

# SMM Quantitative Trading Strategy

| Contract    |                      | Arbitrage Type  |
|-------------|----------------------|-----------------|
| Non-Ferrous | SHFE Copper          | Inter-Commodity |
|             | SHFE Aluminum        | None            |
|             | SHFE Lead            | None            |
|             | SHFE Zinc            | Inter-Commodity |
|             | SHFE Nickel          | None            |
| Ferrous     | SHFE Steel Rebar     | Inter-Commodity |
|             | SHFE Hot-rolled coil | Inter-Commodity |
|             | DCE Iron Ore         | None            |

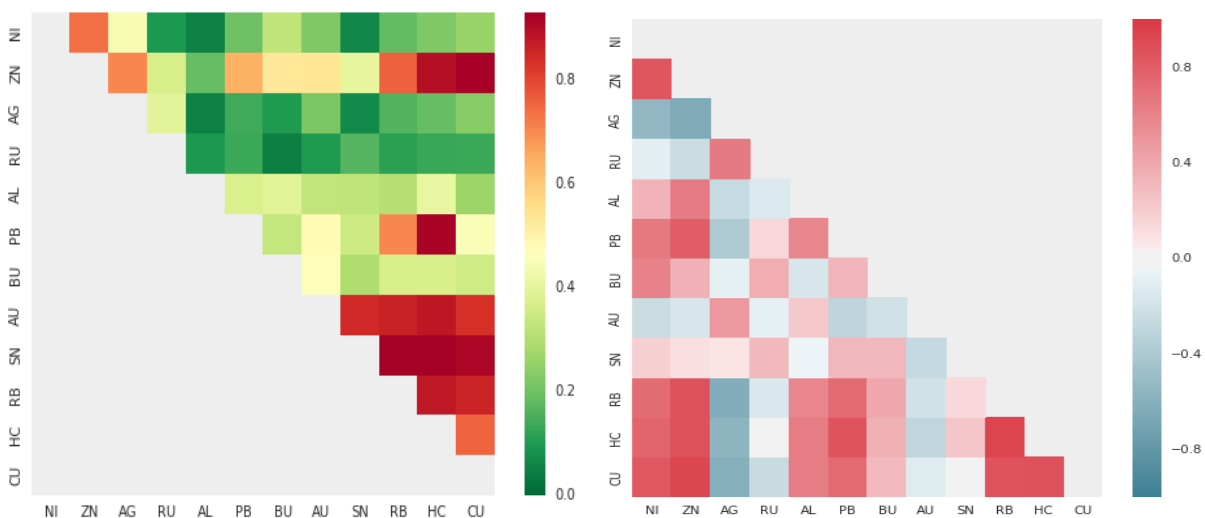
Source: SHFE, SMM

### Methodology:

In this report, we use the statistical arbitrage strategy to find the historically correlated underlying assets, the profitability of pairs trading is selected by using the co-integration method in China's commodity market over the period of 2017 to 2018.

### Co-integration Matrix

### Correlation Matrix:



Source: SMM

Note: Darker colors indicate higher correlation/co-integration

After applying the unit root test (in this case, the ADF method is applied) to identify the feasibility of the potential trading pairs, we choose the high-correlated pairs ( $\rho > 0.80$ ) as follows:

**Table1: Selected Correlation Matrix**

|    | CU     | ZN     | HC     | RB     | NI     | PB     |
|----|--------|--------|--------|--------|--------|--------|
| CU | 1.0000 | 0.9350 | 0.8687 | 0.8621 | 0.8427 | 0.7376 |
| ZN | 0.9350 | 1.0000 | 0.8814 | 0.8747 | 0.8462 | 0.8077 |
| HC | 0.8687 | 0.8814 | 1.0000 | 0.9378 | 0.7627 | 0.8647 |
| RB | 0.8621 | 0.8747 | 0.9378 | 1.0000 | 0.7338 | 0.7446 |
| NI | 0.8427 | 0.8462 | 0.7627 | 0.7338 | 1.0000 | 0.6583 |
| PB | 0.7376 | 0.8077 | 0.8647 | 0.7446 | 0.6583 | 1.0000 |

Source: SMM

We use linear regression to determine the integration equation (in mt).

After standardising the residuals series, we determine the long/short position of each portfolio as follows:

**Table2: Trading Pairs**

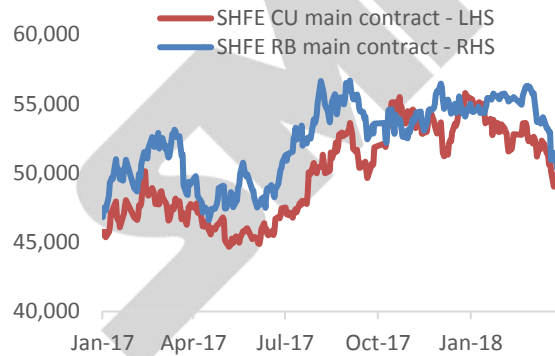
| Contract    | Trading Pair         | Portfolio         | Position |
|-------------|----------------------|-------------------|----------|
| SHFE Copper | SHFE Steel Rebar     | CU1805-8*RB1810   | Short    |
|             | SHFE Zinc            | 2*CU1805-3*ZN1805 | Long     |
| SHFE Zinc   | SHFE Hot-rolled Coil | ZN1805-4*HC1805   | Short    |

Source: SMM

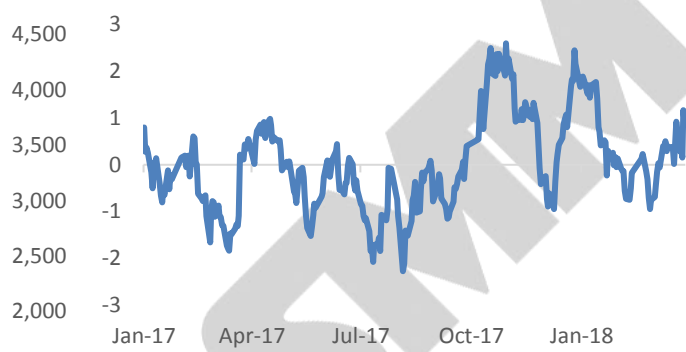
# SHFE Copper pair trading analysis

CU1805-8\*RB1810

## 1.SHFE Close Price(Yuan/mt)

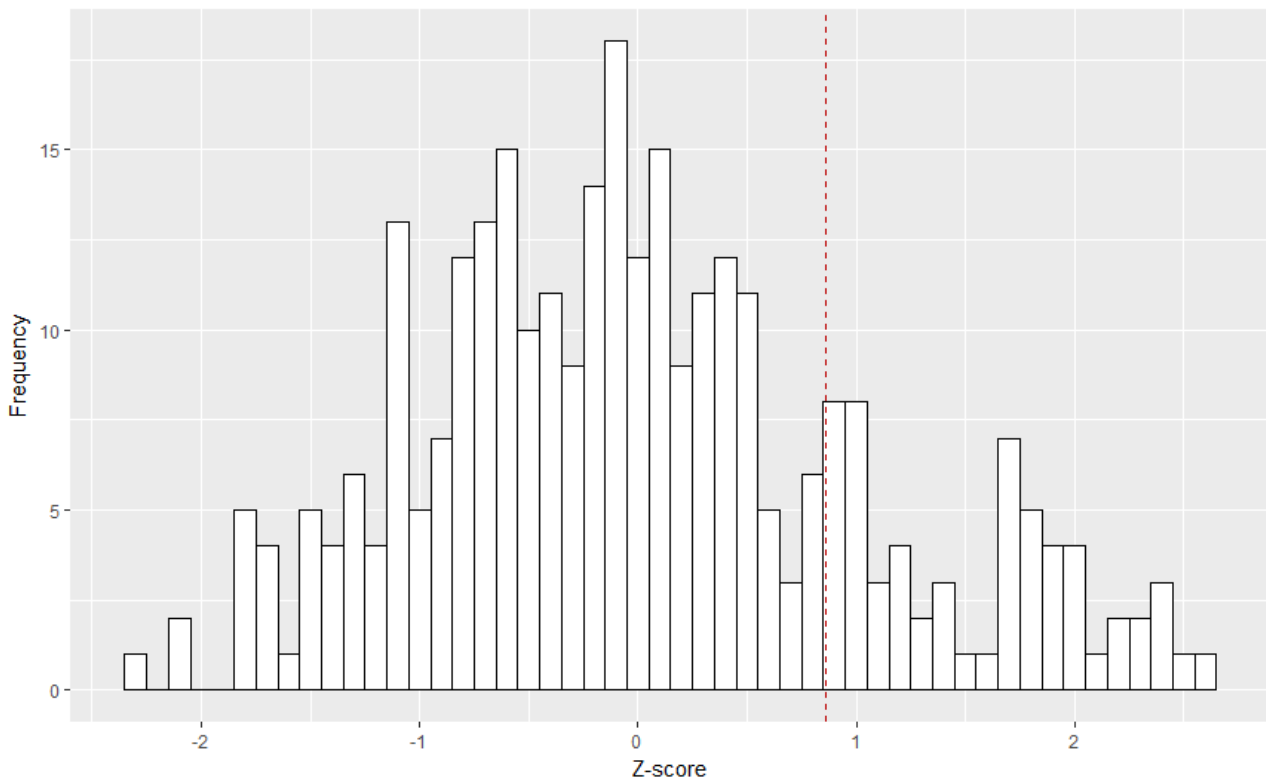


## 2.Residual Series



## 3.Histogram

### Z-score Analysis



Dash line: Current z-score by March 30,2018

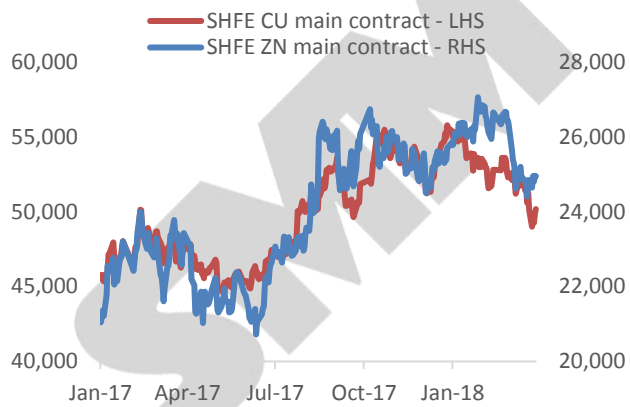
Source: SHFE, SMM

Statistical arbitrage analysis: By March 30,2018, the standardised residual of the corresponding portfolio CU1805-8\*RB1810 is 0.86 which is **higher than 81%** of the sample observed. **Thus, SMM forecasts the spread to revert to the previous mean.**

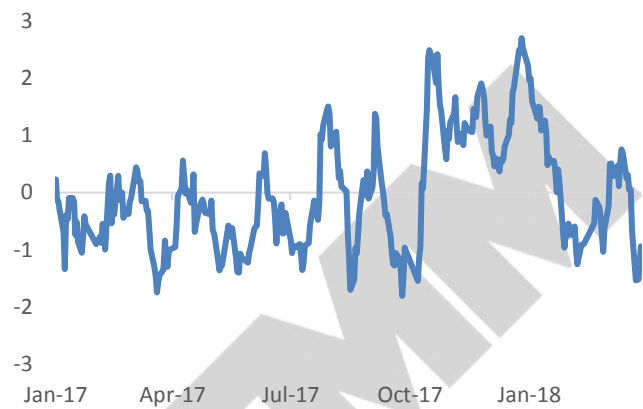
Recommended strategy: **Take the short position of the portfolio and close the position when the standardised residual close to zero.**

2\*CU1805-3\*ZN1805

**1.SHFE Close Price(Yuan/mt)**

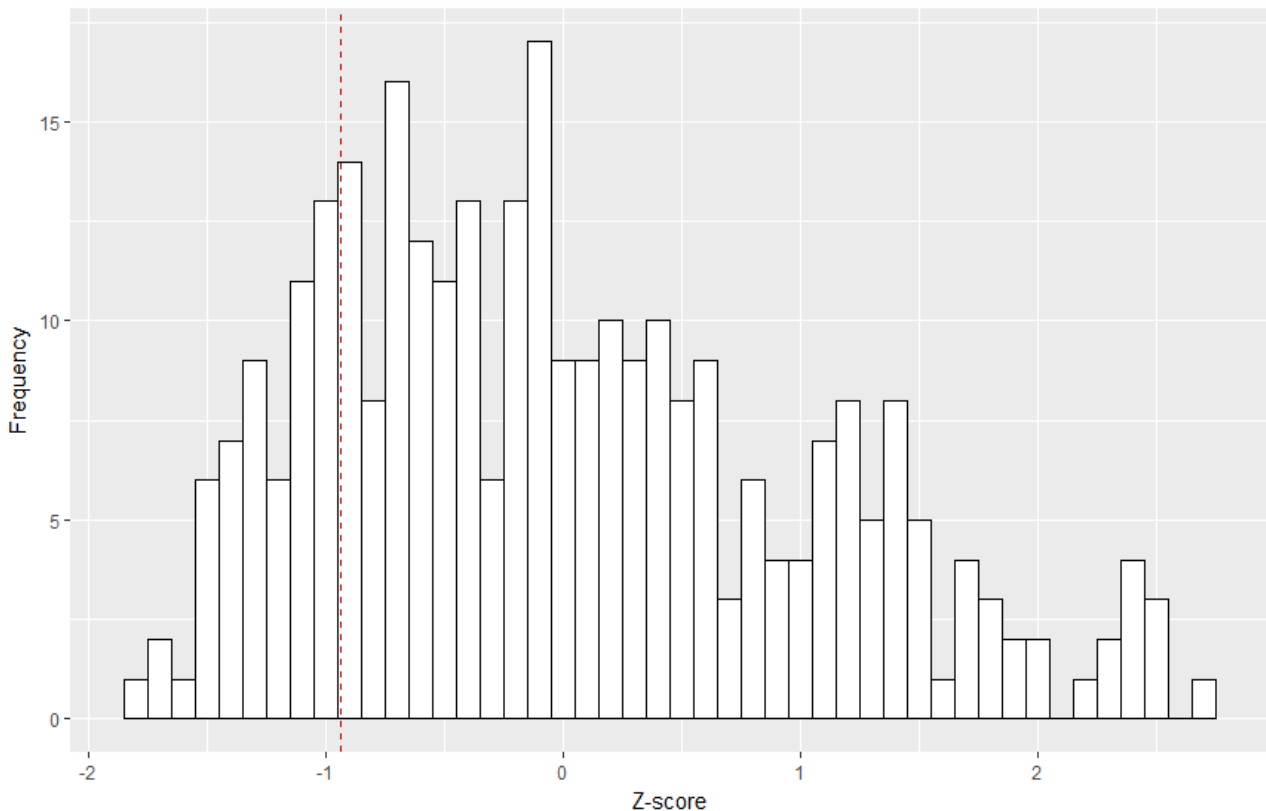


**2.Residual Series**



**3.Histogram**

**Z-score Analysis**



*Dash line: Current z-score by March 30,2018*

*Source: SHFE, SMM*

Statistical arbitrage analysis: By March 30,2018, the standardised residual of the corresponding portfolio 2\*CU1805-3\*ZN1805 is -0.94 which is **lower than 81%** of the sample observed. **Thus, SMM forecasts the spread to revert to the previous mean.**

Recommended strategy: **Take the long position of the portfolio and close the position when the standardised residual close to zero.**

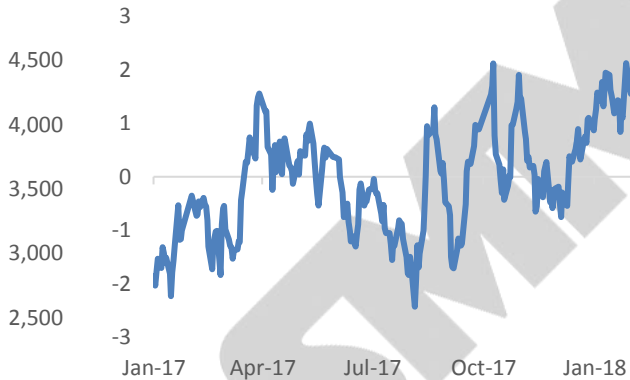
# SHFE Zinc pair trading analysis

ZN1805-4\*HC1805

## 1.SHFE Close Price(Yuan/mt)

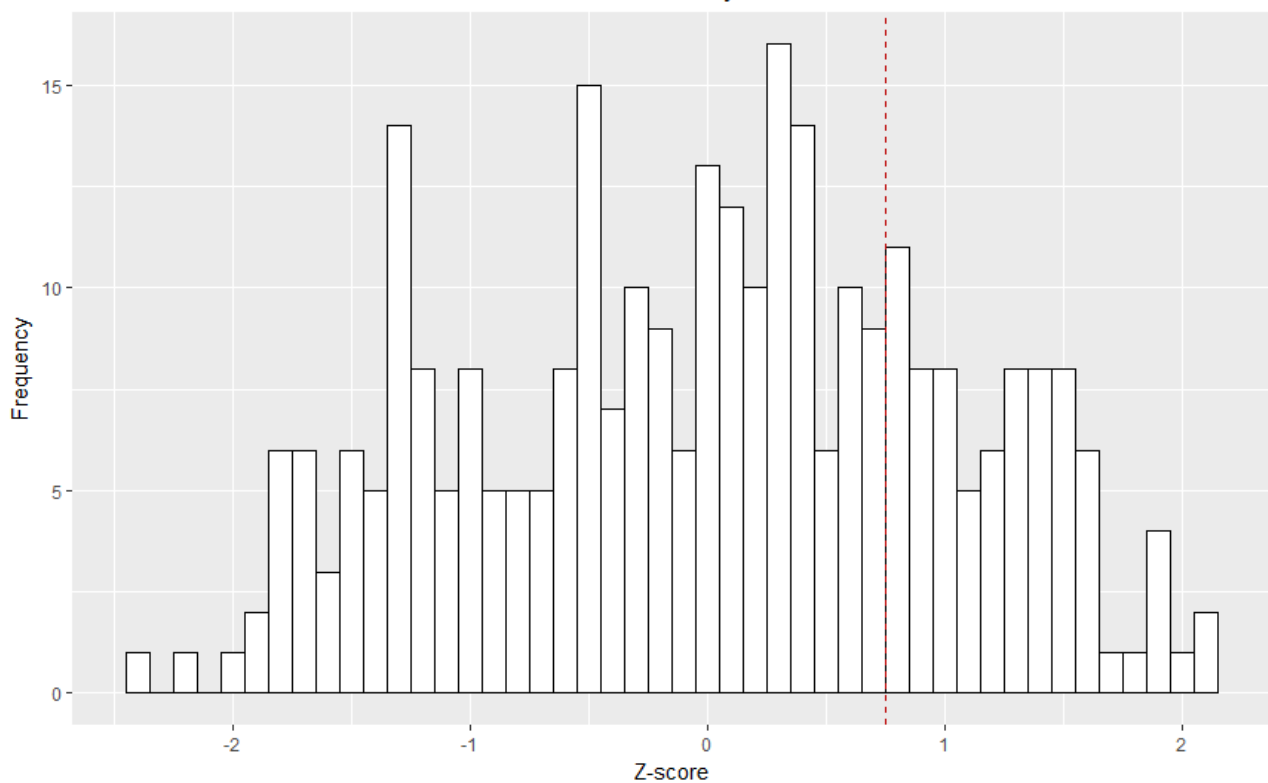


## 2.Residual Series



## 3.Histogram

### Z-score Analysis



Dash line: Current z-score by March 30,2018

Source: SHFE, SMM

Statistical arbitrage analysis: By March 30,2018, the standardised residual of the corresponding portfolio ZN1805-4\*HC1805 is 0.75 which is **higher than 78%** of the sample observed. **Thus, SMM forecasts the spread to revert to the previous mean.**

Recommended strategy: **Take the short position of the portfolio and close the position when the standardised residual close to zero.**

The information contained in this report is only as current as of the date indicated and may be superseded by subsequent market events or for other reasons. Neither the author nor SMM undertakes to advise you of any changes in the views expressed herein.

The views and opinions expressed in this report are not related to any specific trading strategy that SMM offers. It is being provided merely to provide a framework to assist in the implementation of an investor's own analysis and investor's own view on the topic discussed herein.

Past performance is no guarantee of future results.

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