**Trading Models**

1. Rolling OLS Model

- Hedge Ratio: OLS regression on rolling window (20 days)

- Spread: ***Futures - (α + β × Stock)***

- Signal: Z-score = (Spread - Mean) / Std

- Long: Z-score < -2.0 (Spread low → Buy stock, Sell futures)

- Short: Z-score > +2.0 (Spread high → Sell stock, Buy futures)

- Exit: |Z-score| < 0.5

- Note: Just sell stock if having available stock be bought before

2. Bayesian & Kalman Models

Process:

- Model: ***Price\_fut\_t = α + β\_t × Price\_stock\_t + ε\_t*** (with β dynamic)

- Prior: β0 ~ Normal(1.0, 0.2²)

- Spread: `Futures - (α + β × Stock)` (β is posterior mean)

- Uncertainty: Bootstrap sampling (1000 samples) + Prior weighting

- Signal Methods: Z-score rule OR Posterior-predictive

- Z-score Long: Z-score < -2.0 AND Confidence > 0.3

- Z-score Short: Z-score > +2.0 AND Confidence > 0.3

- Posterior-predictive: P\_revert ≥ 0.7

- Exit: |Z-score| < 0.5 OR P\_revert ≤ 0.5

**Trading Process**

**Step 1: Model Estimation**

*# Rolling OLS*

*futures = α + β\*stock*

*# Bayesian/Kalman:*

*Price\_fut\_t = α + β\_t \* Price\_stock\_t + ε\_t*

*for* window *in* rolling\_windows(60):

    hedge\_ratios = bootstrap\_sampling(1000)

*# Apply prior: β0 ~ Normal(1.0, 0.2²)*

    beta\_prior = 1.0

    beta\_std = 0.2

    hedge\_ratio\_mean = (mean(hedge\_ratios) + 0.1 \* beta\_prior) / (1 + 0.1)

uncertainty = std(hedge\_ratios) / abs(hedge\_ratio\_mean)

**Step 2: Signal Generation**

# Calculate spread

***spread = futures\_price - (alpha + beta \* stock\_price)***

# Calculate z-score

***z\_score = (spread - rolling\_mean) / rolling\_std***

* Use Rolling OLS When: *z\_score* < 0.3
* Use Bayesian Kalman When: *z\_score* > 0.3 OR Uncertainty\_Level > 0.5

**Step 3: Position Management**

*Fixed position size*

position = base\_size

*# Bayesian/Kalman: Uncertainty-aware sizing*

confidence = 1.0 - min(uncertainty, 0.8)

position = base\_size \* confidence \* (1 - uncertainty)