

Arbitrage Strategies on Futures

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Changes from last time

1. Log both touch and trade events. Can't do more than 10% of the total trade volume in the last 5 minutes on both passive and aggressive orders.
2. Assume optimistic fill ($ltp \pm 0$)
3. Perform symbol-wise handling: churn over some symbols, hold the rest
4. Account for transaction cost and overnight cost in the strategy
5. Handle edge cases
6. Generalise the strategy, make it robust

Final Strategy - Volatility Checks

I define volatility as :

$$\text{Vol} = \text{std dev (AR at ltp)} / \text{mean (AR at ltp)}$$

For each symbol, this is calculated at every time instant, and if $\text{vol} > 10\%$ then the symbol is treated as a “churning” symbol, else it is treated as a “holding” symbol.

For symbols which are very volatile, I want to capture most of their opportunities, and for symbols which are less volatile, I want to build a position at a good AR.

Final Strategy - Tackling Gross utilization

1. Problems faced earlier - good positions being cleared, decent positions being kept. (f% rule).
2. To tackle this, I divided my gross into 2 portions: HOLD_GROSS and CHURN_GROSS. Similarly keep a separate hold_price and churn_price to store the average f-s of my positions.
3. I do not liquidate my positions in the HOLD_GROSS (unless $f = s$), I only build good positions.
4. I keep churning my positions in my CHURN_GROSS.
5. The split between the two portions is kept dynamic

Final Strategy - Passive-Aggressive Strategy

On a trade event, if its a sell side trade:

1. Passive on ask + aggressive on ask
2. Else aggressive on bid + aggressive on ask

On a touch event,

1. aggressive on bid + aggressive on ask

Volume traded is min of (trade vol, bidsz, asksz, 10% of last 5 min trades of market and me) in their respective cases

Final Strategy - Holding and Churning

- Tried to build a good position in CHURN_GROSS on day 1, did not work
- Tried same formulae for hold and churn for all days, did not work
- Hedged to reduce SD implosion and explosion
- Position building \leq market price
- Liquidation \leq My avg price + market price

```
hold_rate <- min(max(k*RISK_FREE, avg_ratio[ind] + k1*std_dev_ratio[ind]), 2*RISK_FREE)
churn_rate <- max(min(RISK_FREE, avg_ratio[ind] + k2*std_dev_ratio[ind]), 0)
```

*Profits worsened on using ema

```
percent = (curr_price - curr_spread - 2*cost)/curr_price
```

Liquidate when profit > 30%

Final Strategy - Tackling Gross utilization

1. HOLD_GROSS was taking 3 days to fill.
2. There was hardly any gross utilization on day 1 because the CHURN_GROSS is filled with decent positions, and HOLD_GROSS is practically empty because it takes time to find good positions.

3. Possible solution:

```
if(day==1){  
  MAX_HOLD_GROSS <- 1500000  
  MAX_CHURN_GROSS <- 5000000 - MAX_HOLD_GROSS  
}  
else if(day==2){  
  MAX_HOLD_GROSS <- 4000000  
  MAX_CHURN_GROSS <- 5000000 - MAX_HOLD_GROSS  
}  
else{  
  MAX_HOLD_GROSS <- 4500000  
  MAX_CHURN_GROSS <- 5000000 - MAX_HOLD_GROSS  
}
```

But profits
decreased*

4. If previous day MAX_GROSS is underutilized (after day 3), decrease the threshold for the hold positions (k in the previous slide)

Final Strategy - Tackling turnover

1. Tried making the churn_rate more attractive, but did not get a good liquidation price after that.
2. Decreased the target profit to increase turnover, but did not accumulate much profit
3. If a symbol has not been traded in since the last 1 hour, liquidate at 10% recovery to clear the position and put our gross elsewhere, else liquidate at 30% recovery after taking into account 2x TX_COST.
4. Can increase the size of my CHURN_GROSS to increase turnover, but it will increase the risk of liquidating my “sureshot” profit in HOLD_GROSS at a worse price.

Final Strategy - Robustness

1. All conditions are derived from the data
 - a. Volatility is dependent on the avg and std dev of the ARs
 - b. Profit is dependent on the TX_COST and the ON_COST
 - c. Thresholds are dependent on the RISK_FREE rate and the avg, std dev of the ARs
 - d. Dynamic shifting of the GROSS value is done based on the past gross utilization

Final Strategy - Casewise analysis

1. AR = 2% and stable => Decrease hold rate threshold
2. AR = 2% and volatile => Will churn
3. AR = 20% and stable => Will hold
4. AR = 20% and volatile => Currently hold.

Tried: if `current_rate < avg_rate` then liquidate, but profits decreased.

On average on 4 cycles, feb-march, sept-oct, oct-nov, nov-dec, our strategy got a profit of 10.5% AR, and a turnover of 2 Cr.

Final Strategy - Numbers (Feb-March)

Max Gross utilization:

Day 1 - 16.48L

Day 2 - 38.00L

Day 3+ - 50L

Turnover:

2.12Cr

Profit:

41K (10.75%)

Issues in our setup

1. R vs Sim

- a. Our impact - we are assuming no impact in R
- b. Racing - we are assuming optimistic fill, and that we can place and cancel infinite orders
- c. Delays - We are assuming 0 delay in R, can add delay in Sim

2. Sim vs Prod

- a. Our impact - People can react after looking at our orders in actual prod
- b. Racing - Multiple users can race for the same instrument, cannot simulate this properly in sim
- c. Delays - Delays can be variable in actual prod, constant in Sim