Portfolio Optimization for Cointelated Pairs: SDEs vs. Machine Learning

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We investigate the problem of dynamic portfolio optimization in a continuous-time, finite-horizon setting for a portfolio of two stocks and one risk-free asset. The stocks follow cointelation model introduced in [1]. The proposed optimization methods are twofold. In what we call an SDE approach, we compute the optimal weights using mean-variance criterion and power utility maximization. We show that dynamically switching between these two optimal strategies via introducing a triggering function can further improve the portfolio returns. We contract this with the machine learning clustering methodology inspired by the band-wise Gaussian mixture model. The first benefit of the machine learning over the SDE approach is that we were able to achieve the same results though a simpler channel. The second advantage is a flexibility to regime change. The easiest way to understand this is to take a look at the world of interest rates. Indeed up to 2014, it was assumed that interest rates could never become negative and a similar SDE approach would have enforced a Cox–Ingersoll–Ross (CIR) like model and would not have therefore been able to accommodate the regime change towards negative interest rates. These types of transitions are easy to handle for the machine learning methodology and the adaptation is almost immediate through, for example, a simple filtering process.

References

[1] Damghani, B.M., *The Non-Misleading Value of Inferred Correlation: an Introduction to the Cointelation Model* , Wilmott Magazine, Issue 67, (2013), 50-61.