

Problem 1A: Observations on Spread Behavior Near Expiry

1. Cash vs. Near Future (CM-FUT1) - Basis Convergence

Observation: The Basis (*Spot - Future*) represents the cost of carry. Empirically, as Days to Expiry (DTE) approaches zero, arbitrage forces the spread to converge (Basis to 0).

- **Index Convergence:** The mean spread compresses significantly from **3.86** (DTE 10) to **0.78** (DTE 0). The residual positive value reflects transaction costs and settlement friction.
- **Constituent Behavior:** Liquid stocks exhibit textbook convergence. **SBIN** tightens from **1.50** to **-0.12**, and **GAIL** from **0.44** to **-0.04**. High-priced names like **SHREECEM** show rougher convergence due to lower liquidity.

2. Near Future vs. Far Future (FUT1-FUT2) - Roll Dynamics

Observation: The Calendar Spread tends to **widen** (become more positive) as expiry approaches, reflecting the cost of rolling positions.

- **Roll Pressure:** The Index mean spread increases from **2.59** (DTE 10) to **8.25** (DTE 0). This suggests buying pressure on the far month (FUT2) as traders close FUT1 and open FUT2 positions.
- **Market Structure:** Most constituents (e.g., **LUPIN**, **SIEMENS**) remain in **Contango** (positive spread). Exceptions like **SONACOMS** display **Backwardation** (negative spread: -3.15 at DTE 0), indicating higher near-term demand.

3. Volatility and Risk Profile

- **Risk Reduction:** Basis risk diminishes near settlement. The Index standard deviation drops from **19.6** (DTE 10) to **11.5** (DTE 0), confirming that hedging relationships stabilize as expiry nears.
- **Outliers:** Stocks like **SHREECEM** exhibit extreme volatility (Std Dev > 200). Strategies trading these names require significantly wider stop-losses or outright exclusion compared to stable names like **SBILIFE**.

Conclusion for Strategy

The reliable **Basis Convergence** in liquid names validates a **Mean Reverting Strategy** (e.g., Sell Spot / Buy Future when the basis is high). However, the widening **Calendar Spread** indicates that roll strategies must account for directional drift rather than relying solely on mean reversion.