Homework: Futures Spread Dynamics

Thursday 9th January, 2025

1 Introduction

Here we will practice obtaining data for spreads for two different pairs in futures markets, and characterizing their individual dynamics, as well as a little bit about the dynamics of the two spreads in relation to each other.

This is a data science assignment, designed to help you grow comfortable with the tools and data at our disposal in preparation for dealing with more quantitative finance related topics as the quarter progresses.

2 Data

Obtain second month quarterly [1] futures prices from the Quandl OWF database for two pair W, X; Y, Z (where W, X and Y and Z depend on your student ID number) for 3 Dec 2021 though 31 Aug 2024. Our definition of second month is the contact where the number of days to futures expiration is the smallest available value greater than 30[2].

Form the spreads $s_t^{(1)}, s_t^{(2)}$ between these numbers as the difference $s_t^{(1)} = X_t - W_t$ and $s_t^{(2)} = Z_t - Y_t$.

[1] Quarterly in this context means expiring in March, June, September, or December.

[2] In other words, for each date in the analysis date range, you have to grab all available futures contracts for that date. Then choose the one with lowest time to expiration so long as it is over 30 days. Note the OWF data set is not entirely fit for purpose and will sometimes be missing data for a futures contract just because the options have expired.

3 Analysis

Characterize the relative dynamics of $s_t^{(i)}$ in reasonable ways, using charts and statistics.

For example, you could compute the median and standard deviation of the difference $d_t^{(N)}$ between $s_t^{(i)}$ and an N-day rolling average of s_t for some values of N. Examine more quantiles than just the median. Look at tails. Consider some dynamics, for example do the spreads correlate? How about their difference (d) values? Do spreads exhibit patterns over time?

3.1 Data

Futures pairs W, X; Y, Z (in order) are as given by the last two distinct digits[3] of your student number as follows:

0. ICE_TFM_TFM versus NYM_NG_NG $\times$ 13.7261
1. ICE_B_B versus ICE_G_G $\times$ 0.1147
2. ICE_T_T versus ICE_G_G $\times$ 0.11
3. CBT_FV_FV versus CBT_TU_TU $\times$ 1.1066
4. CBT_FV_FV versus CBT_TY_TY $\times$ 0.9338
5. CBT_FV_FV versus CBT_US_US $\times$ 0.7595
6. CBT_TU_TU versus CBT_TY_TY $\times$ 0.8445
7. CBT_TU_TU versus CBT_US_US $\times$ 0.6873
8. NYM_RB_RB versus ICE_G_G $\times$ 0.0033
9. NYX_EMA_EMA versus CBT_C_C $\times$ 0.4362

The final number is a multiplier you should apply to X or Z before computing the spreads s.

When downloading from Quandl, you have to use the years and the quarterly codes (H, M, U, Z) individually, there is no facility for Quandl to combine them itself.

[3]So, if your student ID ends in 6222 then use 6 and 2.

Examples of s_t on various dates that you should be matching in your own data are as follows:

- CBT_FV_FV versus CBT_TU_TU
  - 2021-11-25 0.156306
  - 2021-11-26 -0.181877
- CBT_FV_FV versus CBT_TY_TY
  - 2021-11-19 0.586075
  - 2021-11-23 -0.647106
  - 2021-11-26 0.560350
- CBT_FV_FV versus CBT_US_US
  - 2021-11-19 1.271594
  - 2021-11-24 -0.658906
  - 2021-11-26 1.274656
- CBT_TU_TU versus CBT_TY_TY
  - 2021-11-19 0.859875
  - 2021-11-24 -0.498039
  - 2021-11-29 0.616266
- CBT_TU_TU versus CBT_US_US
  - 2021-11-18 0.968594
  - 2021-11-24 -0.584031
  - 2021-11-26 1.471644
- CBT_W_W versus NYX_T_T
  - (unused)
- ICE_B_B versus ICE_G_G
  - 2021-09-28 -2.676675

  - 2021-09-29 0.038750
  - 2021-11-10 -0.077950
- ICE_B_B versus ICE_T_T
  - 2021-09-28 -1.614950
  - 2021-10-15 1.262385
  - 2021-10-20 -1.172650
- ICE_TFM_TFM versus NYM_NG_NG
  - 2021-10-25 -5.751738
  - 2021-10-28 -2.985990
  - 2021-11-01 9.013603
- ICE_T_T versus ICE_G_G
  - 2021-10-18 -1.3075
  - 2021-10-19 0.6475
  - 2021-11-10 -0.3350
- NYM_RB_RB versus ICE_G_G
  - 2021-10-29 -0.019275
  - 2021-11-01 0.048500
  - 2021-11-10 0.063650
- NYX_EMA_EMA versus CBT_C_C
  - 2017-12-05 -0.639725
  - 2017-12-06 -14.575925
  - 2021-11-12 8.046450
  - 2021-11-15 9.990800