Long-Run Reversal in Commodity Returns: Insights from Seven Centuries of Evidence

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This study examines the long-term reversal effect in commodity spot markets using seven centuries of data. The research is the longest study of the long-term reversal effect covering 52 agricultural, industrial and energy markets from 1265 to 2017 employing U.K.- and U.S.-based commodity prices. Returns over the previous one-to-three years negatively predict subsequent performance in the cross-section of returns. The long-run reversal effect is strong and robust after surviving a variety of robustness checks. The effect cannot be explained by statistical biases, extreme events, or macroeconomic risks. The study reveals that the long-run reversal effect is driven by supply-and-demand adjustments in physical commodities through time.

Introduction

This paper examines one of the most documented anomalies in financial markets, which is the long-run reversal effect. The phenomenon known as the long-run reversal originates from De Bondt and Thaler (1985), which is the tendency for prices with high (low) returns to underperform (outperform) in the future. This effect has been studied in various asset classes including stocks, bonds, stock indexes, and currencies (Blackburn and Cakici, 2017; Khang and King, 2004; Balvers *et al*., 2000; Ahmed *et al*., 2018; Zaremba and Umutlu, 2018; Chan, 2013; Lubnau and Todorova, 2015). Furthermore, this phenomenon has also been studied in commodity spot and futures markets in recent decades (Andersson, 2007; Miffre and Rallis, 2007; Bianchi *et al*., 2015; Chaves and Viswanathan, 2016; Levine *et al*., 2018; Yang *et al*., 2018). This study extends the literature because it evaluates the long-run reversal effect on annual commodity spot prices using a data sample of more than seven centuries. The research is unique as it is the longest analysis of the long-run reversal effect to date in any asset class or investment type. The paper answers three questions, namely: (1) is the reversal effect observable in commodity spot prices? (2) what are its sources? and (3) what drives its variation through time?

The long-term nature of this study allows researchers to determine whether the long-run reversal effect is a modern aberration from data-snooping methods or whether this pattern in prices genuinely exists over long periods of time. Furthermore, the long sample period allows researchers to evaluate whether the long-run reversal effect has diminished over time due to the effects of market efficiency, investor learning, or other factors.

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The study shows a strong and significant long-run reversal effect in commodity returns across all seven centuries of data. Commodity returns over the past one-to-three years negatively predict future performance in the cross-section. A quintile spread portfolio of long (short) commodities with the highest (lowest) return during the past three years reports a mean annual return of -13.07% with a corresponding *t*-statistic of -18.81. The researchers emphasize that investors are unable to "short" a portfolio of physical commodities across seven centuries; however, these calculations are designed to identify the presence of the long-run reversal phenomenon in commodity markets. The key finding is the long-run reversal effect is very strong and statistically significant in commodity spot returns.

Data

The dataset employed in the study comprises of 52 commodity spot prices from the Global Financial Data (GFD) database, consisting of 753 annual observations from 1265 to 2017. A large majority of commodity prices originates from England, and then the study employs United States (U.S.) commodity prices when they are available. The sample of commodities consists of 29 agricultural, 17 industrial markets, and 6 energy markets. Monthly or daily data were unavailable for this long sample period; thus, the study employs the last closing price of every market for each year. All commodity prices and returns are expressed in U.S. dollars. The GBP/USD exchange rate data commences in 1660, and the authors chose to use this conversion rate for data prior to this period in time.

One potential data limitation that may affect the study is survivorship bias. This study mitigates this effect by including commodities that were traded and utilized in the past (for example, coal gas). The study employs various tests including cross-sectional regressions and portfolio sorts; however, the overall findings and conclusions remain the same. As a further check, the study examines inflation-adjusted commodity prices using both U.K. and U.S. consumer price indexes and the findings are qualitatively similar. The study does not employ futures markets in the main analysis due to the unavailability of daily or monthly data during this multi-century time period.

Methodology

Two primary frameworks are employed to estimate the long-term reversal effect, namely, cross-sectional regressions and portfolio single sorts. First, cross-sectional regressions are estimated with the total returns of commodities in current/future years as the dependent variable and total returns of commodities in the past one-year to six-years as the independent variables. Second, portfolio sorts are constructed with single sorts on past returns to verify the key findings. The portfolio sort methodology ranks all commodities on their past cumulative one-, two-, or three-year returns and constructs equal-weighted quintile portfolios. Then, spread portfolios are constructed to estimate the difference in returns between the highest and lowest quintile portfolio returns. The researchers acknowledge that for practical purposes, a short portfolio of perishable physical commodities (such as eggs or milk) is unrealistic; however, the portfolio-sort methodology provides a picture of the return patterns in these commodity markets over time.

Key Results

The cross-sectional regressions report statistically significant negative slope coefficients, which signify that past long-run returns negatively predict future performance. Put another way, high (low) returns in the past one-to-six years are related to low (high) performance in the subsequent one to four years. These patterns of returns hold for both raw and risk-adjusted returns. The *t*-statistics are significant and very large in many regression specifications.

The analysis of the portfolio single sorts show that commodities with the highest past returns significantly underperform the commodities with the lowest past returns on both a raw and risk-adjusted basis. The High-Low portfolio formed on past one-year returns report an average annual return of -8.55% (-8.89) on a raw and risk-adjusted basis with the associated *t*-statistics of -18.81 (-18.86), respectively. A more significant result is the High-Low portfolio formed on past three-year return reports an average annual excess return of -13.07% (-13.14%) on a raw (risk-adjusted) basis with corresponding *t*-statistics of -18.81 (-18.86), respectively. The results of the portfolio sorts demonstrate a strong, significant and robust long-run reversal effect.

The main findings show that commodities with high (low) returns during the past one-to-three years tend to under (out)perform in the future, which supports the presence of the long-run reversal effect. The robustness of the results are checked by calculating the sub-period analysis of the long-term reversal effect across each of the seven centuries in the data. The findings show that the long-term reversal effect is strong and significant in all seven centuries in the entire data sample.

Potential Sources of the Long-Run Reversal Effect

With the long-run reversal effect established in commodities, the next step is to understand the source of this effect and why we can observe this phenomenon in commodity spot markets. The finance and economics literature has developed a number of theories to explain the long-run reversal effect. This study considers five competing explanations that relate to commodity markets and the long-term data sample that is available for analysis. The researchers examine the possibility of (i) data snooping, (ii) data quality, (iii) exposure to macroeconomic risks, (iv) the effects from war, diseases, volcanic activity, and anomalous temperatures over the centuries, and finally, (v) supply/demand adjustments as possible sources to explain the phenomenon. Various regression analyses show that all of these explanations fail to explain the long-run reversal effect with the exception of supply-and-demand adjustments.

Supply-and-Demand Adjustments as the Source of the Long-Run Reversal

The study considers the time variation in demand, supply and inventories as the main driver of the long-run reversal effect in physical commodity prices. The hypothesis suggests that when prices increase above the cost of production, it is likely that producers experience higher profits and are more willing to increase their output of the respective commodity. This increase in the supply of a commodity is generally followed by commodity prices declining to a lower equilibrium price. Conversely, when prices decrease below the cost of production, commodity producers face losses and are willing to reduce or cease production. A period of reduced supply is generally followed by price increases.

Four analyses are performed to explain how supply-and-demand adjustments drive the long-run reversal effect in commodities. First, a return decomposition was performed using the approach from Conrad and Kaul (1998). This decomposition shows that a large proportion of the reversal profits stem from the autocovariance in individual commodity returns. This finding suggests that the mean reversion of individual commodity prices is the source of the long-run reversal effect and supports the supply/demand adjustment hypothesis.

The second analysis examines the supply elasticity of commodities. The long-run reversal effect is expected to be more (less) observed in commodities with elastic (inelastic) supply as producers have the capacity to more easily increase or decrease output. Agricultural commodities are expected to exhibit a stronger elasticity in comparison to non-agricultural markets as the long-term reversal effect was notably stronger in agricultural markets. To quantify this effect, the researchers calculate the speed of reversion by estimating a first-order autoregressive model. The findings show that the speed of reversion (*i.e.,* elasticity) is strongest in agricultural markets in comparison to the remainder of the commodity market universe.

The third analysis considers whether economic forces and technological advances over seven centuries have developed to overcome imbalances in the demand and supply of commodities through time. Over centuries, transportation, storage, import and export systems have improved to alleviate commodity shortages or surpluses, and thus, more easily adapt to demand or supply adjustments. If this hypothesis holds, one can expect to see the behavior of price reversion to decline over time from the Middle Ages to the modern times of today. The researchers employ an AR(1) model to calculate a rolling 100-year regression coefficient for each commodity. The researchers find this regression coefficient is unstable through time; however, it decreases in absolute terms over time. Put simply, demand-and-supply imbalances have moderated from the commencement to the end of the seven century sample period. This finding provides further support for the notion of the supply-and-demand adjustment hypothesis. Technical advances and trade improvements have resulted in the AR(1) regression coefficient decreasing over time which suggests that modern trade practices in commodity markets have reduced supply-and-demand imbalances, thereby resulting in a weaker reversion effect through time.

The fourth analysis compares the reversal effect in both physical spot commodity markets and futures markets. The researchers consider whether the source of the long-run reversal effect originates from the physical spot markets or in the futures derivative markets. To disentangle this effect, a sorting analysis is performed which reveals that the long-run reversal is stronger in physical spot markets than in futures contracts. Furthermore, the reversal effect in spot returns subsumes the same behavior in futures markets; however, the reversal effect in futures markets does not subsume the effect in physical markets. This finding suggests the long-run reversal effect originates from commodity spot markets, and therefore, this further supports the supply/demand adjustment hypothesis in physical commodity prices.

Conclusion

The study examined the long-run reversal effect in commodities over seven centuries, which is the longest study of its kind. The paper analyzed the annual returns of 52 commodity spot markets for the period of 1265-2017. The paper found a strong long-run reversal effect, which was statistically significant using

both cross-sectional regressions and portfolio single sort analyses. The research finds that supply-and-demand adjustments through time explain the source in the behavior of the long-run reversal effect. This research contributes to our current knowledge and understanding of implementing contrarian strategies in commodity markets.

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