

SMM Quantitative Trading Strategy

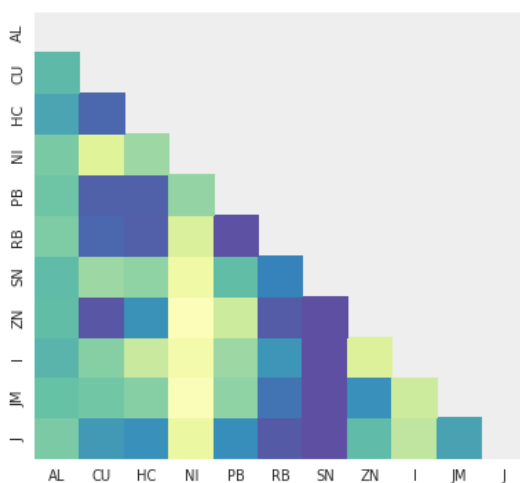
Contract	Arbitrage Type	
Non-Ferrous	SHFE Copper	Inter-Commodity
	SHFE Aluminum	None
	SHFE Lead	None
	SHFE Zinc	Inter-Commodity
	SHFE Nickel	None
Ferrous	SHFE Steel Rebar	None
	SHFE Hot-rolled coil	None
	DCE Iron Ore	None
	DCE Coke	None
	DCE Coking Coal	None
	ZCE Thermal Coal	None

Source: SHFE, SMM

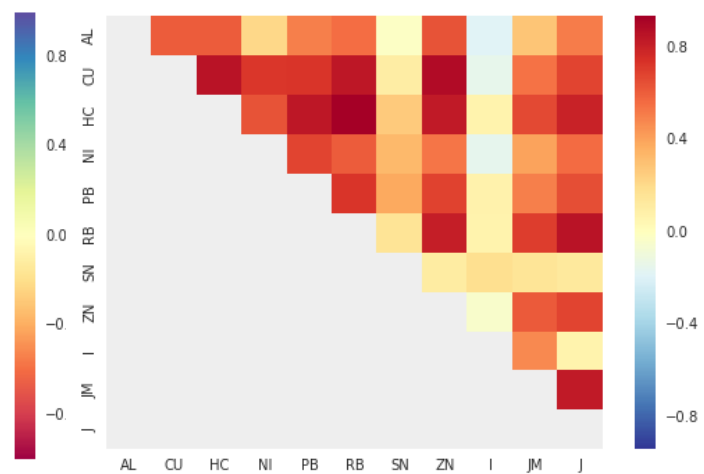
Methodology:

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

In this report, in order to select potential underlying assets for pairs trading, the two-stage correlation and cointegration approach was used. We choose the high-correlated pairs ($\rho > 0.80$) as follows:

Table1: Selected Correlation Matrix

	AL	CU	HC	NI	PB	RB	ZN	JM	J
AL	1.0000	0.6144	0.6083	0.2131	0.5105	0.5572	0.6430	0.2903	0.5196
CU	0.6144	1.0000	0.8620	0.7275	0.7342	0.8477	0.8901	0.5450	0.6825
HC	0.6083	0.8620	1.0000	0.6430	0.8477	0.9369	0.8339	0.6720	0.7993
NI	0.2131	0.7275	0.6430	1.0000	0.6859	0.6126	0.5399	0.4041	0.5675
PB	0.5105	0.7342	0.8477	0.6859	1.0000	0.7372	0.6953	0.5104	0.6579
RB	0.5572	0.8477	0.9369	0.6126	0.7372	1.0000	0.8176	0.7071	0.8572
ZN	0.6430	0.8901	0.8339	0.5399	0.6953	0.8176	1.0000	0.6215	0.6817
JM	0.2903	0.5450	0.6720	0.4041	0.5104	0.7071	0.6215	1.0000	0.8342
J	0.5196	0.6825	0.7993	0.5675	0.6579	0.8572	0.6817	0.8342	1.0000

Source: SMM

The second step is to apply the unit root test (in this case, the ADF method is applied) to identify the feasibility of the potential trading pairs, and then 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:

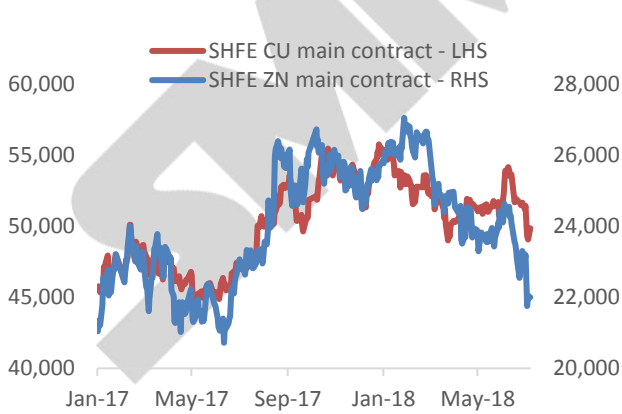
Table2: Trading Pairs

Contract	Trading Pair	Portfolio	Position
SHFE Copper	SHFE Zinc	CU1808-2*ZN1808	Short

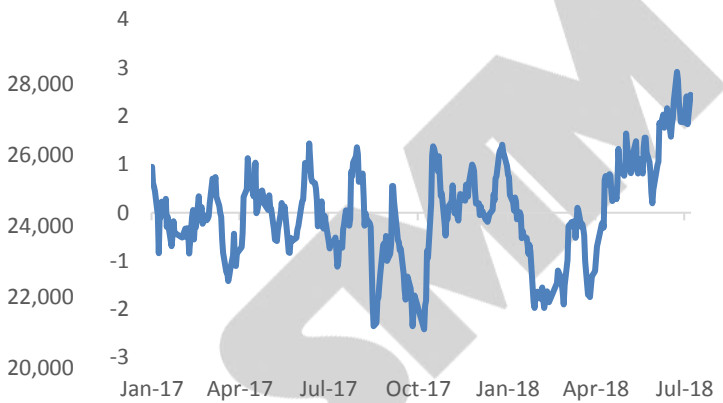
SHFE copper pair trading analysis

CU1808-2*ZN1808

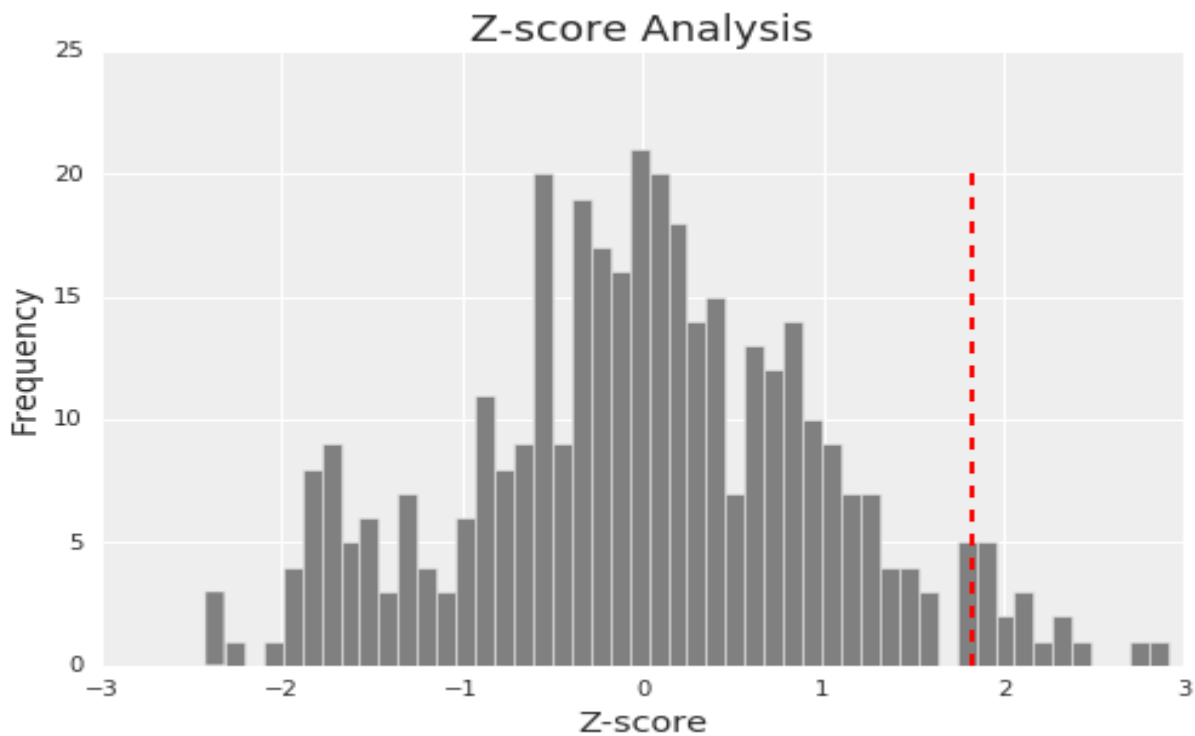
1.SHFE Close Price(Yuan/mt)



2.Residual Series



3.Histogram



Dash line: Current z-score by July 09,2018

Source: SHFE, SMM

Statistical arbitrage analysis: By July 09,2018, the standardised residual of the corresponding portfolio CU1808-2*ZN1808 is 1.83 which is **higher than 95.38%** 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.

For more information, please contact:

Email: service.en@smm.cn

Tel: +86 021-51550306