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The profitability of pairs trading strategies: distance, cointegration and copula methods

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Abstract

We perform an extensive and robust study of the performance of three different pairs trading strategies—the distance, cointegration and copula methods—on the entire US equity market from 1962 to 2014 with time-varying trading costs. For the cointegration and copula methods, we design a computationally efficient two-step pairs trading strategy. In terms of economic outcomes, the distance, cointegration and copula methods show a mean monthly excess return of 91, 85 and 43 bps (38, 33 and 5 bps) before transaction costs (after transaction costs), respectively. In terms of continued profitability, from 2009, the frequency of trading opportunities via the distance and cointegration methods is reduced considerably, whereas this frequency remains stable for the copula method. Further, the copula method shows better performance for its unconverged trades compared to those of the other methods. While the liquidity factor is negatively correlated to all strategies' returns, we find no evidence of their

correlation to market excess returns. All strategies show positive and significant alphas after accounting for various risk-factors. We also find that in addition to all strategies performing better during periods of significant volatility, the cointegration method is the superior strategy during turbulent market conditions.

Keywords:

Pairs trading | Copula | Cointegration | Quantitative strategies | Statistical arbitrage

JEL Classifications:

G11 | G12 | G14

Notes

No potential conflict of interest was reported by the authors.

1 In the last year of our study, 2014, there are an average of 2,377 stocks () per day, resulting in a total of 2,823,876 () unique stock pairs to be analysed for selection into the strategy. When restricted to a single core processor, the average computation time for selecting the best copula model and fit for each stock pair is 0.44 seconds. Thus, analysing all unique stock pairs on a single day requires a total of 345 h for a single core processor. Performing such an analysis within 5 h requires a minimum of 70 core processors using parallel computing techniques. Our analysis is performed on Matlab 2014b with the Parallel Computing toolbox on a compute server with dual Intel Xeon Processors E5-2640 (24 hyper-threaded cores, 30 MB Cache, Max 3.00 GHz) and 128 GBs of RAM.

2 Return on employed capital.

3 Unrestricted pairs are the pairs that have not been formed based on specific criteria such as belonging to the same industry.

4 Cointegration coefficient weighting refers to the method in which position weights are calculated as a function of the cointegration coefficient.

5 Month refers to the calender month.

6 This is set to 12 months to allow for consistency with the DM.

7 This is set to 6 months to allow for consistency with the DM.

8 The formation and trading periods are kept at 12 and 6 months, respectively, to be consistent with the distance and cointegration methods.

9 See Do and Faff (2012) section 3 for full details on commissions and market impact estimations.

10 Do and Faff (2010) report a similar monthly excess return of 0.90% before transaction costs.

11 The threshold value is also known as the minimum acceptable return where we use 0%.

12 For detailed explanation and calculation of lower partial moment measures, refer to Eling and Schuhmacher (2007).

13 For detailed explanation and calculation of drawdown measures, refer to Schuhmacher and Eling (2011).

14 Opening threshold refers to the cumulative mispriced indicies and , formulated in section 4.3.2. These indicies are calculated by accumulating the pairs' daily conditional probability, and .

15 This is a total of 11 out of 53 years consisting of 1969, 1972, 1973, 1977, 1981, 1983, 1987, 2000, 2001, 2007 and 2008.

Additional information

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