7.1%	5.2%	1.2%	9.2%
Median	-2.3%	-4.5%	-0.8%	-3.8%
Mean/STD	-0.2	-0.8	-0.9	-0.4
% of time in contango	66%	83%	88%	65%

Table 2: Summary roll-yield statistics from January 1994 to July 2021 for the four commodity subsectors: energy, agriculturals, metals and livestock.
 Source: Bloomberg/Quantica.

All subsectors have had on average a negative roll-yield throughout the last 26 years (reflective of a contango term structure), with agriculturals and metals having experienced a negative roll-yield in 83% and 88% of the time, respectively. With a drag of around -4% per year, the roll-yield has been most negative for agricultural and livestock markets over the last 26 years (on a portfolio volatility of 12%). Correspondingly, the average roll-yield of energy and metal markets, while negative, has been typically more subdued (-1.6% and -1.1% per year respectively). However, average values do not account for temporal variability. While energy and metals futures have displayed a comparable long-term average negative roll-yield, their variability, as measured by the roll-yield’s historical standard deviation, is almost seven times higher for energy futures. A strong roll-yield variability is a direct reflection of pronounced seasonality price patterns and supply and demand shocks, where periods of contango are typically followed by periods of backwardation. This cyclicity is most pronounced with livestock futures but is also a strong characteristic of agricultural commodities. Most recently and for the last eight months, the aggregate roll-yield of the agricultural futures portfolio was consistently positive, a feat only achieved on a few occasions in the last 26 years, and the longest such period since 1997.

The cost of carry for a diversified long commodity futures basket has wiped out 80% of the spot price gains since 1994

Having reviewed the roll-yield characteristics of the main commodity subsectors, we now look at the aggregate roll-yield of a diversified portfolio allocation across all four commodity subsectors. Rather than assuming an arbitrary weighting scheme between subsectors, we rely on the reference Bloomberg Commodity Index⁶. The Bloomberg Commodity Index is rebalanced annually, based on a set of specific construction rules. It holds contracts located at the front end of the term structure only, rolling positions from the front to the second nearest contract. The 17 contracts we have introduced above are part of the index’ current 23 constituents.

In addition to the futures based BCOM Index, Bloomberg also publishes a “spot price” version of the index. However, as most commodity spot markets are not accessible for institutional investors, the spot price index (BCOMSP) is not investable. Its price is implied from the futures contract prices used to calculate the BCOM Index, relying on a similar methodology to the one we outlined above. The BCOM Index’ roll-yield may therefore be directly implied from the daily return differences between the BCOM and the BCOMSP Index. Figure 3a compares the cumulative returns since 1994 for both the spot and the investable index, while Figure 3b highlights the implied annualized index roll-yield on a day-by-day basis over the same period.

The figures further highlight the significant adverse impact of the roll-yield on a diversified commodity futures portfolio since 1994, offsetting 80% of the spot market gains over that period. While spot commodity returns have annualized at a rate of 7.2% since 1994, negative

⁶ Sector weights as of January 2020: Energy: 30%; Grains: 23%; Precious metals: 17%; Industrial metals: 17%; Softs: 7%; Livestock: 6% (Source: Bloomberg (<https://data.bloomberglp.com/professional/sites/10/BCOM-Methodology.pdf>)).

roll-yields have cost the index a negative -5.7% per year, leaving the investable BCOM Index with an annualized gross return (before any implementation costs) of a modest +1.5% p.a. over the past 26 years.

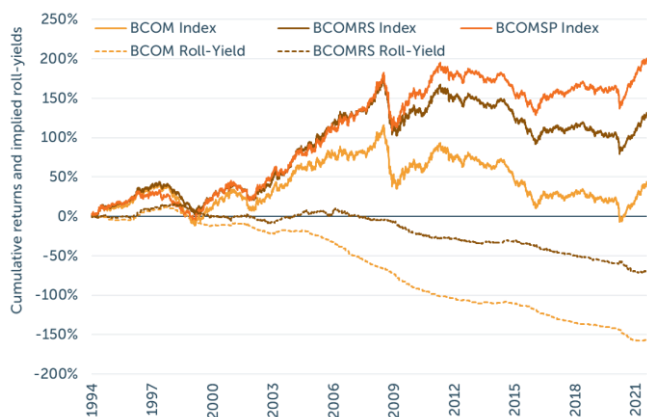


Figure 3a: Comparative cumulative returns of the BCOM Index, the BCOM Roll Select Index (with embedded roll-yield minimization) and the BCOM Spot Index, and comparative cumulative roll-yield of the BCOM Index and the BCOM Roll Select Index from January 1994 to July 2021. *Source: Bloomberg/Quantica.*

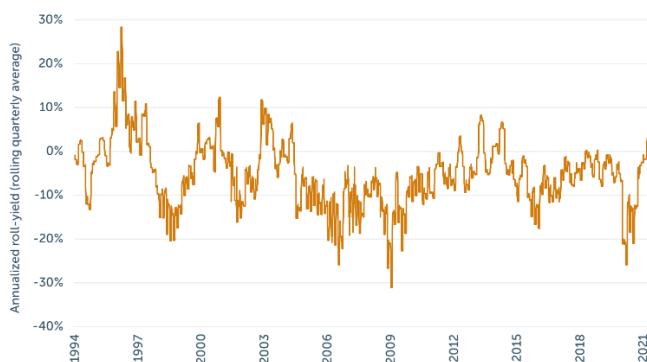


Figure 3b: Implied annualized roll-yield (rolling quarterly average) of the BCOM Index from January 1994 to July 2021, estimated based on a rolling quarterly average of the daily return spread between the BCOM Index and the BCOM Spot Index. *Source: Bloomberg/Quantica.*

It is interesting to observe that the aggregate roll-yield of the broad commodity index has been highly variable over time, and has again turned

positive recently, for the first time since 2014. Such positive aggregate yield carry is obviously an attractive feature of a diversified long-only commodities portfolio.

Can the cost of carry be reduced by trading more backdated futures?

Since the slope of the forward structure is typically steepest at the front end of the curve (most negative roll-yield in the case of a contango curve), a possible solution for a long commodity allocator to reduce its roll costs in a persistent contango environment is to take positions in longer-dated futures contracts where the roll-yield is less pronounced.

This may be achieved through different techniques, which have given rise to a wide range of publicly available indices.⁷

While all these techniques differ in their implementation, they share a common denominator of "sacrificing" liquidity to reduce implied roll costs. To compare the potential benefits of such an approach, we took a look at one of these implementations: For each commodity, the Bloomberg Roll Select Commodity BCOMRS Index rolls into the futures contract that has the most backwardation or the least contango (i.e. the highest roll-yield), "selecting from those eligible contracts with nine months or fewer until expiration".⁸ The index has the advantage of being relatively easy to invest in, as there is at least one future (listed on the CME) and several ETFs tracking it. Figures 3a and 3b show the cumulative return and implied annualized roll-yield since 1994 for this yield-optimized index compared to the spot and front-month indices introduced previously.

⁷ As examples: (i) UBS Bloomberg CMCI Index, which targets a constant maturity exposure to each individual contract by holding on to and rolling between multiple maturities across the curve. (ii) S&P GSCI Enhanced Index, which rolls some of its constituents on a less frequent basis depending on the seasonality and liquidity of the commodity's term structure.

⁸ *Source: Bloomberg; <https://www.bloomberg.com/quote/BCOMRS:IND>*

The opportunistic preference for back-month over front-month futures contracts has had a positive impact on returns, at least when looking back at the last 26 years. The yield-optimized index has outperformed its front-month peer by a remarkable 3.2% p.a. since 1994, thanks to an implied roll-yield that has been reduced by more than 50%, from -5.7% p.a. to -2.5% p.a. Similar results have been achieved with other commodity yield optimization approaches by selectively picking contracts further back on the curve. However, all these results are hypothetical and should be interpreted with caution, as they do not take into account implementation costs. Implementation cost can be critical, as the liquidity of back-month futures is significantly lower than the liquidity of front-month contracts, leading to higher slippage costs and a more restricted investment capacity. Figure 4 highlights how quickly the liquidity of a futures contract deteriorates as its time-to-expiry increases.

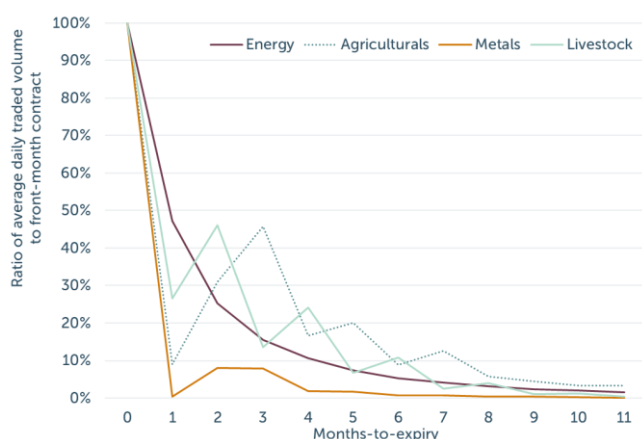


Figure 4: The liquidity of a commodity future deteriorates as its time-to-expiry increases. Ratio of average daily traded volume of first twelve calendar back-month contracts to front-month contract for four commodity subsectors. Average values taken over the period from 2005 to 2021. Source: Bloomberg/Quantica.

To conclude, investing in a diversified buy-and-hold long-only commodity futures portfolio comes with several challenges and significant cost. It may not offer the desired attractive risk-return profile needed for a strategic long-term

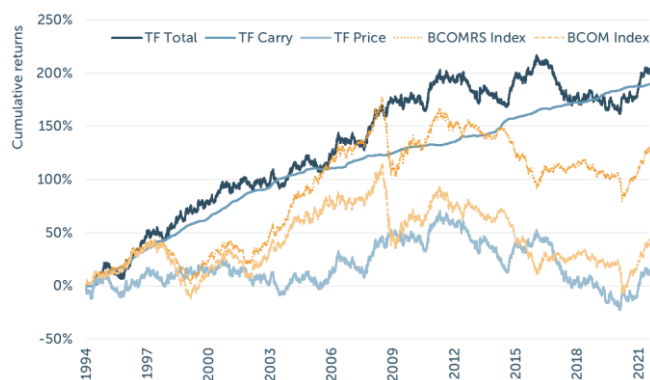
risk-allocation. Still, in certain market environments such as most recently the post COVID-19 recovery, or the years preceding the 2008 GFC, a long-only commodity allocation can indeed offer very attractive risk-return characteristics. We have further highlighted in our previous quarterly publication (Quantica Capital, May 2021)ⁱ that a long allocation to a diversified basket of commodity futures has been a reliable and effective hedge and a powerful portfolio diversifier in times of rising price inflation in the past. Unfortunately, such inflation tail-risk protection comes at the cost of modest long-term expected risk-adjusted returns, mainly due to the embedded negative roll-yield which seems difficult to avoid.

The roll-yield characteristics of a generic trend-following strategy on commodities

So far, we have reviewed and discussed the performance of static long-only commodity portfolios. We now turn to analyze the characteristics of a more dynamic, flexible, and opportunistic, but yet liquid and systematic approach to invest into commodities: trend-following. For that purpose, we rely on the generic medium-to-long-term trend-following approach we have already referred to in a number of our previous publications and restrict its application to a commodity-only universe composed of the 17 futures introduced above (see Table 1).

The strategy is designed to target a 12% annualized volatility, and – importantly – trades in front-month future contracts only. It therefore offers maximum liquidity and minimal implementation cost. The simulated and hypothetical gross *unfunded excess returns* (excluding any trading commissions, market slippage and manager fees) of the *commodity-only* trend-following strategy since 1994 are shown in Figure 5, including their attribution by

roll-yield and spot returns. Key return and risk statistics of the strategy and its long-only commodity index counterparts are additionally provided in Table 3.



	Commodity-only generic TF	BCOMRS Index	BCOM Index
Sharpe ratio	0.57	0.35	0.10
Total p.a. return	7.4%	4.7%	1.5%
Carry contribution p.a.	6.9%		
Price contribution p.a.	0.5%		

Figure 5: Cumulative gross returns between 1994 and 2021 for a commodity-only generic trend-following strategy with a target annualized volatility budget of 12%, broken down by cumulative roll-yield and spot return contribution. (Please refer to Table 1 for the underlying investment universe). Cumulative returns of the long-only BCOM and BCOM Roll Select indices are provided for benchmarking purpose over the same period.

Source: Bloomberg/Quantica.

	Commodity-only generic TF	BCOMRS Index	BCOM Index
Annualized return	7.4%	4.7%	1.5%
Average annualized roll-yield	6.9%	-2.5%	-5.7%
Average annualized price contribution	0.5%	7.2%	7.2%
Annualized volatility	13.1%	13.5%	14.8%
Sharpe ratio	0.57	0.35	0.10
Max. drawdown	-17.4%	-35.4%	-56.9%
Correlation to CM GenTF	1.00	0.11	0.11
Correlation to BCOMRS Index	0.11	1.00	0.99
Correlation to BCOM Index	0.11	0.99	1.00

Table 3: Main excess return, risk and correlation characteristics of a commodity-only generic trend-following strategy and its long-only commodity benchmarks for the period between January 1994 and July 2021.

Source: Bloomberg/Quantica.

The key findings from our study are as follows:

The generic trend-following strategy has historically outperformed a long-only commodity futures portfolio that shares the same underlying investment universe and, importantly, the same liquidity profile. While the long-only BCOM Index has produced a Sharpe

ratio of 0.1 since 1994, the generic trend-following approach has delivered a gross Sharpe ratio of 0.57 over the same period. Even when benchmarked against the BCOMRS Index, that takes advantage of the full term structure to minimize roll-yield, a trend-following approach displays superior risk-adjusted return characteristics with significantly lower drawdowns and better liquidity characteristics.

The correlation between the generic trend-following model and a diversified long-only commodity index is very low (the correlation between our generic trend-following approach and the BCOM indices is only 0.11 over the last 26 years). This is the result of a trend-following strategy’s ability to opportunistically enter short positions in falling markets and to opportunistically scale into positions based on recent market trends.

The attribution of the returns in terms of roll-yield and spot return is unexpected: While we have previously demonstrated that a buy-and-hold strategy benefits from increasing price returns and suffers from negative roll-yield, the results for the trend-following strategy are exactly the opposite. Indeed, the long-term roll-yield of the trend-following strategy has been a positive +6.9% p.a. compared to -5.7% for the long-only Index (and -2.5% for the yield optimized Index). On the other hand, the spot return attribution has amounted to a modest +0.5% p.a. for the trend-following strategy, compared to +7.2% p.a. for the long-only indices.

It appears that trend-following is very well capable of capitalizing on the opportunistic roll-yield characteristics of individual commodity futures. A natural question arising from this observation is if this is the result of a systematic short bias of the trend-following strategy.

Figure 6 shows the trend-following strategy’s aggregate net exposure over the last 26 years. The average net exposure has been 4.8%, and the

strategy was net-long 55% and net-short 45% of the time. Hence, the strategy was not showing a systematic short bias over time.

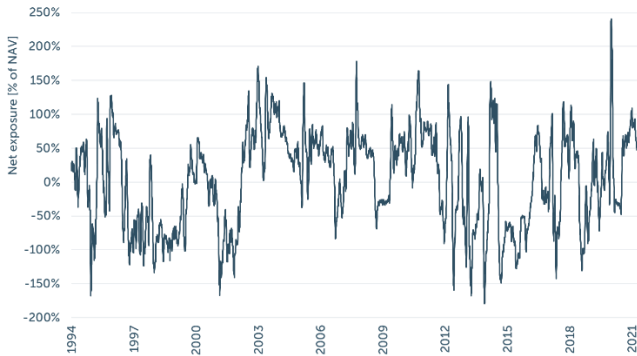


Figure 6: Net exposure [% of NAV] of a commodity-only generic trend-following strategy from 1994 to 2021. Source: Quantica.

More specifically, both the strategy’s long and short positions have been contributing positively to its overall returns, as Figure 7 shows: Long positions have accounted for close to 80% (or 6.1% p.a.) of the overall annualized gross return of 7.4% p.a. since 1994. And importantly, the roll-yield earned on both long and short positions has been positive.

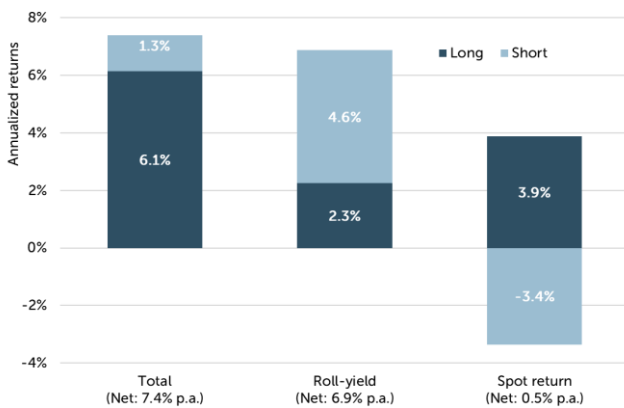


Figure 7: Annualized return attribution of a commodity-only generic trend-following strategy from January 1994 to July 2021 by roll-yield and spot return contribution, broken down by long and short positions. Source: Quantica.

While the positive roll-yield of 4.6% p.a. extracted from short positions should not come as a surprise based on our analysis so far, the positive roll-yield of 2.3% p.a. extracted from long positions is more surprising. In fact, it seems that

one third of the positive roll-yield captured by trend-following on commodities is achieved through taking opportunistic long positions in times of backwardated markets.

Figure 8 shows the long-term decomposition of the yield carry between the long and short side of the trend-following strategy. While both the long and short sides contributed equally to the positive roll return of the strategy before 2005, the roll return thereafter was generated almost exclusively by the short side.

Despite commodity markets being predominantly in a state of contango (a structural headwind to the returns of a long position), a generic trend-following approach still appears to be able to generate a sizeable and consistent profit from long commodity positions over time.

More generally speaking, a generic trend-following strategy seems well suited to successfully capture investment opportunities linked to both periods of contango and backwardation through adequate long and short positioning, and to outperform a long-only allocation into the same basket of commodity futures in the long run.

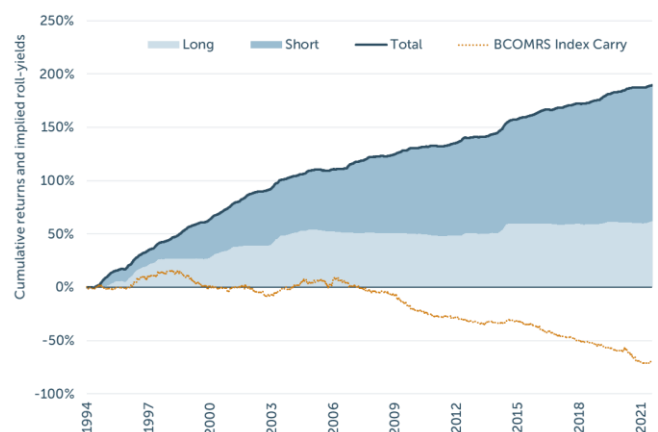


Figure 8: Cumulative commodity roll-yield contribution from long and short positions respectively to the returns of a generic trend-following strategy (target volatility of 12%) from January 1994 to July 2021 and benchmarked to the cumulative roll-yield of the long-only BCOMRS Index. Source: Bloomberg/Quantica.

Conclusion

We have demonstrated that the roll-yield or cost of carry is a key driver of commodity futures returns and has historically caused significant headwind to the performance of a strategic long-only allocation in commodity sectors like energy, agriculturals and livestock, and to a lesser extent in metals. In fact, the cost of carry of a broadly diversified and investable long-only commodity benchmark index has amounted to approximately 6% p.a. over the past 26 years, offsetting almost entirely any upside originating from rising spot commodity prices. Since commodity futures markets are predominantly in contango and their roll-yield is steepest and most negative at the front end of a contango curve, one way to mitigate the negative impact of roll-yield in a long-only context is to trade futures further back on the curve. We have shown, that while such approach may effectively reduce the cost of carry by up to 50%, its implementation comes not without challenges, as the liquidity profile of contracts at the back of the curve tends to be only a small fraction of the front-month liquidity.

We have outlined how a trend-following approach to trading commodity futures markets may allow to take advantage of the liquidity and term structure characteristics more effectively. By being more dynamic and opportunistic in its

positioning, a generic trend-following strategy can simultaneously take advantage of short positions in times of steep contango and long positions in more backwardated markets.

Thanks to such versatility, a hypothetical generic trend-following strategy targeting an annualized volatility of 12% has been able to earn a significantly positive roll-yield of 6.9% per annum since 1994, which has accounted for approximately 90% of the strategy's simulated overall gross return over that period. Surprisingly, the trend-following strategy has indeed strongly benefitted from positive roll-yield whereas the spot return attribution has been modest, which is exactly the opposite compared to a buy-and-hold approach.

Furthermore, we have shown that the positive roll-yield is not the result of a systematic short-bias of the strategy. In fact, long positions have accounted for 80% of the strategy's simulated gross returns since 1994, while short positions were highly effective in capturing positive yield carry in times of pronounced contango. Such ability to effectively capitalize on the dynamic and intrinsic term structure characteristics of individual commodity futures can effectively lead to superior risk-adjusted returns compared to a static buy-and-hold approach of investing into commodities.

References

- ⁱ Quantica Capital, "Trend-following and inflation protection", *Quantica Quarterly Insights*, May 2021

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