# Arbitrage Strategies on Futures

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# Touch events

## Constant thresholds - (5, 10)

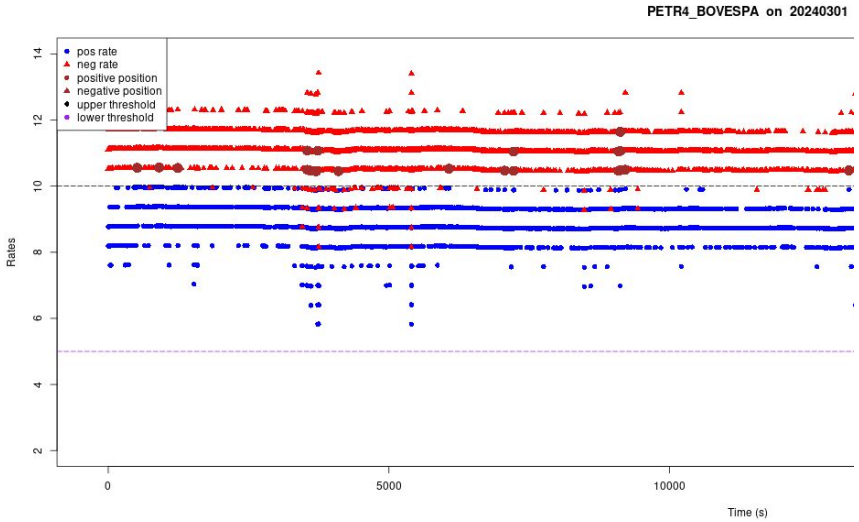
Profit = 11.17L (9.8 %)

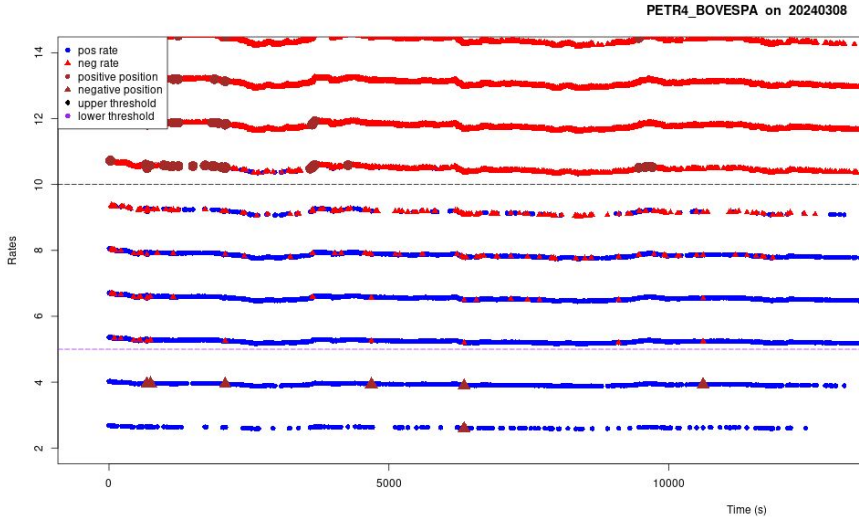
Turnover = 40.47 Cr (1.26x margin)

## Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |

Risk-free = 11.96L



**But, we are not liquidating much, let us try to find better thresholds**

# Touch events

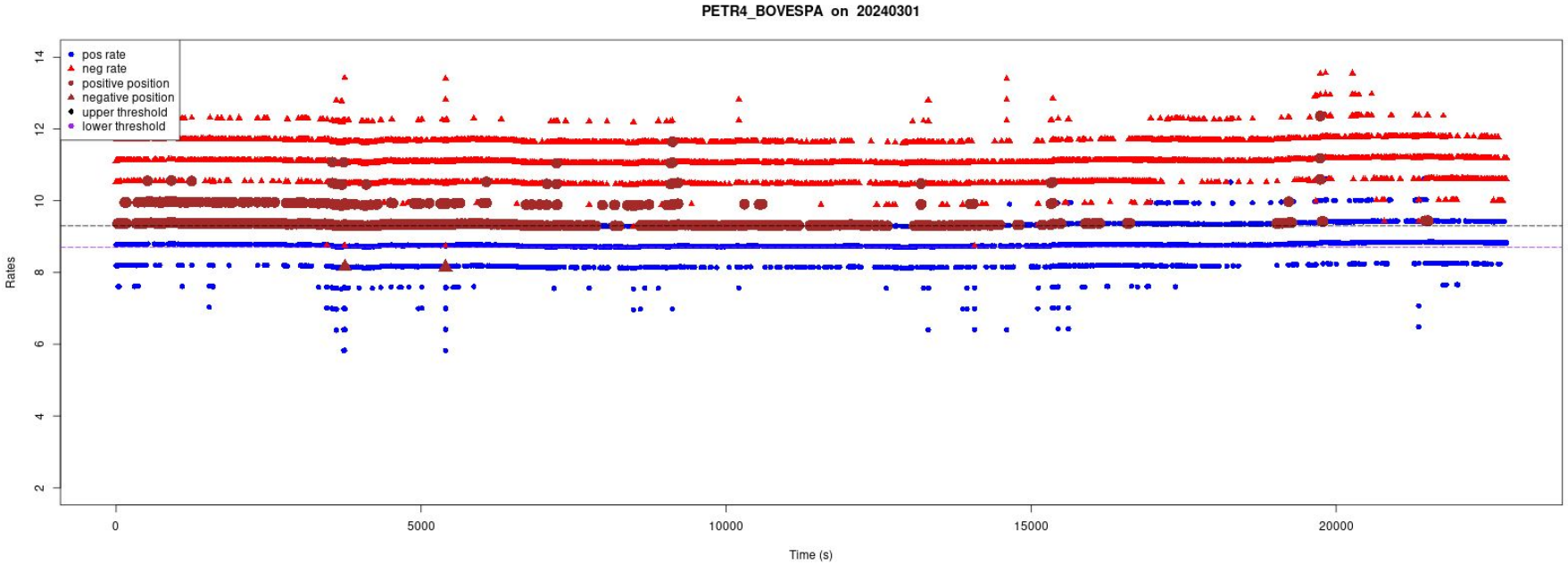
## Constant thresholds - (8.7, 9.3)

Profit = 13.05L (11.46 %)

Turnover = 62.74 Cr (1.96x margin)

Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |
| Const (9.3, 8.7) | 13.05 | 62.74 |



**We have now performed a grid search and have overfitted, we need something that can generalise to the given data, so we need statistics from the data.....how about mean?**

# Touch events

## Running Mean - (+X, -Y)

Profit = 12.01L

Turnover = 35.78 Cr (1.12x margin)

## Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |
| Const (9.3, 8.7) | 13.05 | 62.74 |
| Rmean | 12.01 | 35.78 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| X | 0.01 | 0.01 | 0.01 | 0.01 | 0.005 | 0.011 | **0.012** | 0.013 | 0.014 | 0.015 | 0 |
| Y | 0.13 | 0.14 | 0.15 | 0.16 | 0.15 | 0.15 | **0.15** | 0.15 | 0.15 | 0.15 | 0 |
| Profit | 11.03 | 11.85 | 11.88 | 11.88 | 11.62 | 11.87 | **12.01** | 11.16 | 10.23 | 9.21 | -11.5 |
| Turnover | 49.6 | 38.8 | 35.8 | 34.86 | 36.9 | 35.69 | **35.78** | 34.45 | 31.59 | 28.37 | 268.68 |

**This is the mean over all days, not per day

# Observations

1. Infinite window works best, any sliding window will have “smaller” prices and that will not be as profitable.

2. Mean “rate” window not good either, rates explode in either directions at the end

3. Exponential Moving average also performed worse because it is affected by recent price changes more, and we don’t want that.

**The turnover is still quite less, let us try changing the negative position strategy....**

# Touch events

## Running Mean, Day 1 churning - (+X,  S)

Profit = 12.17L

Turnover = 39.9 Cr (1.25x margin)

Go negative if:

f_ask - s_bid < S * avg price, S<=1

S = **0.9** on day 1, **0.1** on day>=1

Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |
| Const (9.3, 8.7) | 13.05 | 62.74 |
| Rmean | 12.01 | 35.78 |
| Rmean(S0.9) | 12.17 | 39.9 |

**Since rate keeps getting more volatile with time, we need to get maximum positions in minimum time…….choose ‘top k’ stocks with best rate……**

# Touch events

## Running Mean, Top k stocks - (k)

Profit = 12.40L

Turnover = 38.75 Cr (1.21x margin)

Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |
| Const (9.3, 8.7) | 13.05 | 62.74 |
| Rmean | 12.01 | 35.78 |
| Rmean(S0.9) | 12.17 | 39.9 |
| Rmean(T4) | 12.40 | 38.75 |

| k | 8 | 7 | 6 | 5 | 4 |
|---|---|---|---|---|---|
| **Profit** | 12.17 | 12.21 | 12.26 | 12.35 | 12.4 |
| **Turnover** | 39.9 | 38.53 | 38.59 | 38.77 | 38.75 |

I am taking my position early on and wasting the opportunities in the forthcoming days.....why not churn?

# Touch events

## Running Mean, Churn on last k days - (k)

Profit = 12.76L (11.2%)

Turnover = 73.19 Cr (2.29x margin)

+ve posn: Pos_mean>avg(pos_means, neg_means)

-ve posn: Neg_mean<avg(pos_means, neg_means)

Day 1, S = 0.99

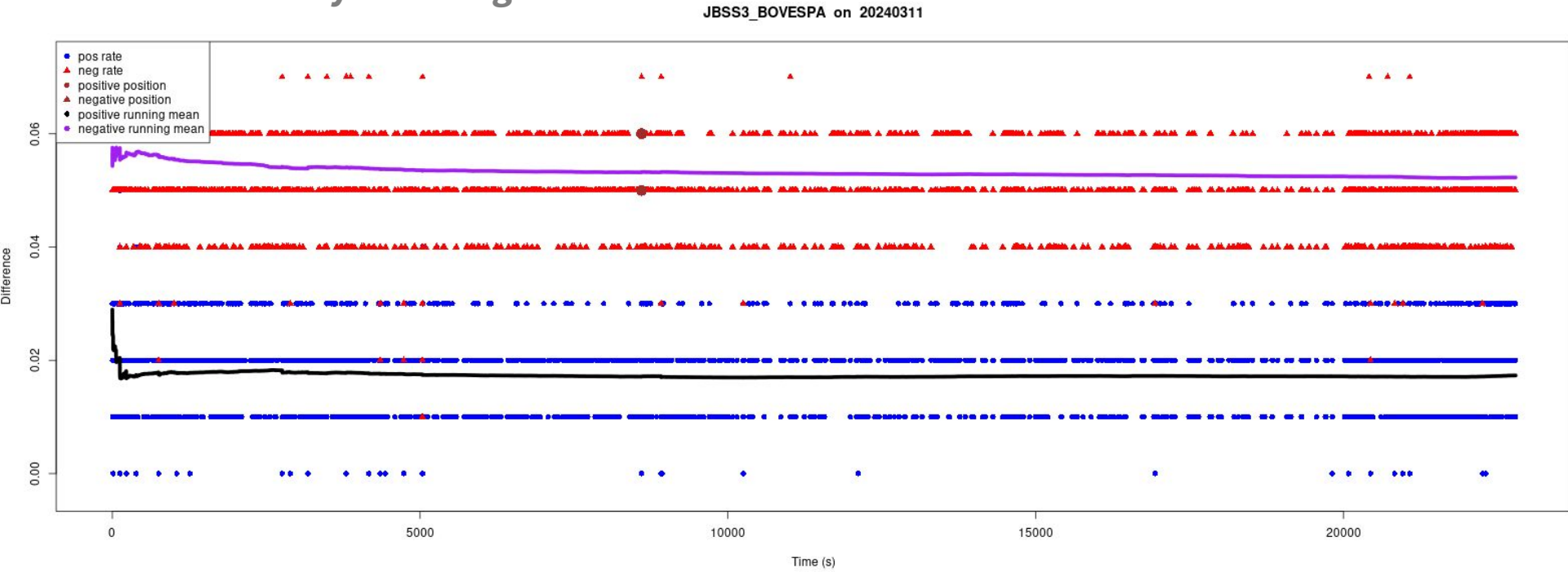
## Leaderboard

| Strategy | Profit (in L) | Turnover (in Cr) |
|---|---|---|
| Const (5, 10) | 11.17 | 40.47 |
| Const (9.3, 8.7) | 13.05 | 62.74 |
| Rmean | 12.01 | 35.78 |
| Rmean(S0.9) | 12.17 | 39.9 |
| Rmean(T4) | 12.40 | 38.75 |
| Rmean(T4, L3) | 12.76 | 73.19 |

| k | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| **Profit** | 12.42 | 12.48 | 12.72 | **12.76** | 10.67 |
| **Turnover** | 41.88 | 49.6 | 64.98 | **73.19** | 88.2 |

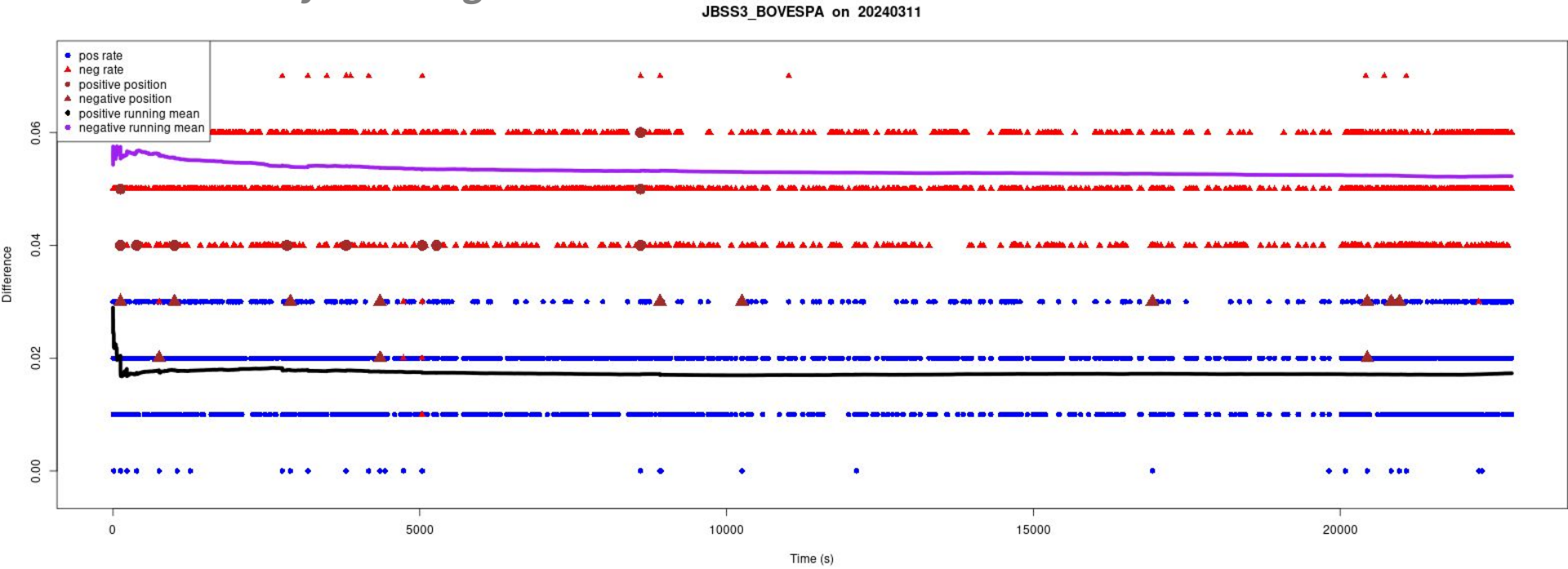
# Touch events

## Before Final Day churning



# Touch events

## After Final Day churning



# Touch events

## Final Strategy

```
if(days==1){
    sell_fraction = 0.99
    buy_cond =  (pos_diff > ticksize + pos_means[ind]) & (ind %in% top_8_indices)
    sell_cond = (neg_diff < avg_price[ind]*sell_fraction)
}
else if(days==2){
    sell_fraction = 0.1
    buy_cond =  (pos_diff > 1.5*ticksize + pos_means[ind]) & (ind %in% top_8_indices)
    sell_cond = (neg_diff < avg_price[ind]*sell_fraction)
}
else if(days>=7){
    buy_cond =  (pos_diff > (pos_means[ind] + neg_means[ind])/2)
    sell_cond = (neg_diff < (pos_means[ind] + neg_means[ind])/2)
}
else{
    buy_fraction = 0.9
    sell_fraction = 0.1
    sell_cond = (neg_diff < avg_price[ind]*sell_fraction)
    buy_cond =  (pos_diff > neg_means[ind]*buy_fraction)
}
```

# Timer events

**Constant thresholds - (5, 10)**

Profit = 10.69L

Turnover = 38.11 Cr (1.19x margin)