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Momentum and mean-reversion in commodity spot and futures markets ☆

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ABSTRACT

We study momentum and mean-reversion strategies in commodity futures prices and their relationship to momentum and mean-reversion in commodity spot prices. We find that momentum performs well in futures markets, but not in spot markets, and that mean-reversion performs well in spot markets, but not in futures markets. A decomposition of the basis (the slope of the term-structure of futures prices) into expected risk premiums and expected changes in spot prices helps us shed some light on the different results across the futures and spot markets. Most interestingly, we find that momentum in futures prices cannot be explained by a sustained trend in spot prices.

Momentum and mean-reversion—also referred to as value—are two of the most popular equity investment strategies in the market today. Because they are simple to implement and have a track record of strong positive performance across asset classes, they have attracted the attention of commodity investors and researchers over the past decade. Interestingly, researchers have found that using commodity futures, momentum strategies consistently perform well, but mean-reversion strategies disappoint, leading Miffre and Rallis (2007) to conclude that "none of the contrarian strategies is profitable."[1]

We investigate the reasons for the success of momentum strategies and the disappointing results of mean-reversion strategies when executed in the commodity futures markets. Further, we attempt to relate the performance of these two strategies to the performance of similar strategies implemented in the spot markets.

In the first part of the paper we investigate momentum and mean-reversion in commodity *spot* prices using two independent datasets containing a total of 46 commodities

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[1] Early examples of momentum strategies using commodity futures are analyzed by Erb and Harvey (2006), Miffre and Rallis (2007), and Shen et al. (2007). Mean-reversion strategies are studied by Miffre and Rallis (2007) and Asness, Moskowitz, and Pedersen (2013).

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and starting in 1946. Surprisingly, our results using commodity spot prices are the opposite of those in the literature on commodity futures prices. We find strong evidence of mean-reversion in spot prices using both recent spot returns over horizons of one to five years and a valuation measure based on past prices. We find no evidence of momentum in spot prices, except perhaps at very short horizons of one to three months and due mostly to seasonal effects.

In the second part of the paper we investigate momentum and mean-reversion in commodity *futures* prices using a dataset containing 27 commodities and starting in 1965. Fama and French (1987) show that the slope of the term-structure of futures contracts—also known as the basis—can be decomposed into two terms containing information about (a) expected risk premiums and (b) expected changes in spot prices. The mechanism through which price adjustments occur in order to reflect these expectations is relatively simple. Imagine that a particular commodity is relatively risky. Then, a futures contract on that commodity needs to offer a price discount (i.e., a return premium), driving up its basis. Alternatively, if market participants expect its spot price to fall over time, they would reduce the price of a futures contract on that commodity, increasing its basis and eliminating any arbitrage opportunities.

We use Fama and French (1987)'s decomposition to shed some light on the disappointing profitability of mean-reversion strategies and the surprising profitability of momentum strategies, both constructed using commodity futures. First, using Fama-MacBeth regressions we show that 20% of the cross-sectional variation in the basis can be attributed to *positive* cross-sectional differences in expected risk premiums, while the remaining 80% can attributed to *negative* cross-sectional differences in expectations about changes in spot prices. For instance, consider that a futures contract on commodity A has a basis of 50 bps and a futures contract on commodity B has a basis of 40 bps. By going $1 long in the contract on A and $1 short in the contract on B, we build a portfolio with a basis of 10 bps. Our results show that, on average, the excess return on this portfolio is 2 bps (the contract on A outperforms the contract on B by 2 bps) and the spot return differential between the two commodities is −8 bps (the spot price of commodity A underperforms the spot price of commodity B by 8 bps).

Second, we calculate the basis of momentum and mean-reversion strategies and investigate their subsequent excess returns and changes in spot price. We find that mean-reversion strategies in futures markets perform poorly because futures prices correctly embed an expectation that spot prices will mean-revert. In other words, mean-reversion strategies earn strong spot returns, as expected given our results using spot prices, but they have equally strong and offsetting bases—i.e., initial price discounts—resulting in futures returns that are close to zero.

Perhaps more interestingly, we find that the strong performance of momentum strategies in futures markets cannot be attributed to sustained trends in spot prices. Futures contracts continue to outperform after a recent strong performance, but not because the spot prices of the underlying commodities outperform. Instead, they outperform because they have higher bases—more discounted futures prices—to begin with.

We provide two potential explanations for the existence of a significantly positive basis in momentum strategies. The first explanation is that the positive basis might indicate a risk premium attributable to the theory of storage and differences in inventories, as suggested by Gorton, Hayashi, and Rouwenhorst (2013). If the positive basis reflects a risk premium it should go away when the risk premium disappears. However, we find no evidence of this relationship in the data. Instead, we find that the performance of momentum strategies is short-lived and disappears after 2–3 months, while the positive basis remains strong, casting doubt on this risk-based explanation.

The second explanation has a behavioral nature and relies on the overreaction of market participants. According to it, the positive basis might exist because market participants see the strong recent 12-month performance and, aware of the mean-reversion in spot prices, set futures prices lower in expectation of declining spot prices. Alas, the mean-reversion happens only slowly—possibly due to the seasonality present in some markets—creating a temporary outperformance. Obviously this explanation suffers from the same criticism as other behavioral theories in that market participants should learn over time and adjust their biases.

One important observation is that our results focus mostly on *cross-sectional* price patterns, i.e., on the relative prices of a group of commodities versus another group of commodities. We hypothesize that the literature has focused on cross-sectional strategies for multiple reasons. First, empirical cross-sectional tests tend to have more statistical power. Second, they are easier to translate into trading strategies that can be exploited in practice by investors. Third, these cross-sectional strategies usually display better performance. We do confirm our findings with *time-series* tests—how the price of a particular commodity varies over time—but those are relatively less powerful.

The remainder of the paper proceeds as follows. In Section 1 we present the basis decomposition from Fama and French (1987) and show how it can be tested using Fama-MacBeth regressions. In Section 2 we describe the different datasets we use and how the variables are constructed. Section 3 presents the results for momentum and mean-reversion strategies. In Section 4 we present some robustness checks. Section 5 concludes.

1. The basis and market expectations

Fama and French (1987) separate the different theories of commodity futures prices into two groups. The first group relates to the theory of storage and explains the difference between spot prices and futures prices, also known as the basis, to interest rates, warehousing costs

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