

# Homework: Futures Spread Dynamics

Tuesday 9<sup>th</sup> January, 2024

## 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 <sup>1</sup> 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 2020 though 31 Aug 2023. Our definition of second month is the contract where the number of days to futures expiration is the smallest available value greater than 30<sup>2</sup>.

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

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<sup>1</sup>Quarterly in this context means expiring in March, June, September, or December.

<sup>2</sup>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<sup>3</sup> 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.

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<sup>3</sup>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