

# MATH584 - Math for Algo Trading

## Homework 4

Niti Wattanasirichaigoon

A20406934

### File Descriptions

File Name	Description
Abs_PnL.csv	2) Absolute PnL process

### 1. Estimating Price Impact Coefficient

I created a function that would loop through all the files within the time frame given the ticker name, concatenated the needed data, and then extract the parameters. During each day, the first and last 30 minutes were excluded (using only data from 10:00 AM to 3:30 PM). The results are the following.

Price Impact Coefficient ( $\lambda$ )

Ticker	Via midprice & order flow	Via LOB
MSFT	$8.51654 \times 10^{-7}$	$1.59959 \times 10^{-6}$
GOOG	$1.14109 \times 10^{-4}$	$5.75862 \times 10^{-4}$

We can see that GOOG generally has a higher estimated impact coefficient than MSFT. Recall that this impact coefficient can be thought as how much prices are affected by trades (size and direction).

The variance in the midprice (5 minute time stamp) is used to approximate the variance of the fundamental value of the assets. The variance is **0.002497 for MSFT** and **0.357785 for GOOG**. This suggests that GOOG stock prices vary a lot more than MSFT. Together with the price impact, they are used to calculate the risk aversion.

Risk Aversion ( $\gamma$ )

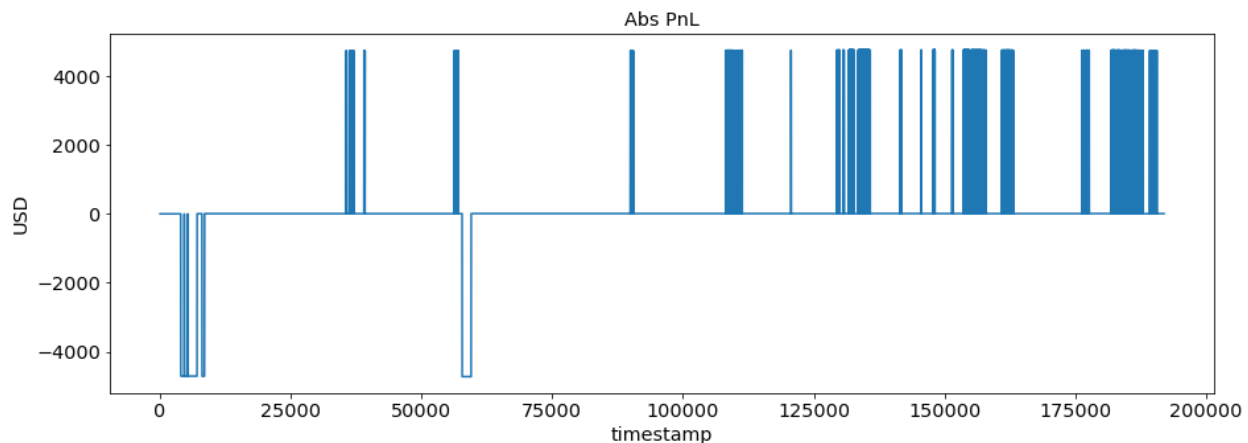
Ticker	$\lambda$ via midprice & order flow	$\lambda$ via LOB
MSFT	0.0001705	0.0003203
GOOG	0.0001595	0.0008048

The risk aversion estimates for values of  $\lambda$  calculated from the midprice and order flow of MSFT and GOOG are similar. The estimates calculated via MSFT LOB is higher than theses

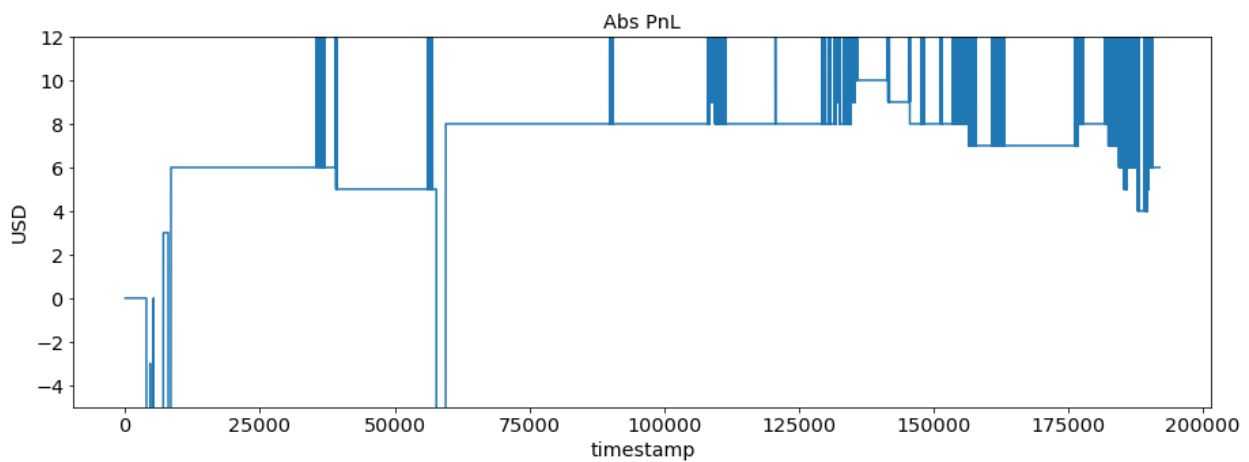
estimates, and the estimate from GOOG LOB is the highest. The model using LOB should be preferred because it produces higher price impact coefficients (factor is stronger), it uses a larger sample (everyday), and not as computationally demanding. The model using price and order flow can also be used if the sample is large enough (over many days), but we also have to keep in mind that the model assumes a linear relation between midprice and order flow, and thus a constant impact factor (which in reality it may not be).

## 2. Implement Trading Strategy based on predicting prices via order flow

The plot of the absolute PnL process can be seen below.



Starting with 0\$, we open a long position when we expect the price to rise and open a short position when we expect the price to go down. The PnL plot travels down when we buy shares (thus losing money) and return when we sell them back, and vice versa in a short position. Since the full scale PnL is hard to visualize the profits, we look at a zoomed up version of the plot below.



Looking close up, we can see how we gain or lose money when we close a long or short position. If the price changed enough in our favor, we make profit even against the spread. Here we end up with a final **PnL of +\$6.00** at the end of the day.