

FRE-6971 Final Part 2 of 2, Spring 2022 (due 5/20/2022 at 8pm)

Your work for this final must be independent. Incomplete work is not a failure, but copying somebody else's work is.

Data:

'Constant_Maturity_ED.csv' in your class Resources contains constant-maturity Eurodollar rates. There are 20 time series in the file: 3m future, 6m future.... 5y futures rates on 3M LIBOR.

Historical samples:

1/1/2011 through 1/1/2014, Training Sample (A)

1/1/2014 through 1/1/2016, Cross-Validation Sample (B)

1/1/2016 through 1/1/2017, Testing Sample (C)

1. Use Sample A to compute 5 cointegrated pairs of futures rates: $[2y,3y]$, $[3y,4y]$, $[4y,5y]$, $[2y,4y]$, $[3y,5y]$
2. Use the same Sample A to construct the following:
 - a. AR(1) model fitted to each of the 5 cointegrated vectors (Signal 1)
 - b. AR(1) model fitted to each {cointegrated vector - EMA(λ)} (Signal 2)
<http://pandas.pydata.org/pandas-docs/stable/computation.html#exponentially-weighted-windows>
3. Compute half-lives for all signals. Pick λ to make sure that half-life of Signal 2 is ~ 5 days
4. EXTRA CREDIT: Signal 3 is a linear combination(mixture) of signals 1 & 2. Weight of the mixture, θ , is a hyper-parameter you can try to determine using Cross-Validation Sample B.
5. Choose a signal quality metric, and use Cross-Validation Sample B to select θ that is maximizing the quality of signal metric you chose. For simplicity, we will only use all the AR(1) estimations from the Training Sample A.
 - a. Signal quality metric will measure predictability of the forecast, $E[z(t+H)|t]$ for Signals 1,2,3 and all cointegrated pairs $z(t)$
 - b. H =Horizon; Use $H = 10$ days
 - c. Define $\alpha(t) = E[z(t+H)|t] - z(t)$. Is forecast predictability stronger for $|\alpha(t)| > 0.1$?
6. Run your signal quality analysis using a testing sample C. Break the test sample into 4 quarters, and see how your results evolve from quarter to quarter. Analyze all results.