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Harvesting Commodity Curve Premia Through Roll-Yield Differentials

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Investments in commodity futures have gained huge popularity among traditional and alternative asset managers over the past fifteen years. Indeed, the commodities market has evolved from being a trading venue inhabited by commercial hedgers and traditional speculators to become a market with a growing financial investor presence (Zaremba [2014]). The main reasons for this lie in commodities' unique features that make them attractive candidates to improve one's portfolio characteristics. These often-cited features are long-term equity-like returns (Erb and Harvey [2006]; Gorton and Rouwenhorst [2006]; Till [2007]), inflation-hedging properties and risk diversification (Bodie and Rosansky [1980]; Bodie [2003]; Greer [2000]; Georgiev [2001]; Gorton and Rouwenhorst [2006]).

Recent research has also established that simple long-short strategies can generate abnormal returns in commodity markets. One of these strategies is based on the shape of commodities term structures, which is known to be an important determinant of commodity returns. There are various theoretical reasons for this. According to Keynes [1930], short hedgers supply usually exceeds long hedgers demand and futures prices therefore embed a discount that is a compensation for insurance against future spot price risk, i.e. futures prices are downward-biased estimates of future expected spot price as commodity producers are willing to forgo part of their expected profits in order to lock their margins. This discount is

aimed at inducing speculators to take long positions on the futures market and restore equilibrium. Hicks [1946] shared this view, emphasizing the "congenital weakness" of inventory holders relative to consumers, notably because consumers have alternatives (substitute products) and as a result are less vulnerable to price increases than producers to price drops.

Another way to view it is through Kaldor's theory of storage [1939] which links the term structure of futures prices to the level of inventories. According to this theory, futures prices should equal spot prices plus the cost of carry (storage, insurance and interest forgone) less the convenience yield. The convenience yield is defined by Brennan [1958] as "*the advantage (in terms of less delay and lower costs) of being able to keep regular customers satisfied or of being able to take advantage of a rise in demand and price without resorting to a revision of the production schedule*". In other words it represents the "comfort" of possessing stocks in periods of low inventories. The theory of storage thus posits that when the convenience yields exceeds the cost of carry, futures prices will be lower than spot prices, a situation referred to as backwardation. The convenience yield is therefore positively correlated with the spot price and negatively correlated with inventory levels. This approach makes sense: inventories act as a buffer for commodities supply when there is a spike in demand. If demand increases faster than supply, inventories will begin to decrease and will eventually reach a level at which they will no longer serve this function, at which point the market will have to offer an incentive to storage holders to promote the build-up of inventories. A downward sloping or backwardated term structure provides this incentive.

Backwardation translates into a positive implied roll-yield, which means that rolling a futures long position on this commodity should generate a profit (the contract sold will be worth more than the newly bought contract) provided the term structure remains stable. The

opposite situation (upward sloping forward curve, negative implied roll-yield) is referred to as Contango.

Following this, commodities in backwardation should tend to outperform because of 1) a tendency for spot price appreciation and 2) positive roll-yield or positive carry. This intuition has been confirmed by previous studies. Erb and Harvey [2006] use the term-structure signals of 12 commodities to implement a simple strategy that goes long the 6 most backwardated commodities and short the 6 most contangoed commodities and find greatly improved Sharpe ratios compared to long-only strategies. Fuertes, Miffre and Rallis [2010] expand on this strategy by assessing the sensitivity of the term structure profits to the roll return definition and the frequency of rebalancing.

The performance of these strategies suggests that the commodity term-structure is a good predictor of future performance. However, it is important to keep in mind that commodity futures excess returns can be broken down into two components, Spot return (sometimes called Price return) and Roll return, and that the term structure has a strong predictive power on Roll returns (Nash and Smyk [2003]; Gorton and Rouwenhorst [2006]), not so much on spot returns, which are much more volatile. The consistency and persistence of roll-returns come from the fact that the shape of commodity forward curves is primarily driven by fundamental factors that tend to adjust slowly over time.

According to these elements, it is therefore interesting to investigate how a strategy aiming at isolating this roll-return (i.e. neutralizing the spot return) would behave.

HEDGING SPOT RETURNS BY TARGETING CORRELATED COMMODITIES

The term-structure of commodity futures is shaped by the interaction of interest rates, fundamental factors such as inventory and seasonality as well as by the diversity of market participants (producers often seek to hedge on longer maturities while consumers or processors

usually hedge their purchases over shorter horizons). As previously explained, this forward curve provides a consistent source of return but expected roll-returns can be hurt by violent spot price moves. In order to reduce this spot price risk, it makes sense theoretically to take long and short positions within sub-groups of highly correlated commodities. Indeed, the hedging of spot returns made possible by the concomitant buying and selling of correlated commodities should result in the monetization of the difference in roll-yields generated by a long position entered on a more backwardated (or less contangoed) curve and a short position entered on a less backwardated (or more contangoed) curve. In other words, doing so should make it possible to capture the carry differential (provided the term structure remains stable) between the targeted commodities and therefore to extract a "purer" curve premium.

In order to test this hypothesis, we create groups of correlated commodities (see Exhibit 1). Within each of these sub-groups, long positions will be entered on commodities exhibiting the highest level of backwardation and short positions will be entered on those exhibiting the highest level of contango. 2 pairs will be selected from the industrial metals complex as this group includes 5 commodities. As a result, the strategy will be long 8 commodities and short 8 commodities. The created basket will be equally weighted and leveraged twice (long 100% - short 100%).

If all commodities in a given group are in backwardation (contango), the strategy will go long the most backwardated (least contangoed) commodity and short the least backwardated (most contangoed) commodity.

EXHIBIT 1. COMMODITY SUB-GROUPS

Name	Commodities included	Average correlation
Cattles	CME Live Cattle CME Feeder Cattle	0.7718
Crude Oils	ICE Brent NYMEX WTI Crude	0.8161
Distillates	NYMEX RBOB Gasoline ICE Gas Oil NYMEX Heating Oil	0.7510
Industrial metals	LME Aluminum LME Copper LME Lead LME Nickel LME Zinc	0.7835
Soybeans	CBOT Soybean CBOT Soybean Oil	0.6414
Sugar	LIFFE Sugar #5 CME Sugar #11	0.7728
Wheat	KCBT Kansas Wheat CBOT Wheat MGEX Spring Wheat	0.9366

Note: correlations computed on monthly observations over the period ranging from February 28th 2002 to August 29th 2014.

For each commodity, the degree of backwardation/contango (denoted Y_t) is measured between the first nearby contract and the contract one year ahead, using the following formula:

$$Y_t = \left[\log P_{t,n} - \log P_{t,d}\right] \times \frac{365}{N_{t,d} - N_{t,n}} \quad (1)$$

where $P_{t,n}$ is the price of the nearby contract at time t, $P_{t,d}$ is the price of the distant contract, $N_{t,n}$ is the number of days between time *t* and the maturity of the nearby contract and $N_{t,d}$ is the number of days between time *t* and the maturity of the distant contract. According to this equation, a negative Y_t will imply a contangoed term structure while a positive Y_t will imply a backwardated term structure. Using the one-year ahead contract instead of a closer one allows to reduce seasonality bias often encountered in some commodities. The strategy will be invested on nearby commodity rolled indices which are described in the next section.

DATA SET

Futures market data are obtained from Datastream and span the period ranging from January 28th 2002 to September 15th 2014. It consists of closing prices for nearby contracts as well as distant contracts (one year ahead) for the 19 commodities already presented. The commodities series are constructed using the S&P GSCI roll schedule and positions are rolled over 5 days from the 5th to the 9th business day of each month (20% each day). The strategy performances reported in this paper will be excess return performances, i.e. collateral returns will not be taken into account.

Open Interest data used later in this study come from the CFTC Aggregated Commitment of Traders Report.

PERFORMANCE ANALYSIS

In order to assess the risk-adjusted returns of the back-tested strategies, we use the following multi-factor model - previously used by Fuertes et al. [2010]:

$$r_{s,t} = \alpha + \beta_1 BOND + \beta_2 EQUITY + \beta_3 MARKET + \varepsilon_{s,t} \quad (2)$$

where $r_{s,t}$ is the return of the strategy being examined, $BOND$, $EQUITY$, and $MARKET$ are the excess returns on the Lehman Aggregate US total return bond index, the S&P500 composite index and the S&P GSCI (Goldman Sachs Commodity Index) respectively and $\varepsilon_{s,t}$ is an error term. Significant positive α would mean that performance is not just compensation for bearing some type of risk (passive return).

EXHIBIT 2. SUMMARY STATISTICS

	Monthly rebalancing		Bi-weekly rebalancing		Weekly rebalancing		Daily rebalancing	
	Roll strategy	TS strategy	Roll strategy	TS strategy	Roll strategy	TS strategy	Roll strategy	TS strategy
Annualized return	0.0673	0.0951	0.0654	0.1306	0.0698	0.1268	0.0683	0.1184
T-statistic	3.2582	1.8582	3.1406	2.3838	3.3882	2.3321	3.3095	2.1832
Annualized volatility	0.0709	0.1812	0.0715	0.1825	0.0706	0.1815	0.0707	0.1816
Sharpe ratio	0.9499	0.5247	0.9147	0.7156	0.9889	0.6988	0.9652	0.6517
5-day 95% VaR	-0.0144	-0.0393	-0.0148	-0.0392	-0.0142	-0.0386	-0.0147	-0.0388
Skewness	-0.1166	0.0079	-0.1544	-0.0536	-0.1339	-0.0260	-0.1054	-0.0830
Excess Kurtosis	1.1197	0.7700	1.3852	0.9934	1.5110	0.8990	1.3170	0.9731
Best month	0.0688	0.1504	0.0679	0.1578	0.0696	0.1498	0.0708	0.1608
Worst month	-0.0607	-0.1076	-0.0613	-0.1262	-0.0653	-0.1050	-0.0640	-0.1055
Maximum drawdown	-0.1314	-0.2800	-0.1697	-0.2606	-0.1753	-0.2891	-0.1778	-0.2746
% positive months	58.94%	54.30%	63.58%	58.28%	64.90%	58.28%	60.26%	56.95%
Turnover p.a.	17.1665	16.4879	24.0513	21.9298	31.4351	27.6946	53.7702	42.1996

EXHIBIT 3. RISK-ADJUSTED PERFORMANCE

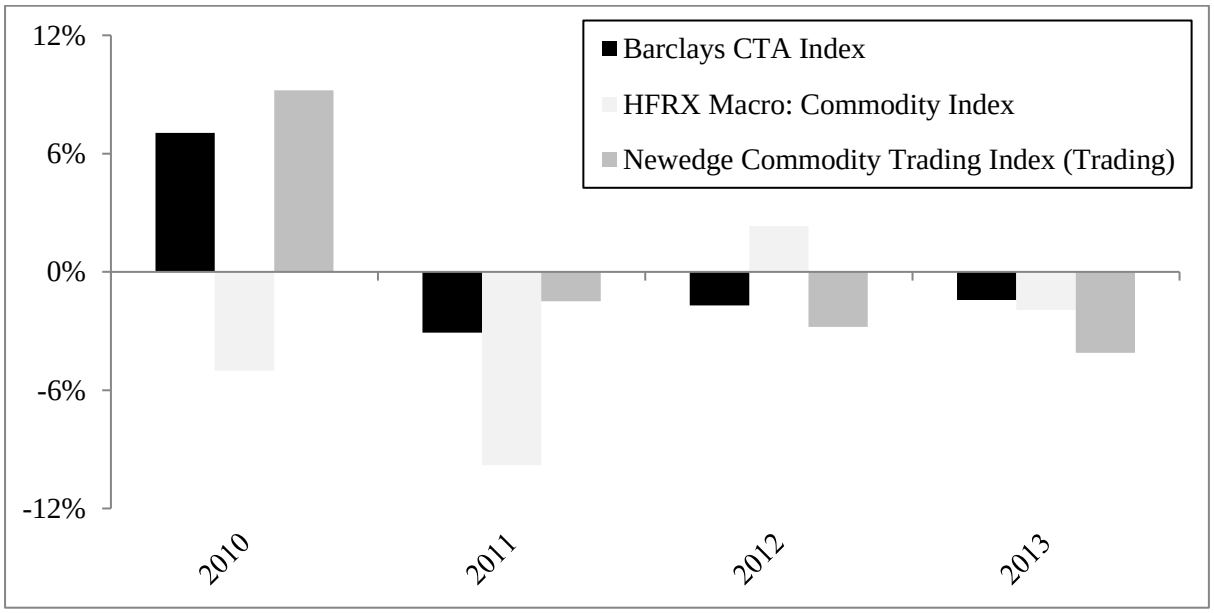
	Monthly rebalancing		Bi-weekly rebalancing		Weekly rebalancing		Daily rebalancing	
	Roll strategy	TS strategy	Roll strategy	TS strategy	Roll strategy	TS strategy	Roll strategy	TS strategy
Annualized α	**0.0664**	0.0803	**0.0654**	**0.1246**	**0.0690**	**0.1220**	**0.0668**	**0.1141**
	(3.310)	(1.5826)	(3.2337)	(2.4331)	(3.4583)	(2.3909)	(3.3405)	(2.2337)
$BOND$	-0.0342	-0.0045	-0.0597	0.0030	-0.0515	-0.0189	-0.0307	-0.0158
	(-1.0310)	(-0.0541)	(-1.7836)	(0.0349)	(-1.5606)	(-0.2236)	(-0.9271)	(-0.1865)
$EQUITY$	0.0005	**-0.0737**	0.0034	**-0.0823**	0.0110	**-0.0776**	0.0110	**-0.0702**
	(0.0722)	(-4.3233)	(0.5029)	(-4.7800)	(1.6446)	(-4.5212)	(1.6365)	(-4.0873)
$MARKET$	0.0008	**0.1122**	0.0016	**0.0943**	-0.0018	**0.0790**	0.0009	**0.0793**
	(0.1475)	(8.0717)	(0.2802)	(6.7163)	(-0.3357)	(5.6508)	(0.1640)	(5.6658)

Note: The table reports coefficients estimates for equation (2). Significance t-ratios are in parentheses. Bold denotes significance at the 5% level or better.

For robustness purposes, we test four versions of the strategy (denoted roll strategy) featuring monthly, bi-weekly, weekly and daily rebalancing respectively. For each frequency, we also create simple Term Structure strategies (denoted TS strategy), simply buying the 8 most backwardated commodities and selling the 8 most contangoed commodities. Rebalancing occurs the last day of the month for the monthly rebalanced strategy, every two Friday for the bi-weekly version, every Friday for the weekly-rebalanced version and every day for the daily-rebalanced version.

Exhibit 2 reports summary statistics for these various strategies. We can see that regardless of the rebalancing frequency the roll strategy systematically yields higher Sharpe ratios than the classic TS strategies. This is explained by the much lower volatility obtained as a result of partially neutralizing spot price movements.

EXHIBIT 4. PERFORMANCE OF CTA INDICES FROM 2010 TO 2013



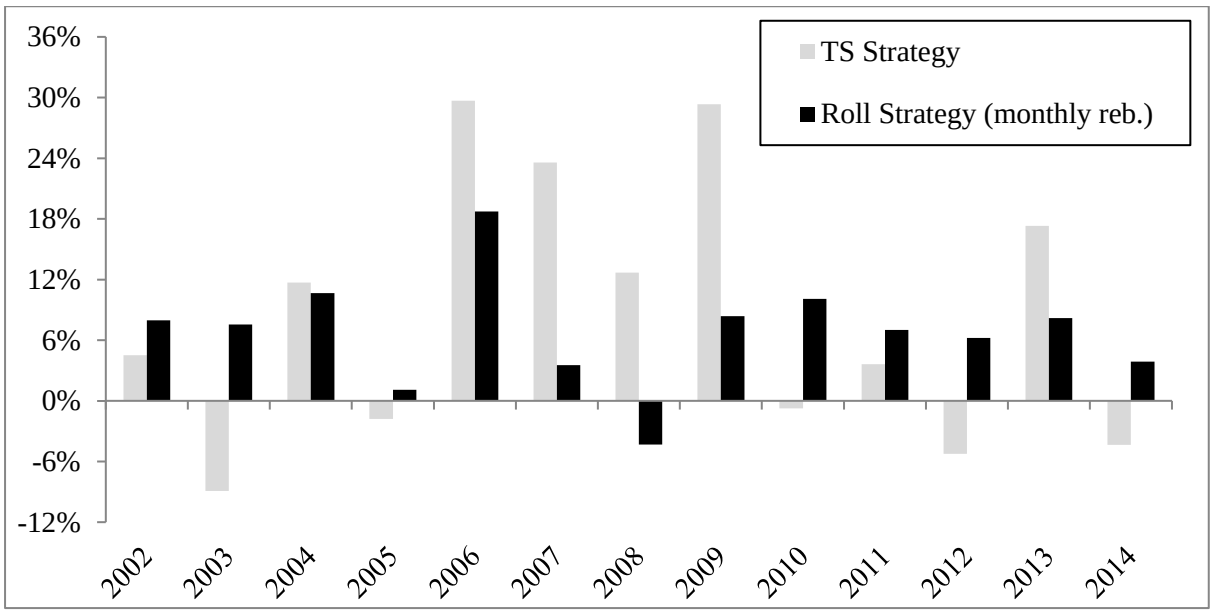
Sources: BarclayHedge, HFRX, Newedge

The roll strategies also feature much lower maximum drawdowns compared with classic TS strategies and the proportion of positive months is systematically higher for the roll strategies (61.92% on average compared with 56.95% for the traditional TS strategies). The lowest maximum drawdown is achieved by the monthly rebalanced roll strategy (-13.14%) and the

average maximum drawdown for the four rebalancing frequencies is -16.36%, much lower than the average figure for the four classic TS strategies (-27.61%).

This leads to much more consistent returns over time as can be seen on Exhibit 5. Annualized returns for the roll strategy are much more stable than for the classic TS strategy, even during the recent period in which many commodities strategies have achieved disappointing performances (Exhibit 4). Over the period studied, the strategy only posted one negative annual return (in 2008).

EXHIBIT 5. YEARLY ANNUALIZED RETURNS FROM FEB-02 TO SEP-14



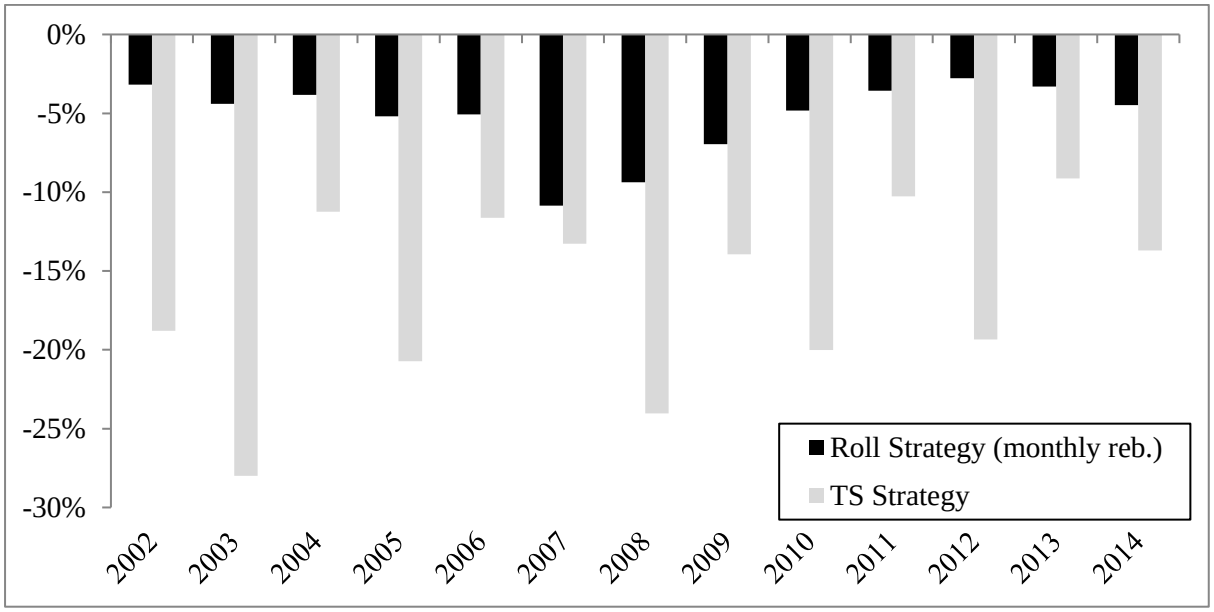
The comparison is even more staggering when we look at maximum drawdown figures (Exhibit 6). As mentioned in the introducing paragraph, we see that targeting roll-yield differentials allows to greatly reduce drawdowns compared with a classic term-structure strategy. This can be easily explained by the market neutral nature of the strategy as opposed to the directional nature of the classic term-structure strategy.

Exhibit 3 shows the coefficient estimates resulting from equation (2). For the classic TS strategies, we can see that coefficients related to the S&P GSCI are always positive and statistically significant, which is in line with the results of previous studies. Coefficients associated with the equity market are also significant but negative for the classic TS strategies.

We can also emphasize that returns of the classic TS strategies are not related to the bond market. Finally, their alphas are positive and usually significant.

If we turn our attention to the roll strategies, we notice that their alphas are all positive and significant. On average, they earn an annualized gross alpha of 6.69%. More importantly, none of the other coefficients are statistically significant, implying that the performance of these strategies is not mere compensation for bearing equity, bond or commodity risks. In other words, the performance of the roll strategy does not come from passive exposure to traditional risk factors or "Betas" but instead results from the active features of the strategy.

EXHIBIT 6. YEARLY MAXIMUM DRAWDOWNS FROM FEB-02 TO SEP-14



The results presented above are gross of transaction costs but these have been shown to be small (Locke and Venkatesh [2007]), especially for liquid futures as those used in our strategy. Even if we pick the high-range estimate of Locke and Ventakesh (0.033%) and use the strategy annual turnovers reported in Exhibit 2, the average annualized alpha stands at 5.65% (penalized by the very high turnover of the daily-rebalanced strategy).

Exhibit 7 reports the Pearson correlation coefficients between the returns of the back-tested strategies and those of traditional asset classes. Overall, correlations with T-bills, bonds, stocks and the US dollar index are either very low or non-significant. In line with the results of

previous research, the returns of classic TS strategies are significantly correlated with those of the S&P GSCI (average correlation of 9.67%).

EXHIBIT 7. RETURN CORRELATIONS BETWEEN BACK-TESTED STRATEGIES AND TRADITIONAL ASSET CLASSES

	T-Bill	LAB index	S&P 500	S&P GSCI	USD Index
Monthly Roll Strategy	**0.0127**	-0.0195	0.0081	0.0058	**-0.0122**
	(2.5422)	(-0.6670)	(0.3086)	(0.6033)	(-3.002)
Biweekly Roll Strategy	**0.0044**	-0.0367	0.0213	0.0124	**0.0022**
	(2.4300)	(-0.5802)	(0.2793)	(0.5779)	(2.9533)
Weekly Roll Strategy	**0.0001**	-0.0379	0.0388	0.0066	**0.0029**
	(2.6681)	(-0.7626)	(0.3500)	(0.6362)	(3.1050)
Daily Roll Strategy	**-0.0043**	-0.0274	0.0377	0.0142	**0.0048**
	(-2.5909)	(-0.7040)	(0.3263)	(0.6174)	(3.0589)
Absolute average	0.0054	0.0304	0.0265	0.0097	0.0055
Monthly TS Strategy	0.0025	0.0044	-0.0406	**0.1252**	-0.0208
	(1.2578)	(0.5528)	(-0.4105)	(2.7036)	(-1.8758)
Biweekly TS Strategy	**0.0138**	0.0124	-0.0568	**0.0979**	**-0.0082**
	(2.106)	(1.3890)	(-0.9635)	(2.2374)	(-2.6517)
Weekly TS Strategy	**0.0182**	0.0090	-0.0560	**0.0805**	**-0.0059**
	(2.0526)	(1.3317)	(-0.9240)	(2.1876)	(-2.6073)
Daily TS Strategy	0.0076	0.0067	-0.0479	**0.0830**	**-0.0117**
	(1.9037)	(1.1860)	(-0.8312)	(2.0959)	(-2.4667)
Absolute average	0.0150	0.0081	0.0503	0.0967	0.0117

Note: Significance t-ratios are in parentheses. Bold denotes significance at the 5% level or better.

As suggested by Fuertes et al. [2010], this positive relationship between traditional TS strategies and the S&P GSCI is probably due to the relatively high weighting of energy commodities within this index (approximately 70%), associated with the fact that these commodities are often long picks in term-structure based strategies because of their typically backwardated forward curves. However, we see that the correlation coefficients between the roll strategies and the S&P GSCI are not statistically significant, which is consistent with our risk-adjusted analysis.

EXPOSURE TO ALTERNATIVE RISK FACTORS

Given the low correlation usually observed between traditional assets and commodity futures (Bodie and Rosansky [1980]), the *BOND* and *EQUITY* factors previously used and which emanate from traditional asset pricing models may not be appropriate to assess the performance and our strategy. We thus build an alternative pricing model aimed at capturing

the fundamentals of the term structure based on the hedging pressure hypothesis (Cootner [1960]; Hirshleifer [1990]) and the theory of storage (Brennan [1958]). The proposed asset pricing model (Equation 3) includes benchmarks based on hedging pressure (Basu and Miffre [2013]) and on term structure (Erb and Harvey [2006]) in addition to the traditional factors (bond, equity and commodity markets).

$$r_{s,t} = \alpha + \beta_1 BOND + \beta_2 EQUITY + \beta_3 MARKET + \beta_4 CARRY + \beta_5 HEDGING + \varepsilon_{s,t} \quad (3)$$

where $r_{s,t}$ is the return of the strategy being examined, $MARKET$ stands for the excess return of the S&P GSCI (Goldman Sachs Commodity Index), $CARRY$ is the excess return of the classic TS strategy examined in the previous section (rebalanced monthly) and $HEDGING$ is the excess return of a monthly-rebalanced strategy that takes long and short positions on commodity futures based on the activity of *hedgers* (commercial participants) and *speculators* (non-commercial participants). More precisely, to compute this factor, we base our methodology on Basu and Miffre [2013] and use a double-sort:

1) First, we split the cross section of commodities - using a 50% breakpoint – into Low_{HP} and High_{HP} according to the average hedging pressure of *hedgers* over the past 4 weeks. According to Hirshleifer's hedging pressure theory [1990], contracts with *hedger*'s low hedging pressure are presumably backwardated (and their price is thus expected to increase) while those with *hedger*'s high hedging pressure are presumably contangoed (and their price is thus expected to decrease).
2) Then, we combine the positions of *hedgers* with those of *speculators* by buying the 30% of Low_{HP} for which *speculators* have the highest average hedging pressure over the previous 4 weeks and selling the 30% of High_{HP} for which *speculators* have the lowest average hedging pressure over the previous 4 weeks.

Hedging pressure for a category (commercial or non-commercial participant) is defined as the number of long open interest in that category divided by the total number of open interest in the category.

EXHIBIT 8. RISK-ADJUSTED PERFORMANCE (ALTERNATIVE FACTORS)

	Monthly rebalancing	Bi-weekly rebalancing	Weekly rebalancing	Daily rebalancing
	Roll Strategy	Roll Strategy	Roll Strategy	Roll Strategy
Annualized α	**0.0585**	**0.0582**	**0.0617**	**0.0596**
	(3.0178)	(2.9645)	(3.1860)	(3.0639)
$BOND$	-0.0360	0.0622	-0.0538	0.0321
	(-1.1211)	(1.5125)	(-1.6786)	(0.9972)
$EQUITY$	0.0077	0.0100	0.0178	0.0176
	(1.8462)	(1.5035)	(2.7227)	(1.6905)
$MARKET$	-0.0360	0.0004	0.0041	0.0037
	(-0.5872)	(0.0674)	(0.6736)	(0.6116)
$CARRY$	**0.0994**	**0.0905**	**0.0929**	**0.0911**
	(14.5848)	(13.0958)	(13.6557)	(13.3218)
$HEDGING$	**0.0205**	**0.0273**	**0.0247**	**0.0169**
	(2.4058)	(3.1600)	(2.9079)	(1.9794)
R^2	0.0667	0.0576	0.0621	0.0572

Note: Significance t-ratios are in parentheses. Bold denotes significance at the 5% level or better.

We can see from Exhibit 8 that the coefficients associated with the CARRY and HEDGING factors are both statistically significant, implying our strategy performance results partially from exposure to classic term-structure and hedging pressure risk premia. That being said, exposure to these factors explains only a very small part of the strategy returns and alpha remains significant with annualized values ranging from 5.82% to 6.17%.

SENSITIVITY TO ALTERNATIVE YIELD MEASURE

As explained in a previous section, we computed term-structure's degree of backwardation/contango using the first nearby contract and the contract one-year ahead in order to avoid seasonality bias encountered in some commodities. For the sake of robustness, we now examine what performance the strategy would yield if the degree of backwardation/contango were computed using the annualized slope between the first and second nearby contracts. This alternative strategy specification (denoted Roll Strategy Alt.) leads to slightly different results (Exhibit 9).

EXHIBIT 9. SUMMARY STATISTICS (ALTERNATIVE YIELD MEASURE)

	Monthly rebalancing	Bi-weekly rebalancing	Weekly rebalancing	Daily rebalancing
	Roll Strategy Alt.	Roll Strategy Alt.	Roll Strategy Alt.	Roll Strategy Alt.
Annualized return	0.0746	0.0691	0.0739	0.0716
T-statistic	2.7910	2.1349	2.7880	2.6706
Annualized volatility	0.0871	0.0848	0.0839	0.0949
Sharpe ratio	0.8565	0.8149	0.8808	0.8433
5-day 95% VaR	-0.0169	-0.0176	-0.0172	-0.0180
Skewness	0.4761	0.5033	0.4241	0.4306
Excess Kurtosis	6.4730	8.4291	4.9976	5.1334
Best month	0.0940	0.0691	0.0690	0.0995
Worst month	-0.0566	-0.0489	-0.0543	-0.0482
Maximum drawdown	-0.1615	-0.1814	-0.1897	-0.1880
% positive months	60.93%	58.94%	56.29%	58.28%
Turnover p.a.	18.3939	25.2553	34.4945	57.4904

Overall, annualized mean returns are higher, ranging from 6.91% to 7.46%. However, this comes at the cost of a higher level of volatility (8.77% on average compared with 7.09% for the strategy using one-year measures). This increased variability leads to slightly lower Sharpe ratios (ranging from 0.81 to 0.88). Maximum drawdown figures are also higher on average even though they remain much lower than for classic TS strategies.

EXHIBIT 10. RISK-ADJUSTED PERFORMANCE (ALTERNATIVE YIELD MEASURE)

	Monthly rebalancing	Bi-weekly rebalancing	Weekly rebalancing	Daily rebalancing
	Roll Strategy Alt.	Roll Strategy Alt.	Roll Strategy Alt.	Roll Strategy Alt.
Annualized α	**0.0581**	**0.0440**	**0.0552**	**0.0532**
	(2.2807)	(2.0241)	(2.1991)	(2.0880)
$BOND$	0.0103	0.0354	0.0408	0.0318
	(0.2446)	(0.8403)	(0.9834)	(0.7550)
$EQUITY$	0.0158	0.0180	0.0215	0.0197
	(1.8462)	(1.7671)	(1.5485)	(1.2985)
$MARKET$	**0.0279**	**0.0270**	**0.0232**	**0.0303**
	(3.5161)	(3.4025)	(2.9639)	(3.8191)
$CARRY$	**0.1690**	**0.1516**	**0.1573**	**0.1525**
	(19.4923)	(17.4964)	(18.4191)	(17.6144)
$HEDGING$	**0.0259**	**0.0315**	**0.0333**	**0.0386**
	(2.3032)	(2.8110)	(3.0113)	(3.4371)
R^2	0.1183	0.1003	0.1091	0.1036

Note: Significance t-ratios are in parentheses Bold denotes significance at the 5% level or better.

Turning to the risk-adjusted performance analysis (Exhibit 10), we notice that the strategy still generates consistent alpha (from 4.40% to 5.81%). Interestingly, the $MARKET$ factor becomes significant, indicating some degree of exposure to the broad commodity market. The

coefficients associated with the $CARRY$ factor are higher than when using one-year ahead contracts, indicating a higher exposure to the term-structure risk premium. Finally, the $HEDGING$ factor remains significant.

To sum up, using the annualized slope between the first and second nearby contracts to build the strategy (i.e. not accounting for seasonality) leads to slightly lower risk-adjusted performance by moderately increasing volatility, adding some degree of exposure to the commodity market and increasing exposure to the classic term-structure premium. However, exposure to examined risk premia remains very low and the strategy still generates significant alpha.

CONCLUDING REMARKS

This paper introduces a new way to systematically invest in commodity futures and provides risk and performance analysis. Building on the fact that buying backwardated commodities and selling contangoed commodities generates abnormal returns over the long run, we modify the strategy in order to reduce its sensitivity to spot price movements. We do so by targeting roll-yield differentials between highly correlated commodities i.e. buying the most backwardated/least contangoed one(s) and selling the most contangoed/least backwardated one(s) within these sub-groups and we compare the performance of this strategy with a classic term-structure strategy. We test for various rebalancing frequencies and show that this approach creates significant alpha and greatly improves Sharpe ratios. More importantly, the strategy returns are not related to either the commodity, equity or bond markets, resulting in a strategy that is truly market neutral. Moreover, the alpha generated does not result from passive exposure to term-structure or hedging-pressure based benchmarks.

In addition, the performance of the strategy appears to be remarkably stable even during the recent past. This point is worth emphasizing as the majority of commodity based strategies have suffered during this period.

These findings are of particular interest for asset managers since they offer insights into new ways of diversifying a portfolio and generating consistent alpha irrespective of broad market moves, especially at a time when the merits of holding a commodity exposure within an asset portfolio has been challenged. Overall, it improves our knowledge of commodity futures returns.

ENDNOTE

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