Commodity Portfolio Monthly

Extending our vol framework

Bank of America Merrill Lynch

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We extend our fair value & predictive vol framework

We recently introduced both a fair value and a predictive vol framework for WTI crude oil and the BCOM index based on macro and micro variables such as the VIX, the US 2y interest rate and inventories. We now extend this idea to other commodities, including Brent crude oil, US natural gas, wheat, corn, soy, sugar and gold. Of course, oil is the largest commodity market in the world, and it tends to drive other raw materials. So we estimate fair values for realized vol across a set of commodities as a function of WTI vol as opposed to the VIX, but we still include micro inventory data for each commodity.

Is this a good time to broadly sell commodity volatility?

Fair value vol estimates are a good starting point to analyzing commodity vol but are generally backward looking. Our analysis suggests that a predictive vol return framework may work better. We have previously shown that implied-realized spreads and vol skews have some predictive power on delta-hedged short straddle returns over a 3-month horizon, and we extend this analysis to other commodities. The negative implied-realized spread in WTI, coupled with a relatively modest put skew still implies negative returns from being short vol over the next 3 months. We now find a similar negative return for Brent. In contrast, we project large, positive returns for corn, soy and sugar short vol strategies over the next 3 months as we enter a period of seasonally low realized vol.

Our predictive vol return tool works best in a portfolio

The predictive vol framework can also be used to build a dynamic short vol cross-commodity strategy. Based on our backtested analysis, the dynamic signal provided by our predictive framework generally improved information ratios relative to a static delta-hedged short straddle strategy, particularly in the cases of WTI, US nat gas, soybeans and gold. Given the relatively low correlations among the individual strategies, we move on to package them into an equally weighted portfolio, and the information ratio would have increased from 0.55 to 0.76 relative to a static portfolio over the backtested period. We also attempt to build a strategy that selects only the four highest return signals across this group of eight commodities, and our backtested analysis indicates show that this dynamic strategy would have improved the information ratio relative to a comparable static basket.

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Refer to important disclosures on page 13 to 14.

Extending our vol framework

We recently introduced a fair value estimate of crude oil vol…

In our latest Commodity Portfolio Monthly (see Taking stock of commodity vol), we introduced a fair value estimate of WTI crude oil and BCOM index realized volatility based on a small set of macro and micro fundamentals. The fair value estimate corresponds to the long-run equilibrium level of volatility, given current market conditions. We also introduced a predictive vol return framework for systematic short straddle strategies. The predictive vol framework uses both the implied-realized spread as well as the put skew to forecast 3M delta-hedged short straddle returns. In this note, we extend our work to other commodities and show how it can be used to dynamically adjust exposure to short volatility strategies.

…based on macro (VIX, rates) and micro (inventories) factors

Our prior research revealed that a combination of both macro and micro factors is most successful at pinning down an estimate of fair value oil vol. The key macro drivers, US 2Y nominal interest rates and the VIX, capture both fixed income and equity market conditions and have significant explanatory power across many asset classes. But, unlike volatility in other asset classes, oil vol is linked to the level of physical inventories. After all, US crude stocks, together with prices, are the key mechanism to adjust imbalances in oil supply and demand. As such, we choose stocks as the key micro factor in determining the equilibrium level of WTI vol.

We now extend that idea to other commodities in energy…

Since Brent and WTI crude oil are essentially the same commodities, and are therefore interconnected through cross-market physical arbitrage as well as exposed to common global supply and demand conditions, we apply a similar framework to explain Brent volatility. However, Brent is a seaborne barrel traded in the North Sea while WTI is a landlocked grade that prices at Cushing, OK. As such, these two contracts have distinct inventory dynamics, and we find that European crude oil stock levels are naturally more powerful as an explanatory variable of Brent vol (Table 1) than US stocks.

Table 1: Fair value of Brent vol is driven by macro factors as well as European crude oil stocks

	Beta	t-stat	p-value
2Y US nominal rate	0.12	1.35	0.176
SPX Volatility Index (VIX)	0.57	2.68	0.008
ARA stocks (linear)	1.64	6.97	0.031
ARA stocks (squared)	8.95		
Adj R-squared	0.63		

Source: Bloomberg, Reuters, BofA Merrill Lynch Global Research

Note: Regression is estimated using dynamic OLS (with 4 leads and lags of the first differences of the independent variables) on weekly data spanning Apr 18, 2003 to Oct 2, 2015. Dependent variable is logarithm of trailing 3M realized volatility of the Brent BCOM subindex (BCOMCO). Given the log-log specification, the coefficients can be interpreted as long-run elasticities. De-trended and de-seasonalized stocks stored at the Amsterdam-Rotterdam-Antwerp (ARA) hub enter the regression in both linear and quadratic terms in order to capture a U-shaped relationship between inventories and realized volatility. Newey-West HAC standard errors are used to calculate t-stats and p-values. We jointly test for the significance of the inventory terms and report the Wald statistic and corresponding p-value.

…and in the agricultural sector (corn, wheat, soy, sugar)…

As the largest commodity market in the world, oil volatility tends to spill over into the markets for other raw materials like gasoline, nat gas, corn, wheat and even metals. This is not only because oil markets are highly sensitive to global macro demand conditions but also because crude oil and its refined products are an input to the production of many other commodities. For instance, oil is used extensively in farming as well as the mining, smelting and refining of aluminum and copper. As such, we adopt the parsimonious modeling strategy of first relating crude oil volatility to a set of macro and micro fundamentals, and then explaining the volatility of other commodities, such as US nat gas, as a function of WTI vol in addition to market-specific fundamentals, such as nat gas inventories (Table 2).

Table 2: Fair value of nat gas vol is a function of the level of WTI realized vol and nat gas storage

	Beta	t-stat	p-value
WTI realized volatility	0.34	3.01	0.003
DOE nat gas storage (linear)	0.30	9.26	0.010
DOE nat gas storage (squared)	1.98		
Adj R-squared	0.37		

Source: Bloomberg, BofA Merrill Lynch Global Research

Note: Regression is estimated using dynamic OLS (with 4 leads and lags of the first difference of the independent variables) on weekly data spanning Jan 4, 1999 to Oct 2, 2015. Dependent variable is logarithm of trailing 3M realized volatility of the Nat Gas BCOM subindex (BCOMNG). Given the log-log specification, the coefficients can be interpreted as long-run elasticities. De-trended and de-seasonalized nat gas storage enters the regression in both linear and quadratic terms in order to capture a U-shaped relationship between inventories and realized volatility. Newey-West HAC standard errors are used to calculate t-stats and p-values. We jointly test for the significance of the inventory terms and report the Wald statistic and corresponding p-value. The specification also includes monthly dummies.

...using a combination of similar macro and micro variables

In addition, we estimate similar fair value vol regressions for corn, wheat, soy and sugar using WTI crude oil vol as the key macro determinant and commodity-specific inventory levels as the key micro determinant (Table 3). Compared to the fair value regressions of volatility in the energy markets, these regressions are somewhat less successful at explaining the historical level of realized vol across the agriculture markets, which is perhaps not surprising given the lower frequency (and likely lower quality) of agricultural inventory data as well as the fact that movements in grain and oilseed markets are frequently caused by unpredictable forces, such as weather shocks. Nevertheless, the vol framework still appears robust, generally displaying statistically significant coefficients and strong evidence of mean reversion toward estimated levels of equilibrium vol.

Table 3: Fair value vol across the agriculture complex is driven by WTI vol and inventories

Panel A: Corn	**Beta**	**t-stat**	**p-value**
WTI realized volatility	0.38	5.29	0.000
USDA corn stocks (linear)	-4.42	5.67	0.059
USDA corn stocks (squared)	0.30		
Adj R-squared	0.20		
Panel B: Wheat	**Beta**	**t-stat**	**p-value**
WTI realized volatility	0.29	1.49	0.139
USDA wheat stocks (linear)	-9.62	25.31	0.000
USDA wheat stocks (squared)	0.75		
Adj R-squared	0.21		
Panel C: Soy	**Beta**	**t-stat**	**p-value**
WTI realized volatility	0.39	2.39	0.018
USDA soy stocks (linear)	-1.94	5.71	0.057
USDA soy stocks (squared)	0.15		
Adj R-squared	0.27		
Panel D: Sugar	**Beta**	**t-stat**	**p-value**
WTI realized volatility	0.42	2.50	0.013
Sugar stocks to use-days (linear)	-0.56	6.36	0.042
Sugar stocks to use-days (squared)	0.07		
Adj R-squared	0.26		

Source: Bloomberg, USDA WASDE, F.O. Licht, BofA Merrill Lynch Global Research

Note: Each regression is estimated independently using dynamic OLS (with 1 lead and lag of the first differences of the independent variables) on monthly data spanning Jan 1999 to Sep 2015. Dependent variables are the logarithm of trailing 3M realized volatility of the relevant BCOM subindex (BCOMCN, BCOMWH, BCOMSY, BCOMSB). Given the log-log specification, the coefficients can be interpreted as long-run elasticities. For the corn, wheat, and soy regressions, inventory data are taken from the USDA WASDE which reports the monthly estimate of the level of inventories at the end of the current crop year, so these data are not seasonally adjusted. For the sugar regression, inventory data are taken from F.O. Licht which provides a monthly estimate of the current level of inventories; since these data display seasonal patterns, sugar inventories are de-seasonalized prior to estimation. None of the inventory series are de-trended, given the absence of a noticeable upward drift in stocks over the sample period. Both linear and quadratic terms of stocks are included in all regressions in order to allow for a nonlinear and inverse relationship between inventories and volatility. In all regressions, expect for corn, Newey-West HAC standard errors are used to calculate t-stats and p-values. For the corn regression, reported test statistics are calculated using robust HC standard errors. We jointly test for the significance of the inventory terms and report the Wald statistic and corresponding p-value. Corn, wheat, and soy specifications also include monthly dummies.

Still, gold vol seems to be driven by macro (VIX, rates, FX) factors

Since gold is both a currency and a commodity, realized volatility in the gold market cannot be easily explained by micro factors like inventories. After all, the global stockpile of gold is about 180,000 tons, compared to average annual mine production of just 2,875 tons over the period 2009-14. Rather, we argue that the equilibrium level of gold volatility is a function of equity market vol (VIX), USD vol, and interest rate vol (Table 4). Based on our analysis, it appears that oil volatility, just like oil prices, has diverged from gold volatility, so the level of realized oil vol is omitted from the set of explanatory factors used in the framework. Although the gold vol regression is less robust than the vol regressions for the other seven commodities, we still believe that the framework is useful in providing a benchmark against which to compare the level of volatility implied by the gold options market.

Table 4: Fair value gold vol is explained by VIX vol, USD vol, and US interest rate vol

	Beta	t-stat	p-value
SPX Volatility Index (VIX)	0.09	1.97	0.049
USD realized volatility	0.26	7.11	0.000
2Y US nominal rate realized vol	0.07	3.95	0.000
Adj R-squared	0.15		

Source: Bloomberg, BofA Merrill Lynch Global Research

Note: Regression is estimated using dynamic OLS (with 4 leads and lags of the first differences of the independent variables) on weekly data spanning Jan 4, 1999 to Oct 2, 2015. Dependent variable is logarithm of trailing 3M realized volatility of the Gold BCOM subindex (BCOMGC). Given the log-log specification, the coefficients can be interpreted as long-run elasticities. USD realized volatility is computed as the logarithm of trailing 3M realized vol of the DXY Index. Robust HC standard errors are used to calculate t-stats and p-values. We jointly test for the significance of the inventory terms and report the Wald statistic and corresponding p-value.

We find current implied vol levels are priced to sell for WTI and Brent

When looking across these eight diverse commodities, we find that the current level of 3M ATM implied vol is roughly in line with the values determined by our realized vol framework (Table 5). However, there are some notable discrepancies. We find that the gap between the current implied vol and the fair value vol estimated by our framework is widest for Brent and WTI, suggesting that vol is potentially priced to sell in the crude oil market. Meanwhile, implied vols are trading below fair value levels across the agriculture complex, and gold implied vol appears to be roughly in line with our fair value estimate.

Table 5: Our fair value framework suggests that vol is priced to sell in crude oil markets

	WTI	Brent	Nat gas	Wheat	Soy	Corn	Sugar	Gold
ATM 3M implied vol	38.1%	37.2%	45.1%	24.1%	17.1%	20.9%	26.2%	16.0%
Fair value vol	35.6%	31.8%	50.6%	35.1%	27.0%	28.7%	36.5%	17.5%

Source: Bloomberg, BofA Merrill Lynch Global Research

So, is this a good time to sell commodity volatility?

It is important to emphasize that our fair value framework simply provides an estimate of the steady-state level of realized volatility, given current market conditions. In other words, it is a first approximation of where we think volatility should be trading today in light of current observable macro and micro fundamentals. Although we expect volatility to revert toward its fair value over the long run, the fair value estimate is not an explicit forecast of where we think volatility will be trading tomorrow, since the steady-state level is a moving target which shifts along with market conditions. Additionally, volatility levels over typical investment horizons may be driven in complex ways by other factors, such as momentum or investor positioning, not just mean reversion. Thus, this framework may not necessarily be a great predictor of short vol returns. Rather, in order to determine the best time to sell vol in commodity markets, our analysis suggests that it is more straightforward to leverage a predictive framework which directly forecasts short vol returns.

We extend our predictive commodity vol framework…

In our previous monthly, we introduced a predictive vol return framework to help investors determine when to sell delta-hedged WTI straddles. In particular, we forecast straddle returns by regressing cumulative 3M straddle returns on the current level of the implied-realized spread and the put skew. Of course, forecasting vol returns is more an art than a science, and the R-squared of our parsimonious regression highlights the difficulty of this prediction problem (Table 6). However, our analysis finds that both the implied-realized spread and the put skew have historically had some predictive power, at least over longer horizons, such as 3Ms. When attempting to forecast over shorter horizons, such as 1M, the predictive power declines substantially, with the associated R-squared's falling below 0.1.

Table 6: Implied-realized spread and skew help predict WTI straddle returns, though with a relatively low R-squared

	Beta	t-stat	p-value
Implied vol - realized vol	1.26	2.01	0.045
25D risk reversal	-3.89	-3.70	0.000
R-squared	0.32		

Source: Bloomberg, BofA Merrill Lynch Global Research

Note: 3M-ahead returns to a delta-hedged WTI short straddle are regressed on the level of the spread and the 25D risk reversal for WTI. Data are weekly are spance the period from Oct 2007 to Sept 2015. Implied volatility is measured using 3m ATM WTI options, and realized volatility is calculated as the average value of forecasted volatility over the following 3Ms using a GARCH(1,1) model. 25D risk reversal is computed as the difference between the implied vol of a 3m 25D call option and the implied vol of a 3m 25D put option. To correct for serial correlation in the residuals (due to overlapping data), Newey-West HAC standard errors are used to calculate t-stats and p-values.

…by further analyzing vol skews and implied-realized spreads

We further extend our predictive vol return framework to seven additional commodities – Brent, nat gas, corn, wheat, soy, sugar and gold – and use the predicted short straddle returns as trading signals. This predictive vol return framework is forward looking in the sense that it uses observable option market information (implied-realized spreads and put skews) to explicitly forecast 3M returns from delta-hedged short straddles. In constructing implied-realized spreads, option prices directly provide an observable level of 3M implied vol, while we forecast realized vol over the subsequent 3Ms by using a standard GARCH(1,1) model, which accounts for both persistence and mean reversion in volatility. As such, unlike the fair value framework, the predictive vol return regressions are forward looking.

Implied-realized spreads and put skews look too narrow to short oil or gas vol…

Our analysis across various commodity markets shows that the projected 3M implied-realized spread and the level of the put skew, as opposed to a fair value volatility metric, provide more useful indicators of whether or not to sell delta-hedged short straddles at a particular point in time (Table 7). As we argued in our last piece, the negative projected implied-realized spread in WTI, coupled with a relatively modest put skew by historical standards (currently -2.5% compared with an in-sample average of -3.7% and a recent high of -5.25%), suggests negative returns from being short WTI vol over the next 3 months. Additionally, we forecast even larger negative returns for Brent straddles, given the smaller observed put skew (currently -1.5% compared with an in-sample average of -3.4%).

…but we project strong returns from selling vol in corn, soy, and sugar

Our outlook for nat gas delta-hedged short straddle returns is neutral. The wide projected 3M implied-realized vol spread is offset by the large call-skew driven by seasonal demand for hedging by consumers. In the case of wheat, our regression projects negative returns from being short vol over the next 3 months on the back of a large call skew. On the other hand, despite the negative implied-realized spreads and presence of call skews, we project large, positive returns for corn, soy and sugar short vol strategies over the upcoming 3 months as we enter a period of seasonally low realized vol (and historically high straddle returns).

Table 7: We recommend selling vol in soy, corn and sugar markets

	ATM 3M implied vol	Fair value vol	Forecasted realized vol	25D risk reversal	Forecasted short vol returns	Straddle outlook
WTI	38.1%	35.6%	40.5%	-2.5%	-1.1%	Bearish
Brent	37.2%	31.8%	42.5%	-1.5%	-2.6%	Bearish
Nat gas	45.1%	50.6%	35.0%	1.9%	-0.2%	Neutral
Wheat	24.1%	35.1%	27.1%	2.1%	-0.4%	Bearish
Soy	17.1%	27.0%	21.7%	-0.2%	1.3%	Bullish
Corn	20.9%	28.7%	24.5%	0.9%	2.7%	Bullish
Sugar	26.2%	36.5%	26.1%	1.0%	1.3%	Bullish
Gold	16.0%	17.5%	16.0%	-0.2%	0.1%	Neutral

Source: Bloomberg, BofA Merrill Lynch Global Research

Note: ATM 3M implied vol and 25D risk reversal correspond to observed market values as of Oct 21,2015. Forecasted realized volatility is the projected volatility realized over the upcoming 3Ms using a GARCH(1,1) model. Forecasted short vol returns are produced by our predictive vol framework and represent the cumulative returns to a delta-hedged short straddle over the next 3Ms.
The framework is new and the backtested performance presented is hypothetical in nature and reflects application of the framework prior to its inception date as if it has been in existence at that time. It is not intended to be indicative of actual or future performance. The actual performance of the framework may vary significantly from the backtested performance.
The backtested performance results are based on criteria applied retroactively with the benefit of hindsight and knowledge of factors that may have positively affected its performance, and cannot account for all financial risks that may affect the performance of the framework going forward.

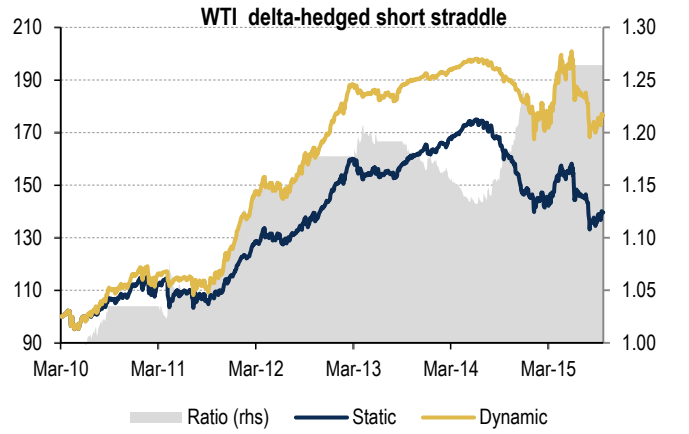
Our predictive vol framework can be effectively used…

Naturally, expected vol returns vary over time and can thus provide a dynamic trading signal for each commodity. In this note, we move from a systematic strategy that passively sells delta-hedged straddles to a dynamic vol strategy that adjusts exposure to short straddles based on forecasted straddle returns. For the purpose of this strategy, when our quarterly signal predicts returns above the 60th percentile of the historical return distribution for each commodity, we increase our notional exposure to a systematic, delta-hedged short straddle to 150%. However, if our quarterly signal predicts returns below the 40th percentile of the historical return distribution, we decrease exposure to 50%. In between these cutoff values, we maintain exposure at 100%. We show the backtested results of this dynamic strategy applied individually to each of the eight commodities in the charts below (Chart 1 to Chart 8).

Before discussing the historical backtested results, a few caveats are important to highlight. In our analysis, we re-estimate the predictive vol return regression for each commodity on each rebalance day (which occurs on the last business day of each quarter) using only data up to that point. These regression results display considerable variation both across time and across commodities. For instance, the average R-squared for the Brent regression is approximately 0.49, while the average R-squared for the wheat regression is 0.01. Additionally, for a given commodity, the regression coefficients change from one rebalance period to the next, sometimes even switching signs. These cross-sectional and temporal instabilities raise the possibility that this predictive framework may not deliver consistent results out-of-sample.

Additionally, the selection of cutoff values materially affects the historical backtested performance. To avoid any perception of over-fitting, we apply the same cutoff values as set out above across each commodity, rather than tailoring these limits to maximize in-sample performance in each market. Despite these limitations, we still think that this simple framework provides some insight in guiding investors on how to dynamically adjust short vol exposure.

Chart 1: WTI dynamic vol selling



Source: Bloomberg, BofA Merrill Lynch Global Research
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Chart 2: Brent dynamic vol selling

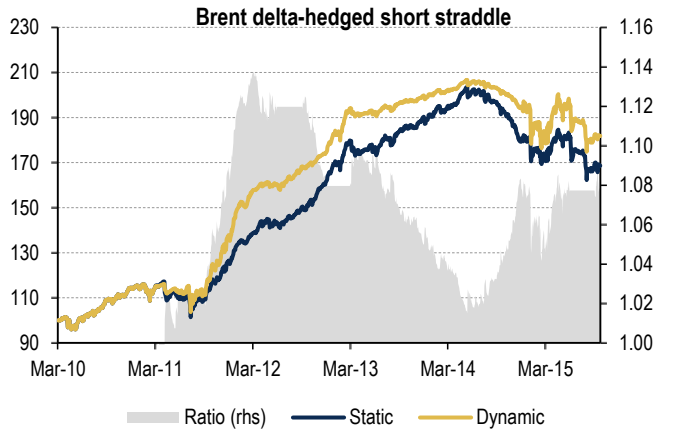

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Chart 3: Nat gas dynamic vol selling

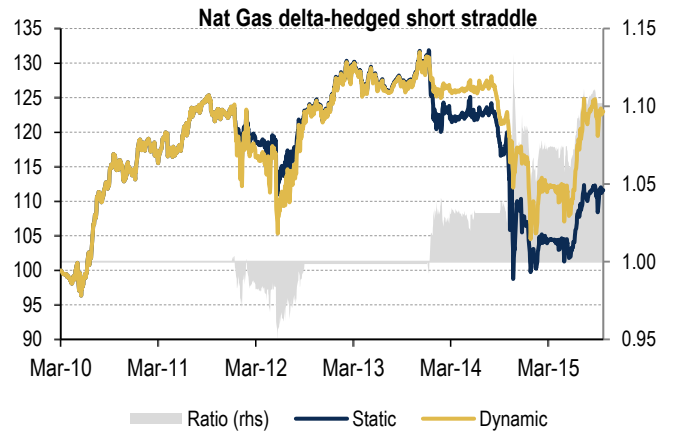

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Chart 4: Wheat dynamic vol selling

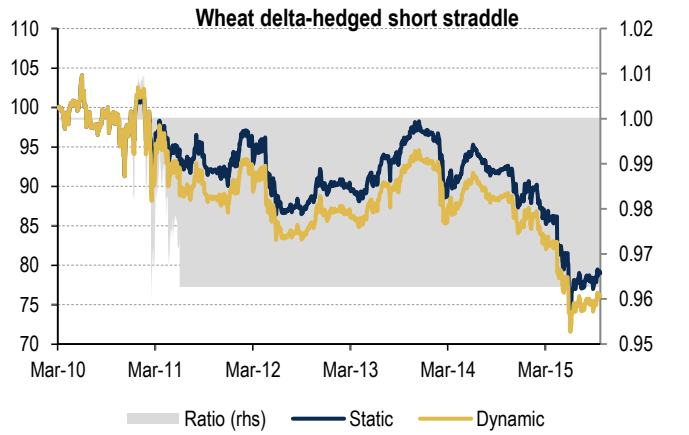

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Chart 5: Soy dynamic vol selling

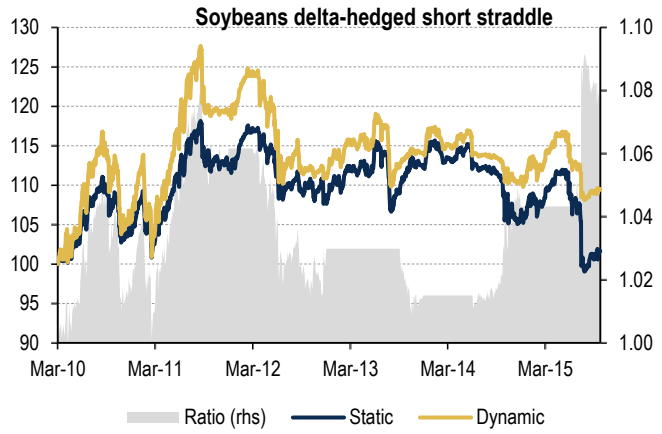

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Chart 6: Corn dynamic vol selling

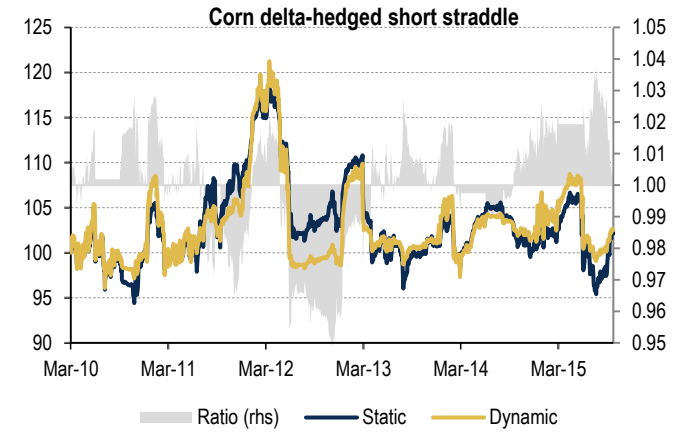

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Chart 7: Sugar dynamic vol selling

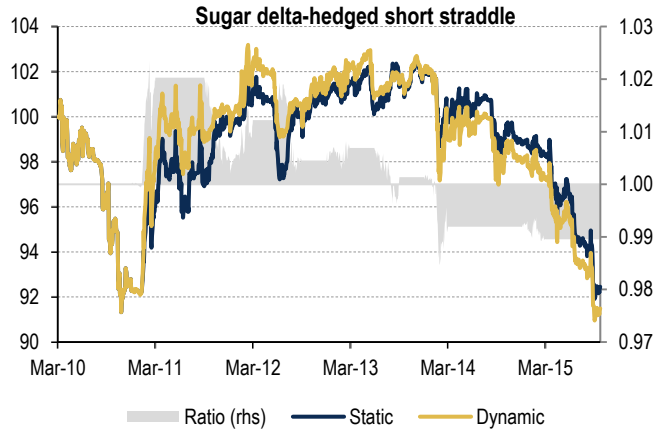

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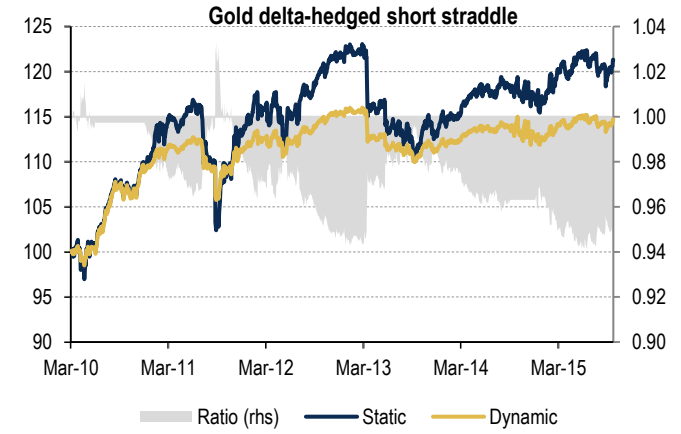
Chart 8: Gold dynamic vol selling



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...to build a dynamic short vol cross-commodity strategy

Our backtested strategy suggests the dynamic strategy improves information ratios relative to a static delta-hedged short straddle strategy for six of the eight commodities considered in this report (Table 8). The improvement is particularly noticeable for WTI, nat gas, soybeans and gold. However, the dynamic strategy does not provide any significant improvement when applied to Brent, corn, sugar and wheat, although at least in these cases the signal-based strategy does not substantially worsen static short straddle returns (declines in wheat and sugar were marginal). Given the relatively low correlation among the dynamic strategies, we move on to consider packaging the individual strategies into an equally weighted portfolio.

Table 8: Dynamic vol selling delivers a more attractive risk-reward profile than static vol selling for WTI, natural gas, soybeans and gold

		Avg return	Std dev	Info ratio
WTI	(Static)	6.0%	9.3%	0.64
	(Dynamic)	10.2%	9.9%	1.03
Brent	(Static)	9.4%	9.0%	1.05
	(Dynamic)	10.8%	9.5%	1.13
Nat gas	(Static)	2.0%	9.4%	0.21
	(Dynamic)	3.7%	9.9%	0.38
Wheat	(Static)	-4.2%	9.4%	-0.45
	(Dynamic)	-4.9%	10.4%	-0.47
Soy	(Static)	0.3%	7.5%	0.04
	(Dynamic)	1.6%	8.6%	0.19
Corn	(Static)	0.4%	9.0%	0.04
	(Dynamic)	0.4%	9.5%	0.05
Sugar	(Static)	-1.4%	4.4%	-0.32
	(Dynamic)	-1.6%	4.8%	-0.34
Gold	(Static)	3.5%	6.7%	0.52
	(Dynamic)	2.5%	3.7%	0.66
EW portfolio	(Static)	2.3%	4.1%	0.55
	(Dynamic)	3.2%	4.2%	0.76

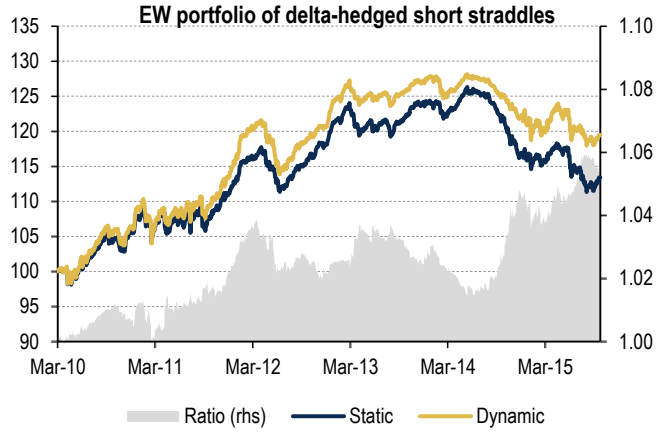
Source: Bloomberg, BofA Merrill Lynch Global Research

Note: All reported statistics are annualized.
The framework is new and the backtested performance presented is hypothetical in nature and reflects application of the framework prior to its inception date as if it has been in existence at that time. It is not intended to be indicative of actual or future performance. The actual performance of the framework may vary significantly from the backtested performance.
The backtested performance results are based on criteria applied retroactively with the benefit of hindsight and knowledge of factors that may have positively affected its performance, and cannot account for all financial risks that may affect the performance of the framework going forward.

The signals work best when used in a portfolio context

Transitioning to a portfolio setting, out backtested analysis suggests that an equally weighted (EW) portfolio of the individual dynamic strategies would have outperformed an EW portfolio of static straddles – delivering 0.9% in additional returns with approximately the same level of volatility, resulting in an increase in the information ratio from 0.55 to 0.76 over the backtested period (Chart 9). However, one negative feature of this implementation is that the choice of the cutoff values used to ensure that the trading signal is delivering a meaningful prediction are somewhat arbitrary. To help counter this, we execute an alternative dynamic strategy that only sells delta-hedged short straddles in the four markets with the highest return signals across the entire cross-section of eight commodities. We compare the backtested performance of this dynamic basket to the performance of a static basket (Chart 10). In this case, our backtested analysis shows an improvement in the information ratio from 0.72 to 0.98, suggesting that a dynamic strategy that only selects the four strongest signals is likely to yield the highest risk-adjusted returns.

Chart 9: An equally-weighted portfolio of individual dynamic vol selling strategies outperforms an EW portfolio of static strategies…



Source: Bloomberg, BofA Merrill Lynch Global Research
The framework is new and the backtested performance presented is hypothetical in nature and reflects application of the framework prior to its inception date as if it has been in existence at that time. It is not intended to be indicative of actual or future performance. The actual performance of the framework may vary significantly from the backtested performance.
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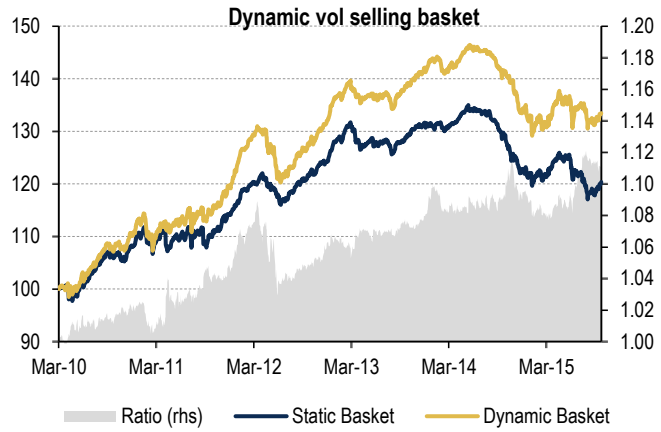
Chart 10: …and a dynamic vol selling basket delivers a higher information ratio than a static basket



Source: Bloomberg, BofA Merrill Lynch Global Research
The framework is new and the backtested performance presented is hypothetical in nature and reflects application of the framework prior to its inception date as if it has been in existence at that time. It is not intended to be indicative of actual or future performance. The actual performance of the framework may vary significantly from the backtested performance.
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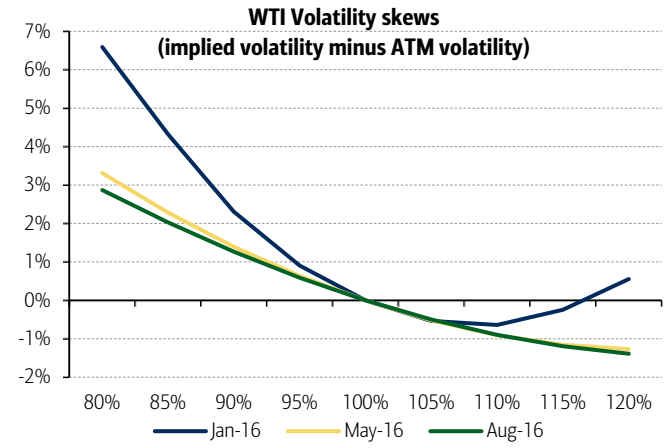
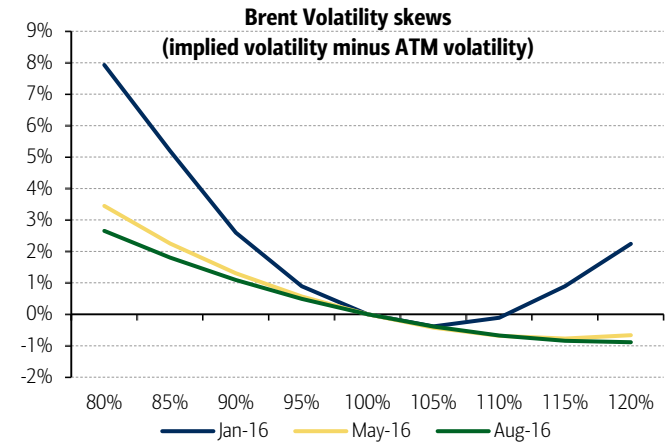
Energy Volatility Skews

Chart 11: WTI Crude Oil



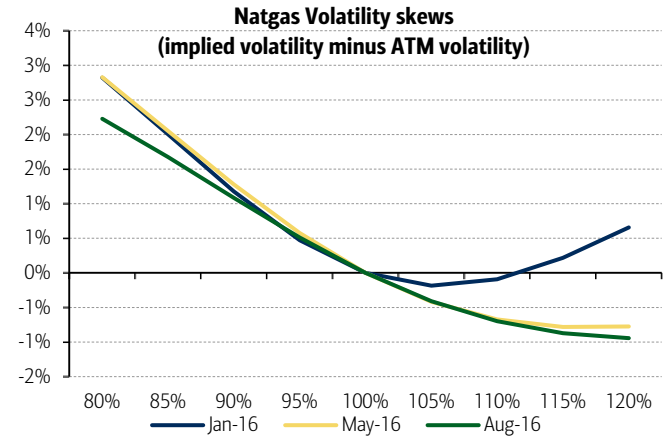
Source: BofA Merrill Lynch Global Research, Bloomberg

Chart 12: ICE – Brent Crude Oil



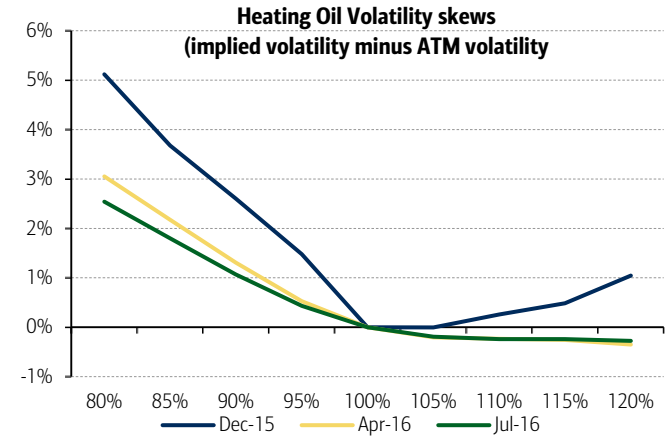
Source: BofA Merrill Lynch Global Research, Bloomberg

Chart 13: Nat Gas



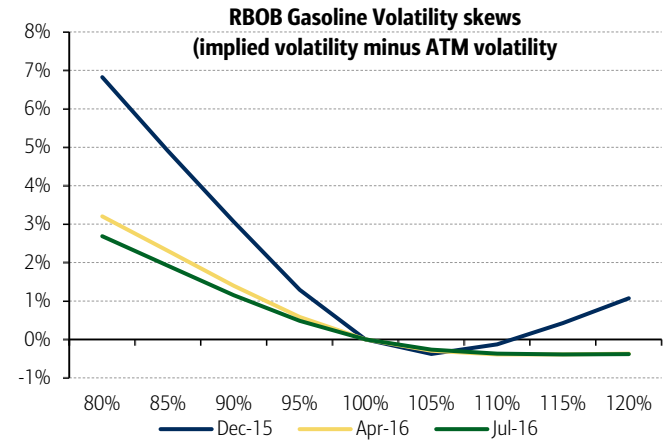
Source: BofA Merrill Lynch Global Research, Bloomberg

Chart 14: Heating Oil



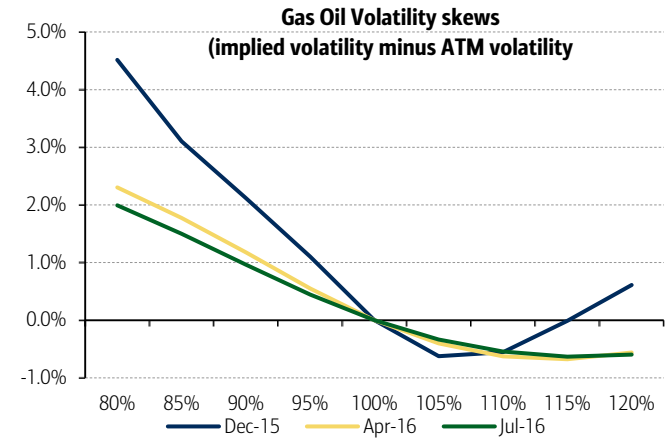
Source: BofA Merrill Lynch Global Research, Bloomberg

Chart 15: RBOB Gasoline



Source: BofA Merrill Lynch Global Research, Bloomberg

Chart 16: ICE – Gas Oil



Source: BofA Merrill Lynch Global Research, Bloomberg

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