Harvesting Commodity Styles: A Flexible Integration Framework

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The authors develop a flexible investment framework that nests standalone styles and integrations thereof and can be applied in a long-short, long- or short-only fashion to any asset class in zero net supply. Motivated by the unsettled debate on how to best model commodity risk premia, the usefulness of integration is demonstrated in the context of a "universe" of eleven long-short commodity styles. The results confirm the superiority of the equal-weights integration (EWI) portfolios vis-à-vis each of the standalone-style portfolios in terms of the reward-to-risk and crash risk profiles. The naïve EWI is not challenged by sophisticated integrations with time-varying, heterogeneous style weights based on past returns according to utility maximization, principal components or style-rotation among other criteria. The findings hold after trading costs, variants of the sophisticated integrations, sub-period analysis and data snooping tests.

Introduction

The literature on commodity futures pricing has established that investment strategies that acknowledge the phases of backwardation and contango are able to capture sizeable risk premium. Accordingly, since the backwardation (contango) phase signals a subsequent rise (fall) in futures prices, three commodity futures investment styles have been proposed that buy at each portfolio formation time, respectively, the commodities with the most downward sloping forward curves (Erb and Harvey, 2006), the best past performance (Miffre and Rallis, 2007), the highest net-short hedging and net-long speculators ratios (Dewally *et al*., 2013), and sell the commodities with opposite values for those signals. Aside from these "traditional" styles, the literature also suggests styles based on liquidity, change in open interest, inflation beta, dollar beta, value, volatility or skewness signals (Hong and Yogo, 2012; Asness *et al*., 2013; Szymanowska *et al*., 2014; Fernandez-Perez *et al*., 2018).

This paper is concerned with *style integration*. The authors develop a flexible investment framework that nests standalone styles and integrations thereof. Among the style-integration methods considered, some of them have already been studied in the literature (which has focused mainly on equity markets) whereas others are novel integrations. First, the proposed integration framework is general enough to accommodate long-short, long- and short-only portfolios for any asset class in zero net supply. Second, given the host of long-short commodity futures styles available to capture risk premia and the dearth of research on commodity style integration, the paper fills a gap by providing a comprehensive analysis to

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assess from the dual perspective of reward-risk trade-off and crash risk, including i) the benefits of commodity style integration versus standalone style investing, and ii) the effectiveness of various integration methods.

Why the Paper's Research Question is Important

Research over the last few years has found that a number of factors can explain return performance in commodity futures, but an exhaustive analysis of how to gain exposure to all these factors in a portfolio has not been provided. Improving the return profile through mixing styles is, in fact, the critical issue for many commodity investors. This paper fills this gap by developing an integration framework that can assist practitioners towards easily constructing long-short, long- or short-only commodity portfolios with simultaneous exposure to several commodity styles. The investment framework is flexible enough to facilitate style integration of any asset class in zero net supply. The integration of 11 styles in this paper for a cross-section of 28 commodity futures contracts using a host of integration approaches is an important investment management exercise for anyone who wants to blend commodity risk factors within a portfolio. The integration framework is also relevant for academics because it facilitates a structured approach towards developing new integration approaches and towards a more theoretical investigation of their relative strengths and weaknesses.

Methodology: A Flexible Framework for Asset Allocation

The decisions at portfolio formation time *t* about the relative wealth to allocate to each asset and the nature of the position, long versus short, are represented by the $N \times 1$ *asset-weighting* (or asset allocation) vector $\boldsymbol{\phi_t}$ defined as

$$\boldsymbol{\phi_t} \equiv \boldsymbol{\Theta_t} \times \boldsymbol{\omega_t} = \begin{pmatrix} \theta_{1,1,t} & \cdots & \theta_{1,K,t} \\ \vdots & \ddots & \vdots \\ \theta_{N,1,t} & \cdots & \theta_{N,K,t} \end{pmatrix} \begin{pmatrix} \omega_{1,t} \\ \vdots \\ \omega_{K,t} \end{pmatrix} = \begin{pmatrix} \phi_{1,t} \\ \vdots \\ \phi_{N,t} \end{pmatrix} \quad (1)$$

where $\boldsymbol{\Theta_t}$ is the $N \times K$ *score* matrix (*N* is the number of assets and *K* the number of styles) and $\boldsymbol{\omega_t}$ is the $K \times 1$ *signal- (or style) weighting* vector. The sign of the *i*th asset allocation weight $\phi_{i,t}$ dictates the type of position (long or short); long positions are characterized by $\phi_{i,t}^{L} \equiv \phi_{i,t} > 0$, and short positions as $\phi_{i,t}^{S} \equiv \phi_{i,t} < 0$. Given the focus of the paper on long-short styles, the entry $\theta_{i,k,t}$ of the matrix $\boldsymbol{\Theta_t}$ is a ternary score assigned to asset *i* according to the *k*th signal, i.e. scores $\theta_{i,k,t} \in \{-1,0,1\}$ which means that 1 is assigned to the quintile of assets (20%*N*) whose prices are expected to increase the most (or to decrease the least), -1 is assigned to the 20%*N* assets whose prices are expected to increase the least (decrease the most) and 0 to all other assets.

The weight $\omega_{k,t}$ reflects the relative importance given to the *k*th individual investment style (or factor) in the integrated portfolio. In the trading exercise, we assume that the investor's mandate is fully invested at each portfolio formation time *t*. For this purpose, the asset allocation weights are normalized so that, in absolute value, they sum to 1; namely, $\sum_{i=1}^{N} |\tilde{\phi}_{i,t}| = 1$ with $\tilde{\phi}_{i,t} = \phi_{i,t} / \sum_{i=1}^{N} |\phi_{i,t}|$. The fully-collateralized long-short integrated portfolio thus constructed at month-end *t* according to the asset

allocation weights $\tilde{\phi}_{i,t}, i = 1, \dots, N$ is held for one month to provide the excess return $r_{LS,t+1} = \sum_{i=1}^{N} \tilde{\phi}_{i,t} r_{i,t+1} = \sum_i \tilde{\phi}_{i,t}^{L} r_{i,t+1} - \sum_j |\tilde{\phi}_{j,t}^{S}| r_{j,t+1}$ where $r_{i,t+1} \equiv ln \frac{P_{i,t+1}}{P_{i,t}}$ is the *i*th asset return. With the ternary scoring scheme $\theta_{i,k,t} = \{-1,0,1\}$ the above normalization implies that $\sum_i \tilde{\phi}_{i,t}^{L} = 0.5$ and $\sum_j \tilde{\phi}_{j,t}^{S} = -0.5$; that is, 50% of the investor's mandate is allocated into long positions and the remaining 50% of her mandate into short positions.

Results

The authors illustrate the integration framework for K=11 commodity styles that exploit as trading signals, respectively, the roll-yield, hedgers' net short positions, speculators' net long positions, momentum, value, volatility, open interest, liquidity, US$ betas, inflation betas and skewness. The standalone and integrated long-short portfolios are constructed using 28 commodity futures contracts from January 1992 to April 2016.

The naïve EWI strategy (with time-constant, homogeneous exposure to the *K* styles, *i.e.*, $\boldsymbol{\omega_t} = \left(\frac{1}{K}, \dots, \frac{1}{K}\right)'$) outperforms each of the individual styles in terms of risk-reward profile and crash risk measures (e.g., downside volatilities, 99% Value-at-Risks and maximum drawdowns). This finding confirms the diversification benefits of style integration. Another key result is that the risk-reward and crash risk profiles of the unsophisticated integrated portfolios (i.e., those formed according to the naïve EWI approach) are not challenged by those of any of the sophisticated integrated portfolios (i.e., those formed according to time-varying, heterogeneous sample-based weights).

Why Does the Unsophisticated Equal-Weighted-Integration Excel?

In essence, a key finding of the paper is that "less is more" in terms of the sophistication of the integration method. A rationale for this result is that albeit the sophisticated integration approaches can discriminate better among the *K* styles (given that they allow time-varying, heterogeneous exposures to the different styles), this potential advantage is contaminated by two sources of *uncertainty*. On the one hand, a finite sample of *past* returns (for each of the individual styles) is used by the sophisticated integrations to obtain the style weights at each portfolio formation time – this implies estimation error. On the other hand, past performance is not a guarantee for future performance; namely, the fact that the *k*th style outperformed the *j*th style in the past window preceding time *t* according to some criteria (which will be reflected as $\omega_{k,t} > \omega_{j,t}$ in the sophisticated integration) does not imply that it will do so subsequently.

In particular, the naïve EWI approach is appealing because: i) it does not suffer from estimation error, ii) it reduces the scope for data mining because by fixing the style exposures (or signal weights) at $\frac{1}{K}$ the investor does not need to carry out a "pre-ranking" of the *K* individual styles which, depending on the underlying integration criteria, may hinge on *ad-hoc* choices to determine the weights (e.g., length of past window, investor's utility assumptions, and so forth), and iii) it is easy to implement.

Conclusions

A large number of factor models have been suggested to explain returns in commodity markets, but to date there have been no attempts at integrating all of them in a single portfolio structure. The simple motivation for style integration is to more reliably identify the commodities with the most (least) attractive expected returns. This paper undertakes this task by integrating a "universe" of 11 commodity styles; some of these are classics across all asset classes like carry, value and momentum, but a number of them are more specific to commodities. A key issue that this paper investigates, which is true for any asset class, is how to blend the factors. The authors offer a structured approach to commodity investors that seek exposure to multiple styles, formalizing a flexible framework that accommodates a host of integration methods and nests all the standalone styles as particular cases. The framework is flexible enough to be applicable in a long-short, long- or short-only fashion for any asset class in zero net supply. Their conclusion is simple and straight-forward – by equally weighting all styles constantly over time, you will get a more attractive return-to-risk portfolio than by focusing on one style only or integrating more styles in a more sophisticated fashion.

Endnotes

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Keywords

Style integration, commodity markets, long-short investment, asset allocation, portfolio choice.