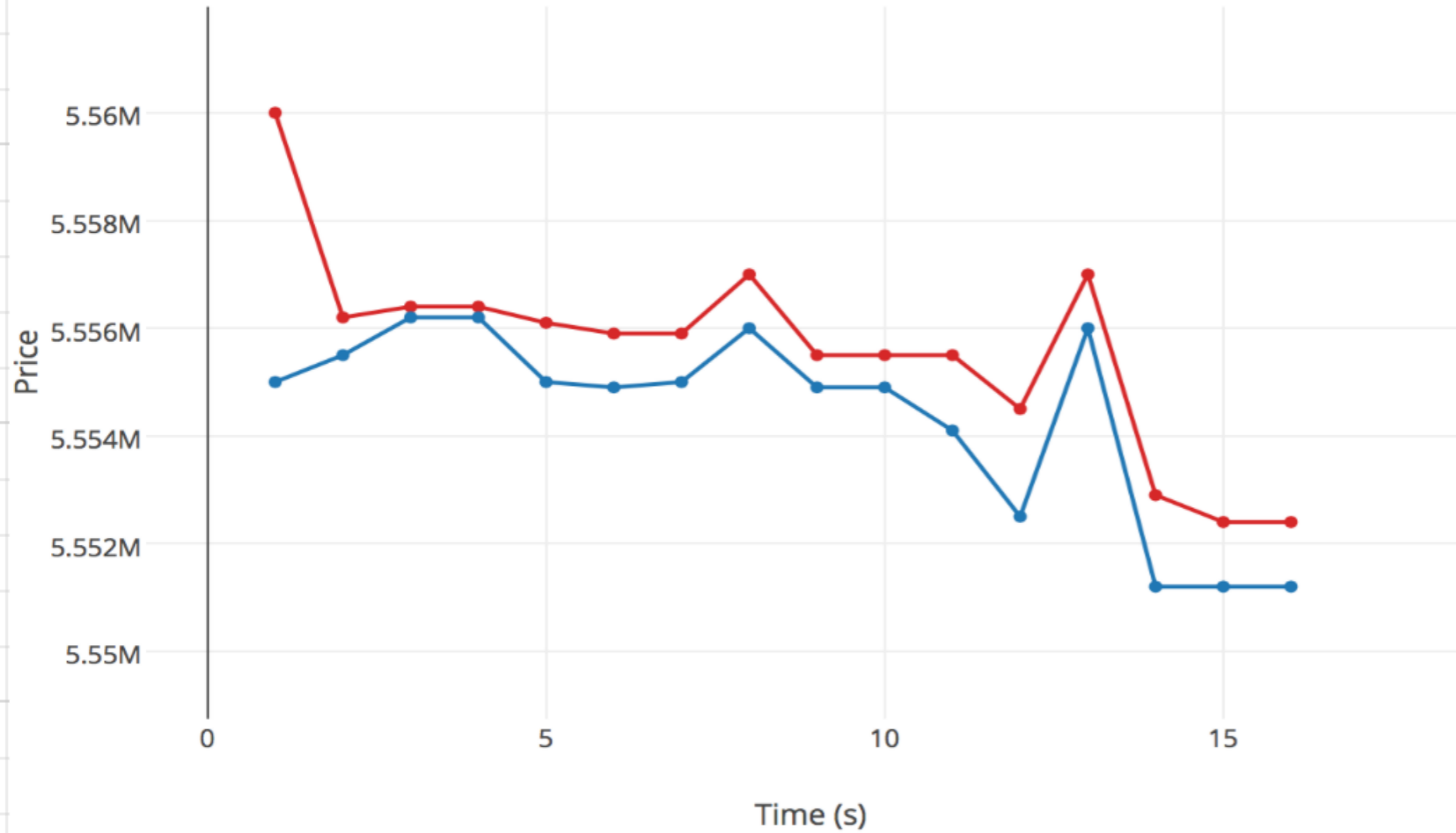


Paper Prototypes

Scenario 1

Apple Stock

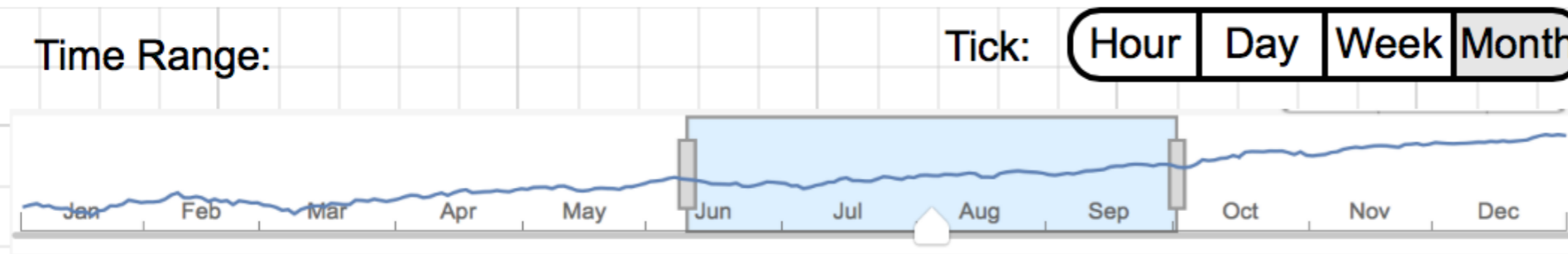


In this prototype, we can see how the prices for the best **Bid** and best **Ask** one stock, respectively the Apple Stock, evolve through time.

The user may choose the time frame, as well as the ticks between this timeframe.

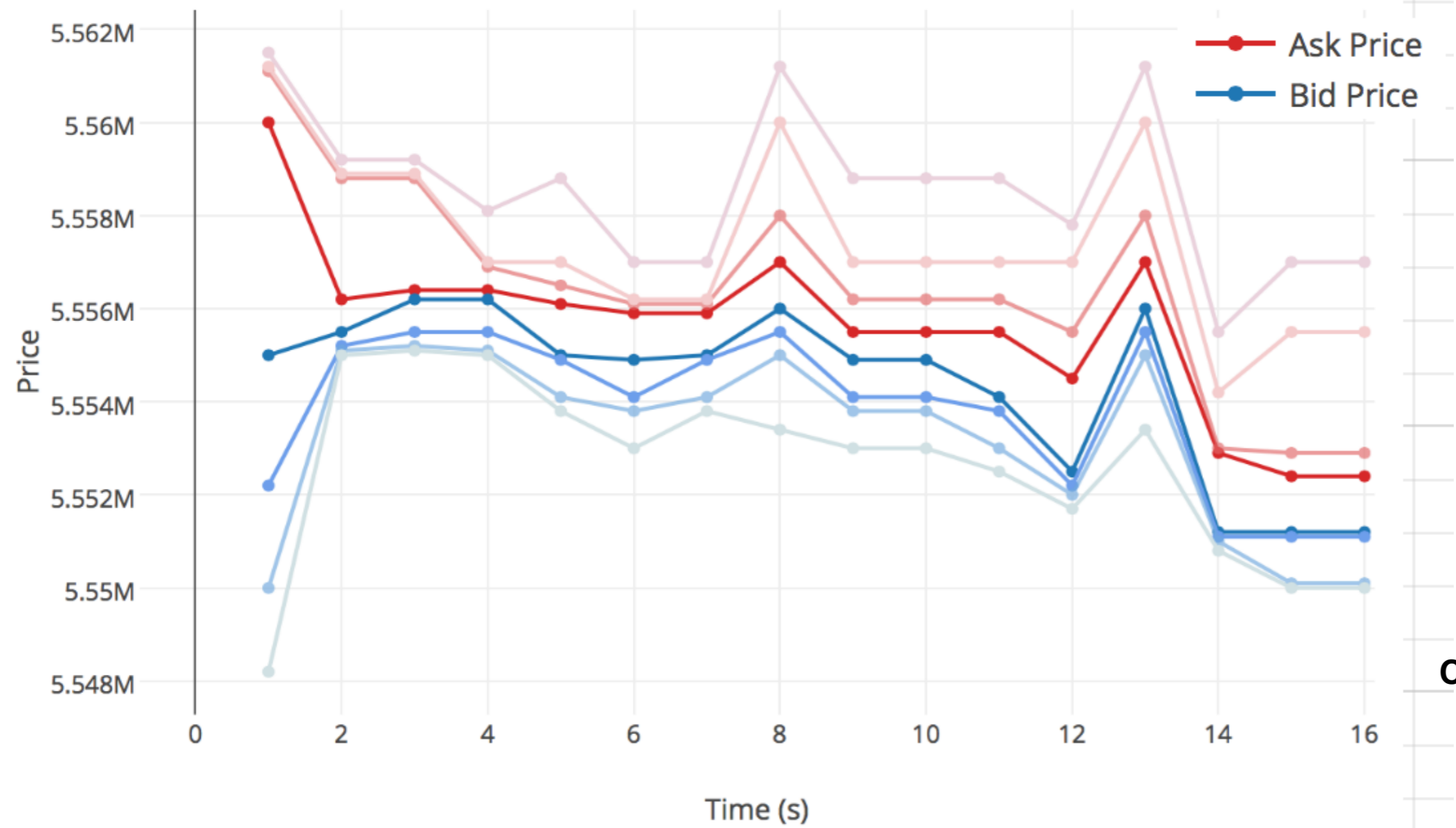
Additionally the user can select the number of Price levels to be displayed in the graph. In our case only the **Level 1** prices were selected.

Pros: clean design
Cons: The tick should be an input field measured in second



Levels:

Show Volume



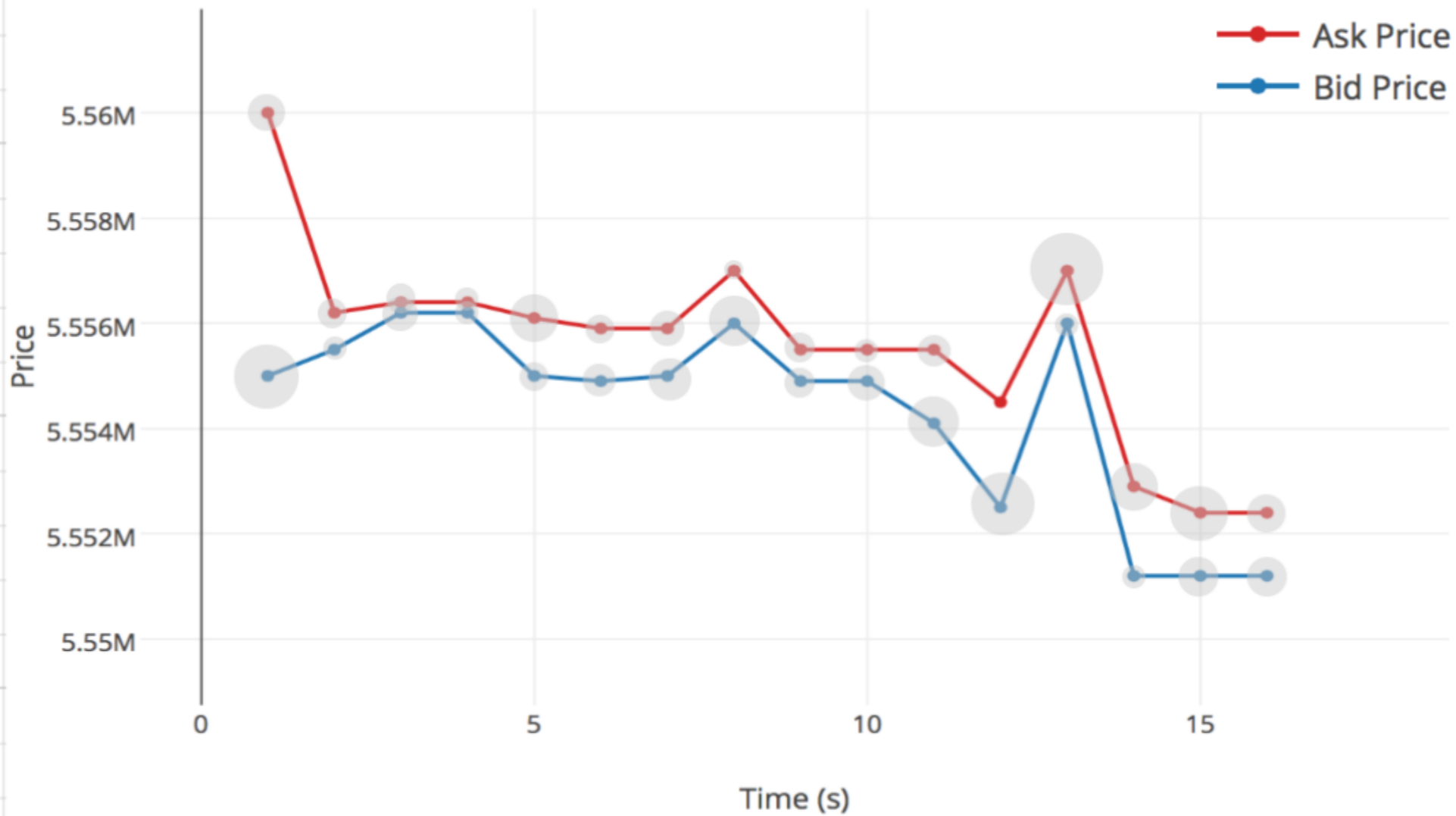
Here we have the same graph as above but **five price levels** are selected.

- Pros:** clean design
- Cons:** The tick should be an input field measured in second

Time Range: Tick: Hour Day Week Month

Levels:

Show Volume



In this view, we selected the show the volume check box. We now see where there are big volumes for the specific prices and where there are small volumes. This is relevant for the next selection step presented in the next slide.

Pros: gives the researcher further knowledge about what points in time might be interesting to analyse.

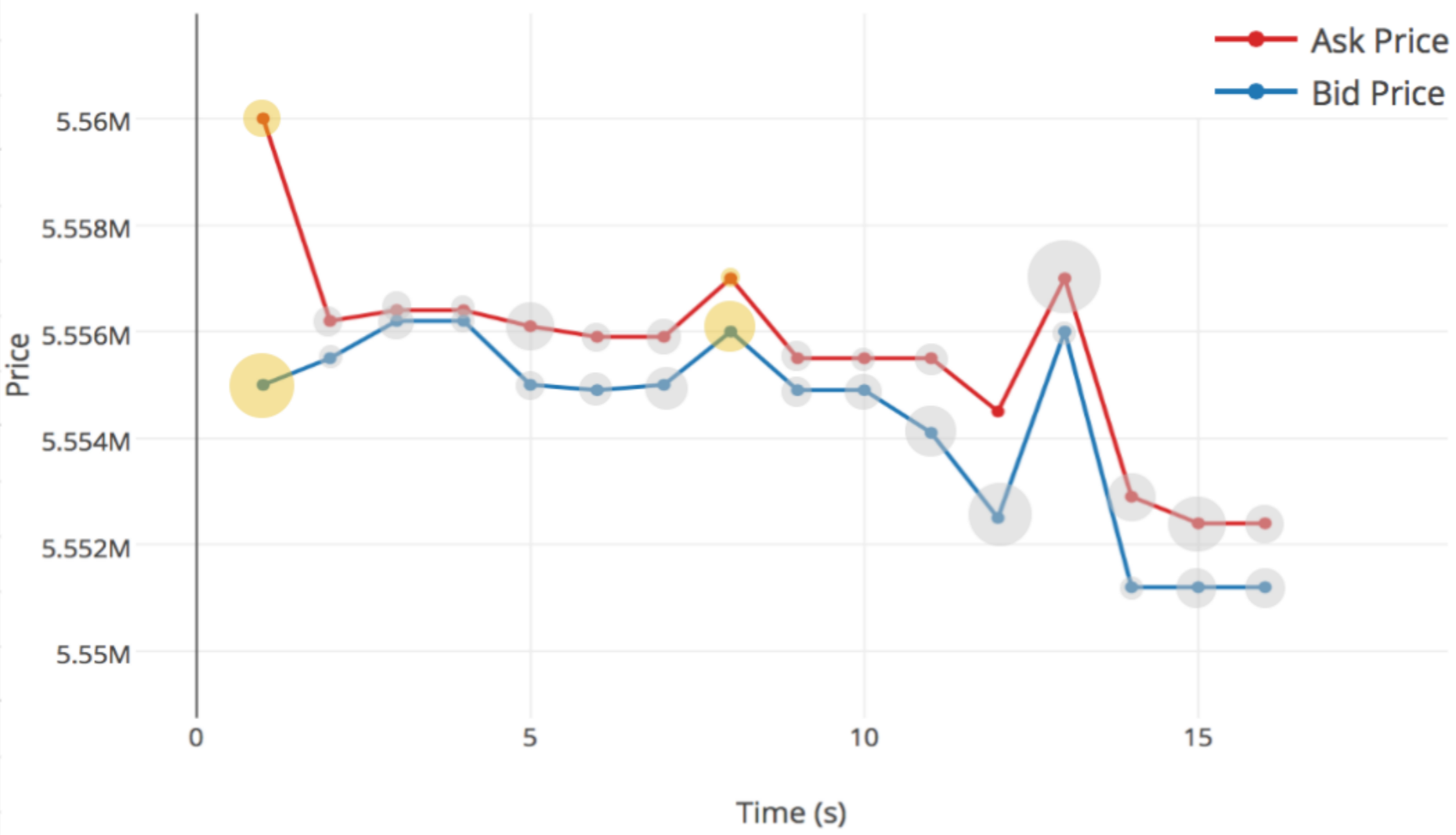
Cons: The graph might get cluttered if the 'Show Volume' checkbox is ticked when more price levels are selected.

Improvement: An additional check box could be added to plot the spread between best bid and best ask.

Time Range: Tick: Hour Day Week Month

Levels:

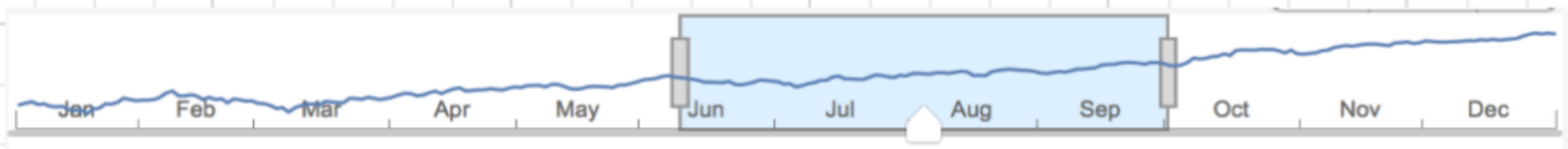
Show Volume



We can select two moments, t0 and t1, from the graph to see what actions triggered the changes between them.

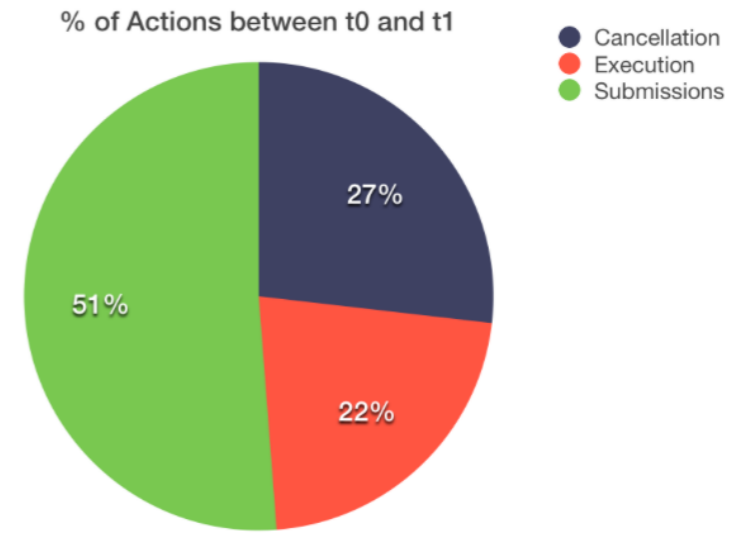
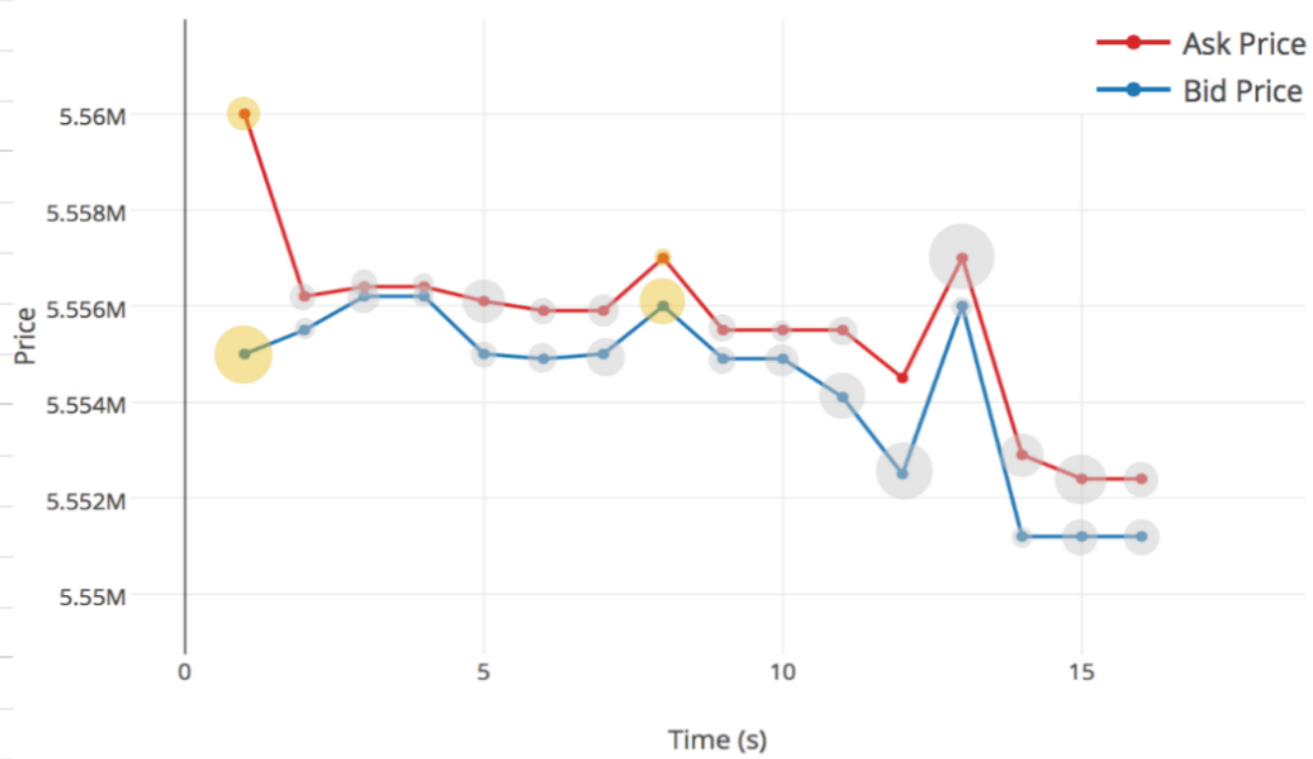
The moment we click this we will get an additional view on the dashboard.

Time Range: Tick: Hour Day Week Month



Levels:

Show Volume



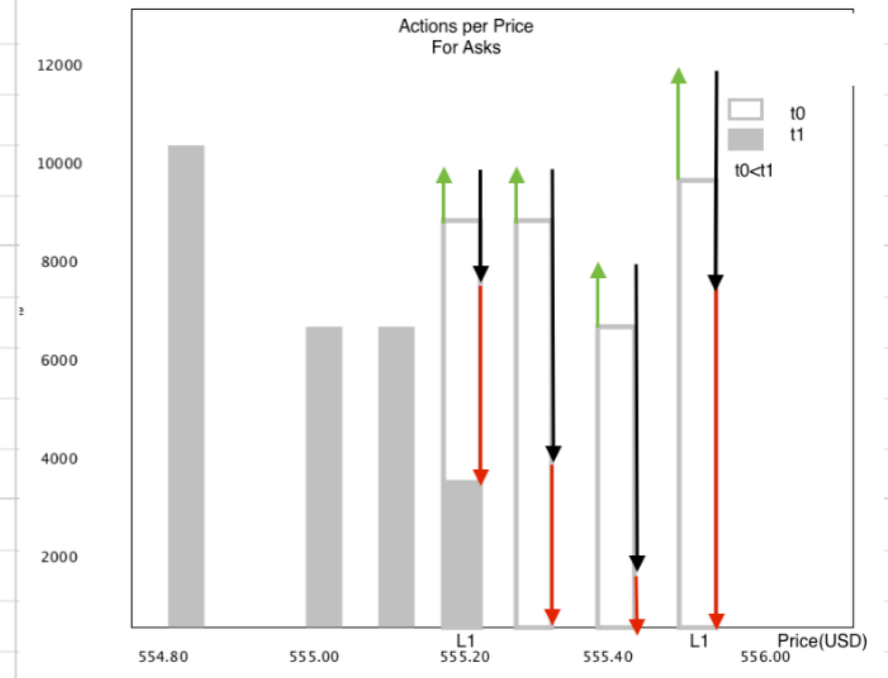
Time Range: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Tick: Hour Day Week Month

Levels:

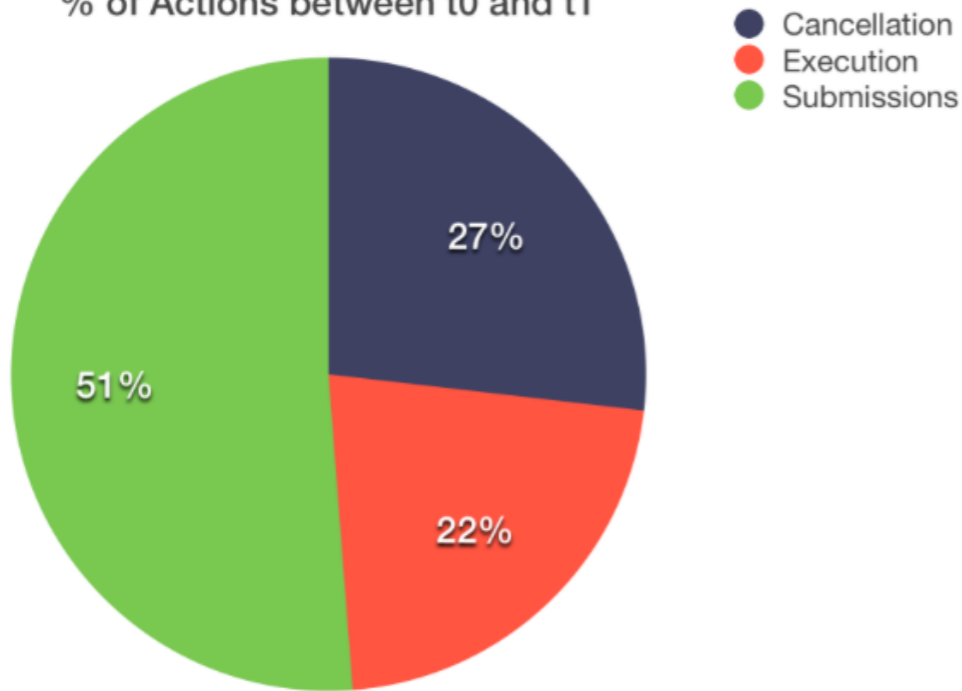
Show Volume

Distribution of the actions within the Timeframe:



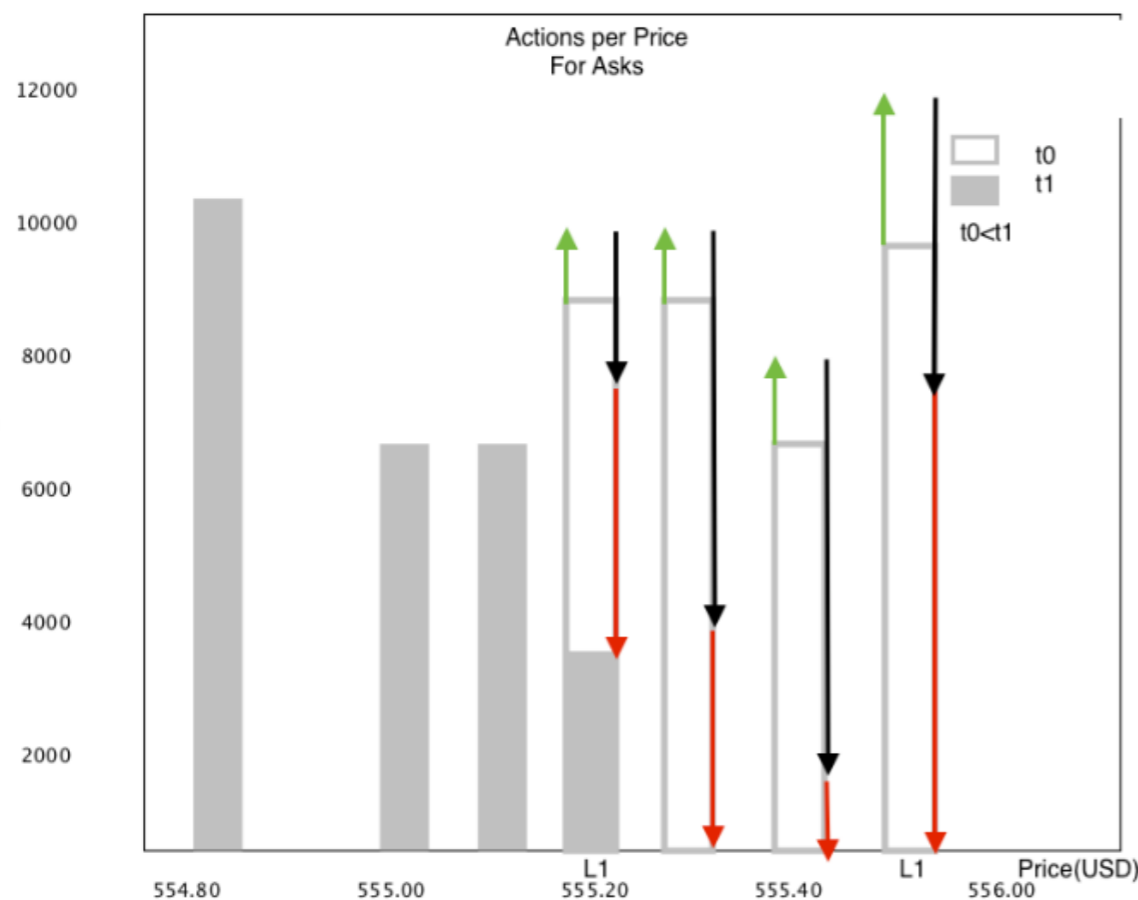
View Actions for: Asks

% of Actions between t0 and t1



It is very relevant to the researcher to know not only the fact that the prices rose or fell during a period of time, but also knowing what kind of actions triggered the rise/fall. The possible actions are **submissions**, **executions** and **cancellations**. We want to know what percentage of each of those actions happened during moment t0 and t1. This is showcased by the piechart.

Distribution of the actions within the Timeframe:



Furthermore we want to know how these actions are distributed. At what price levels do people tend to submit orders? How does that affect the spread of the stock?

View Actions for:

Levels:

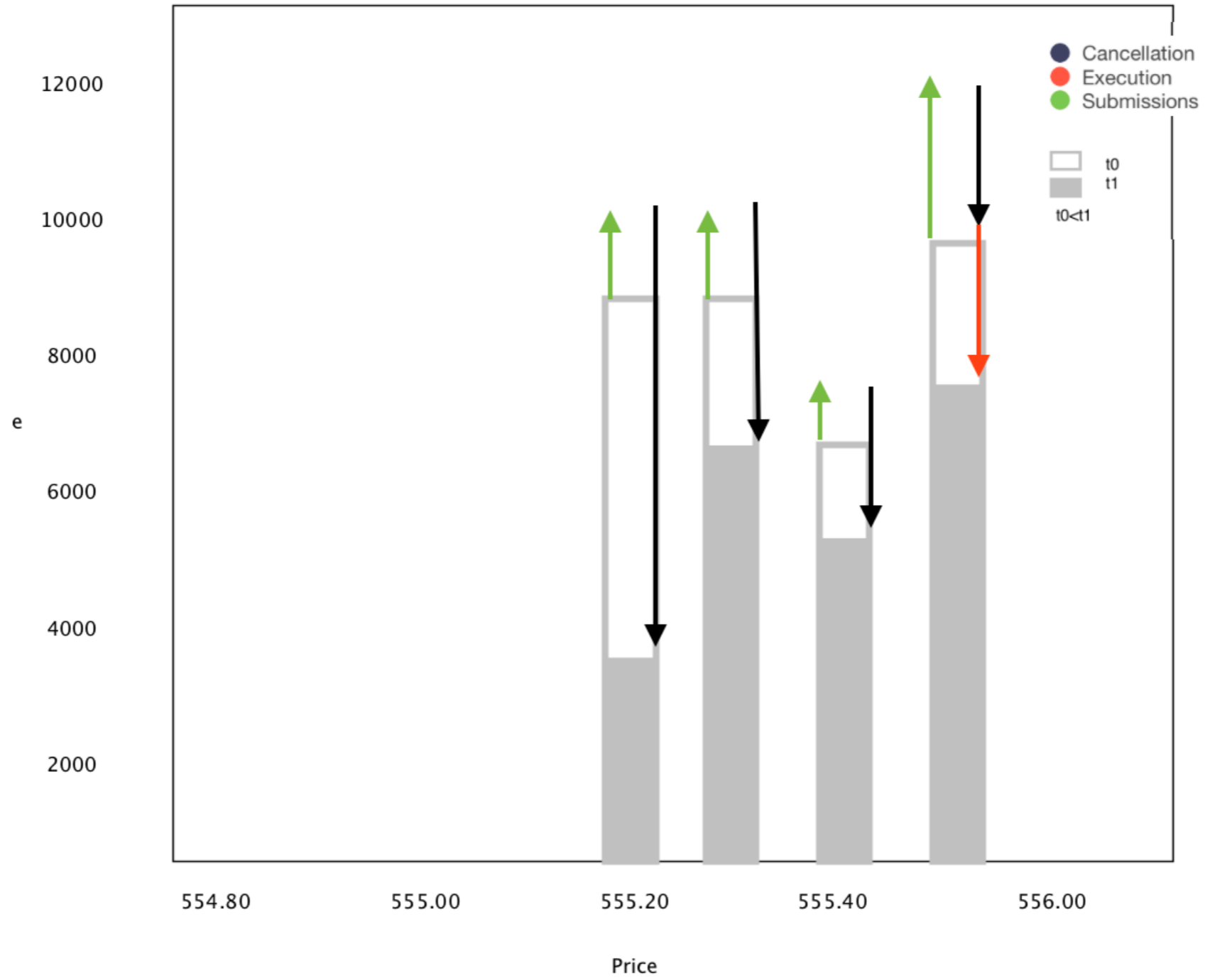
In order to simplify the view the user can select whether to only analyse the actions happening to the Asks or Bids. However it is still possible to have an overall view.

Cons: Everything might transform into a 'rainforest' of arrows.

Improvement: Add some sliders to change t0 and t1 more easily.



Workbook Analysis

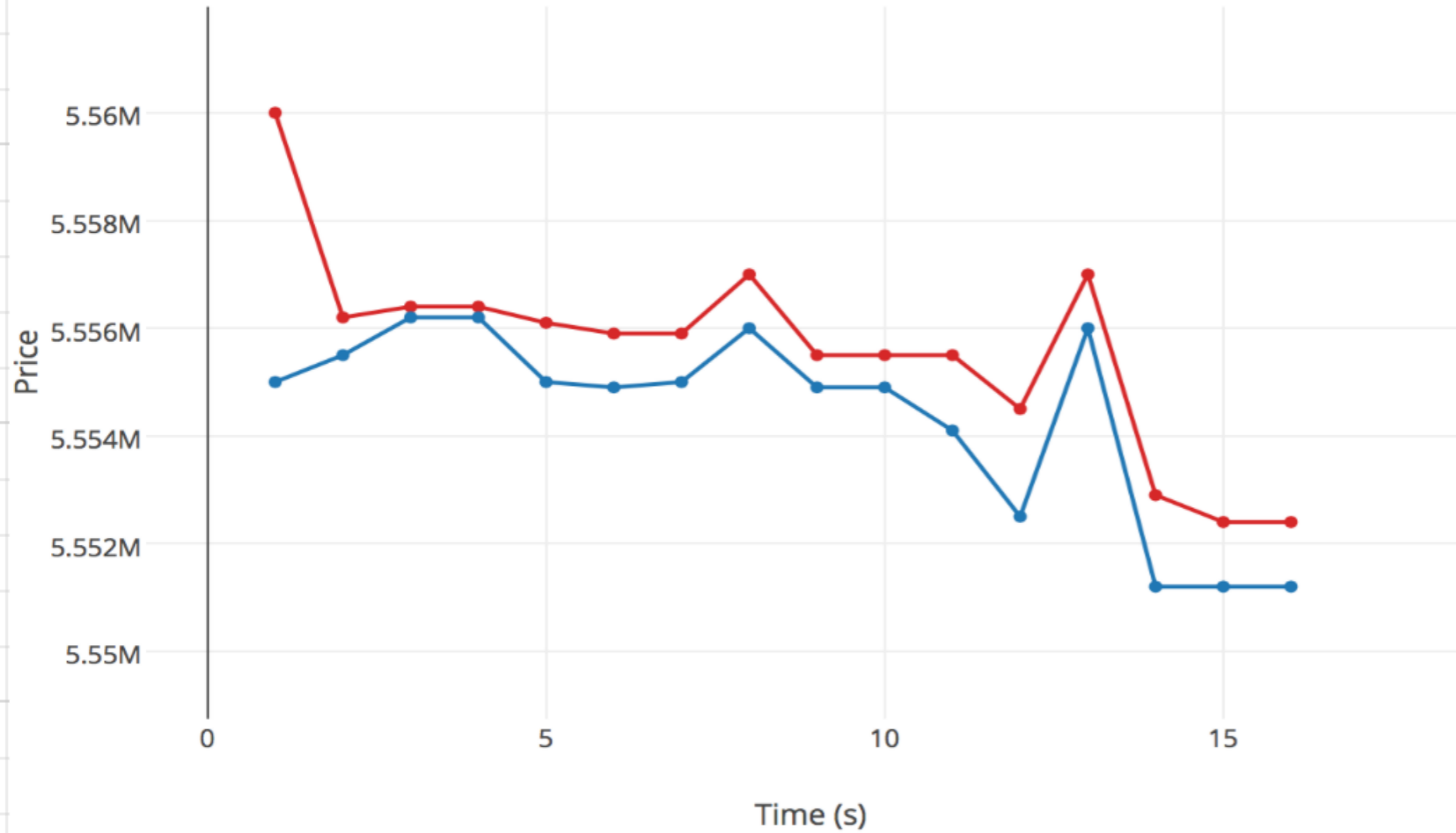


t0:

t1:

Scenario 2

Apple Stock



The user is presented with a line graph comparison of the best bid and best ask where the spread may be visible by hovering over a point in time. Here the user has the option to choose for what interval they wish to view the data for. They may also zoom into a specific time period using the double sided slider. The number of levels shown at once may also be changed. By clicking on a single instance on the graph the second and third view will be activated.

Time Range:

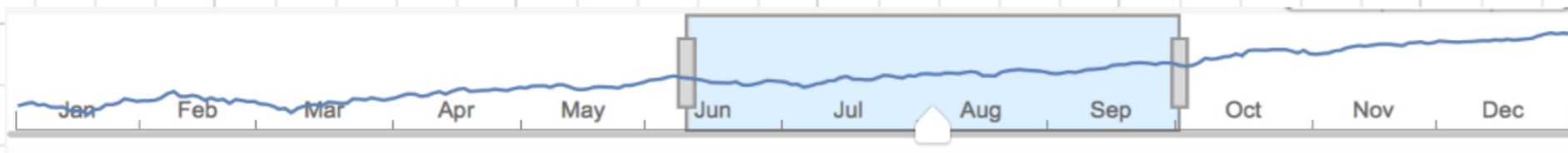
Tick:

Hour

Day

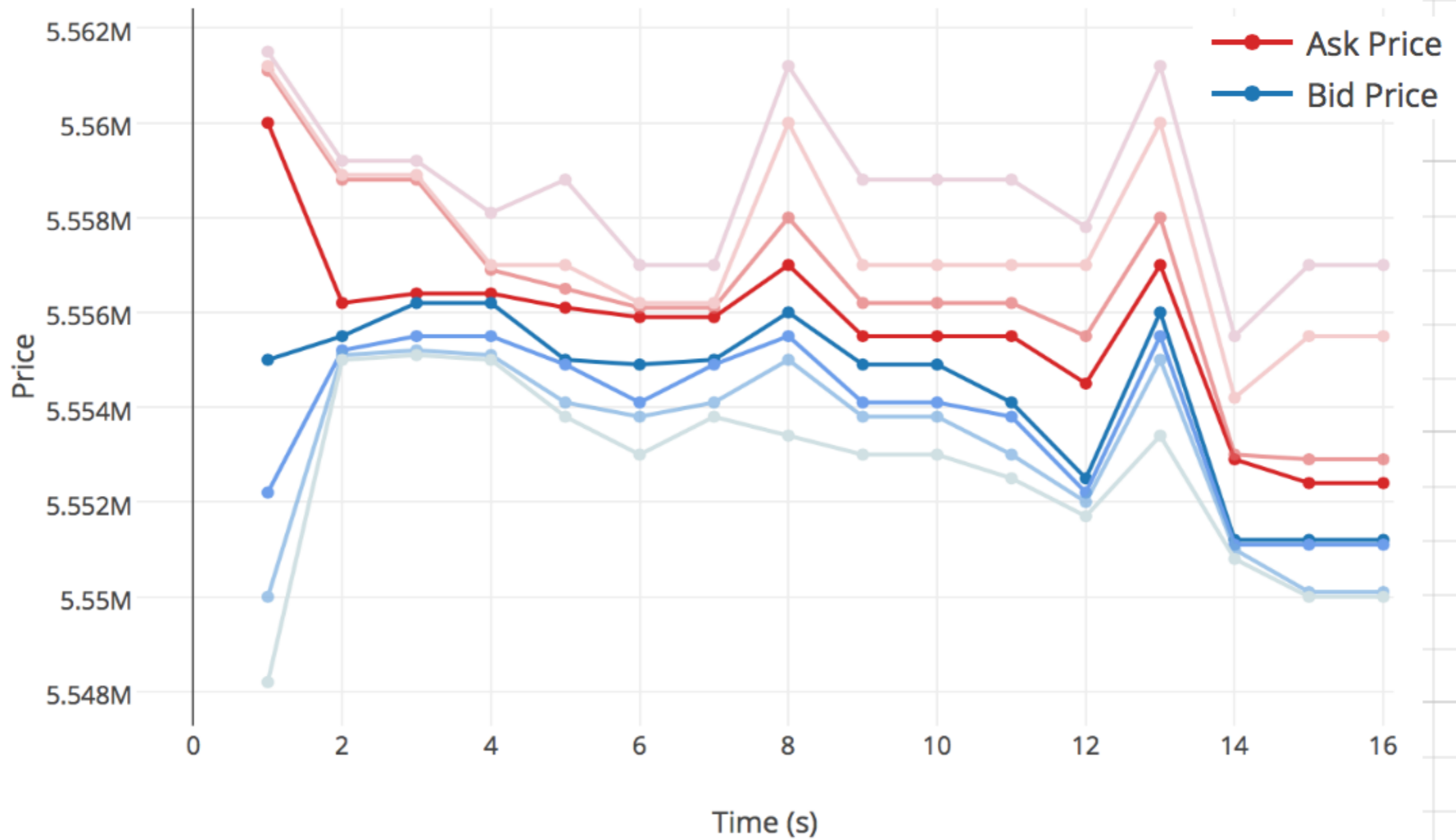
Week

Month



Levels:

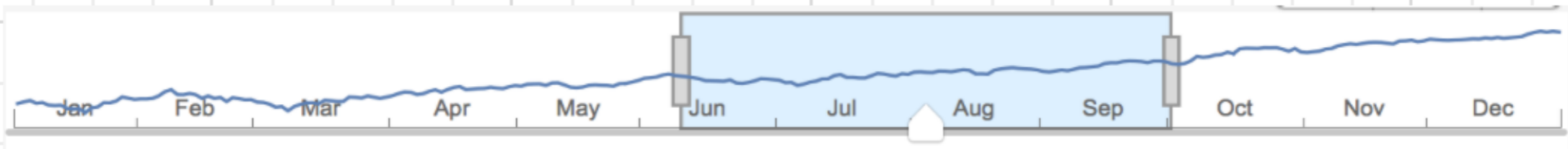
Show Volume



Time Range:

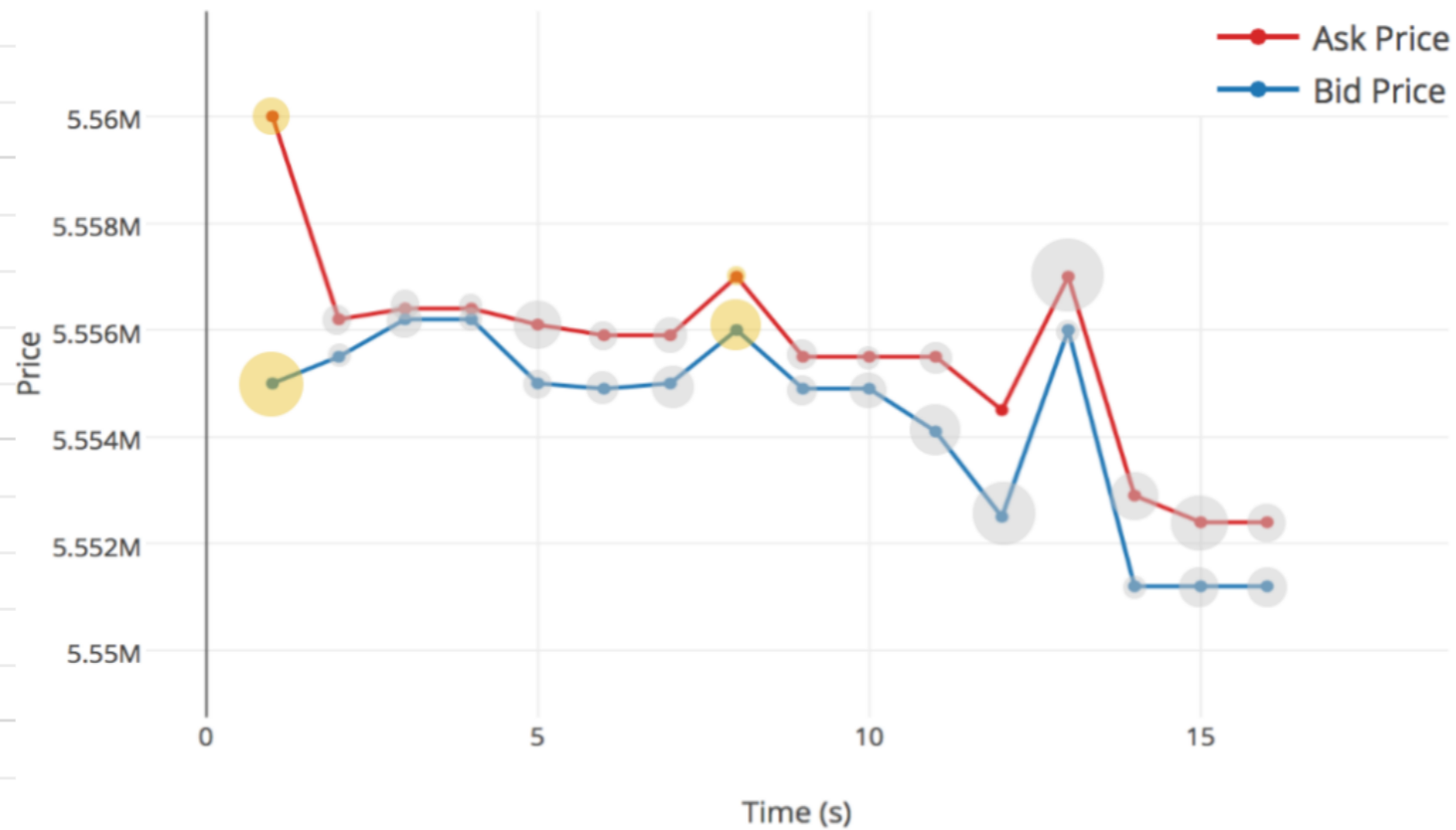
Tick:

Hour Day Week Month



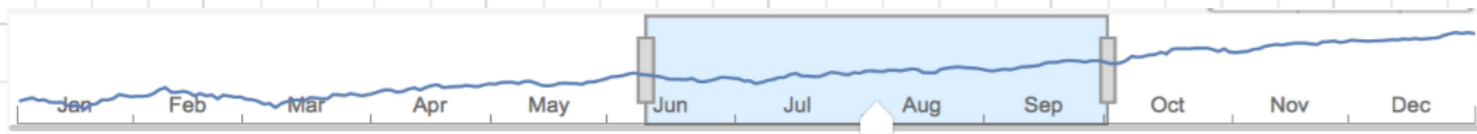
Levels: 5

Show Volume



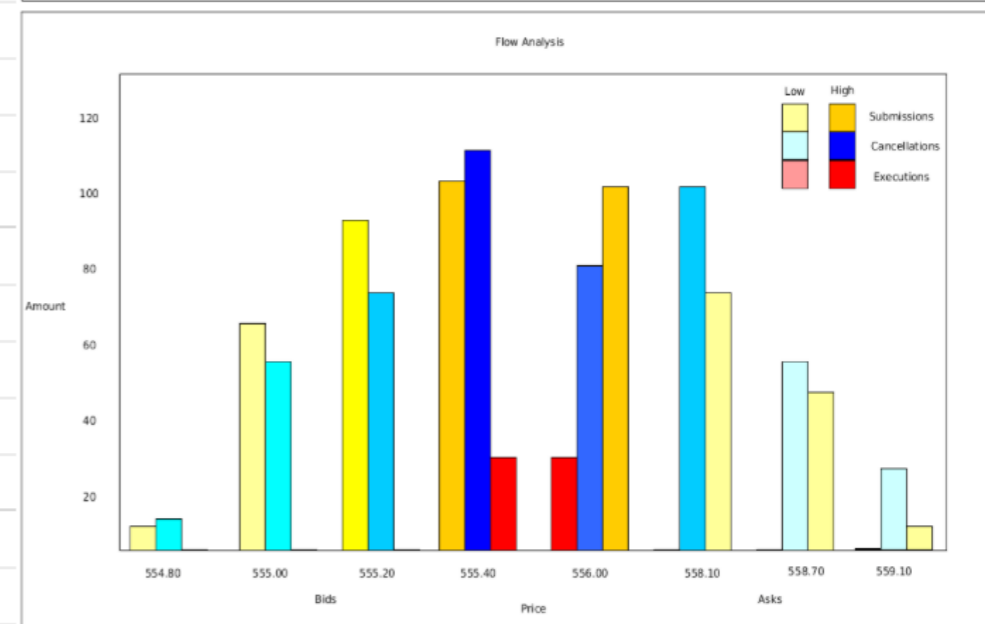
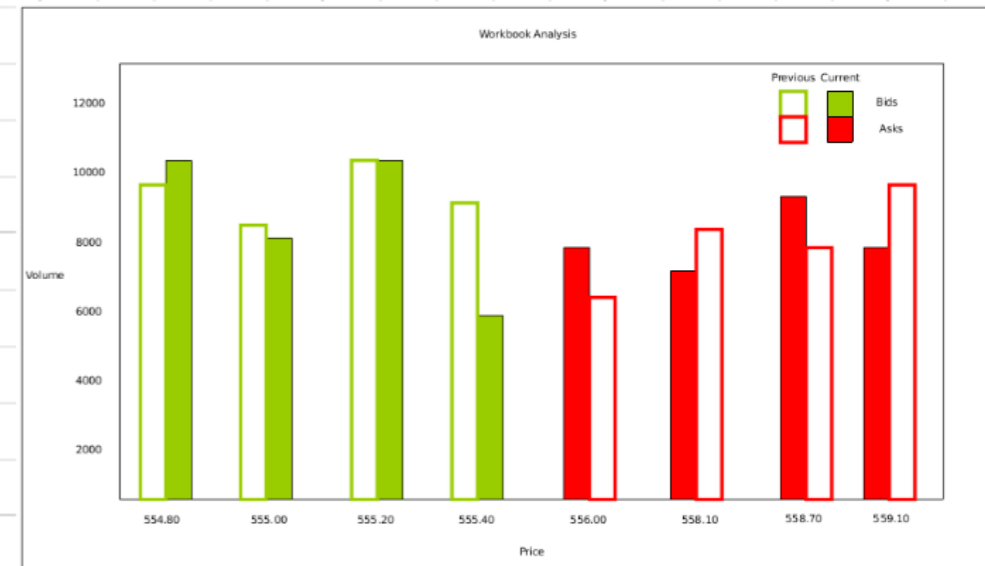
Time Range:

Tick: Hour Day Week Month

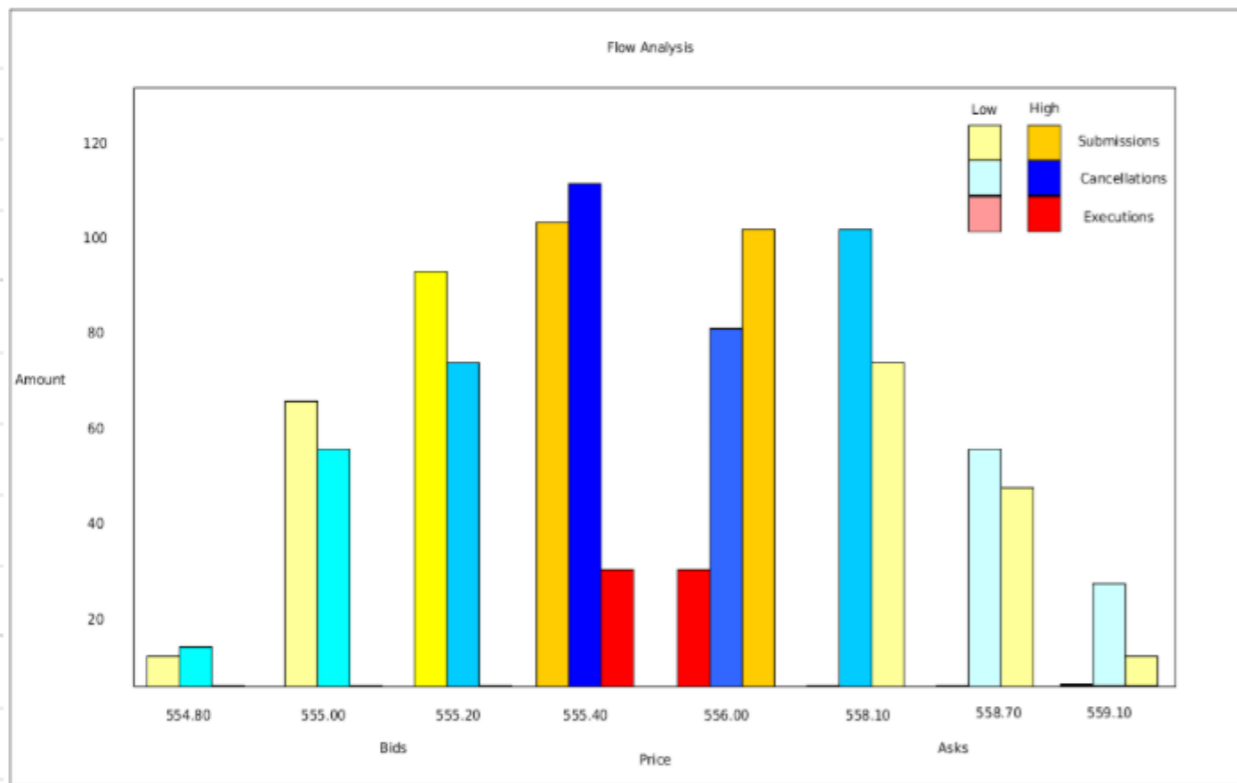
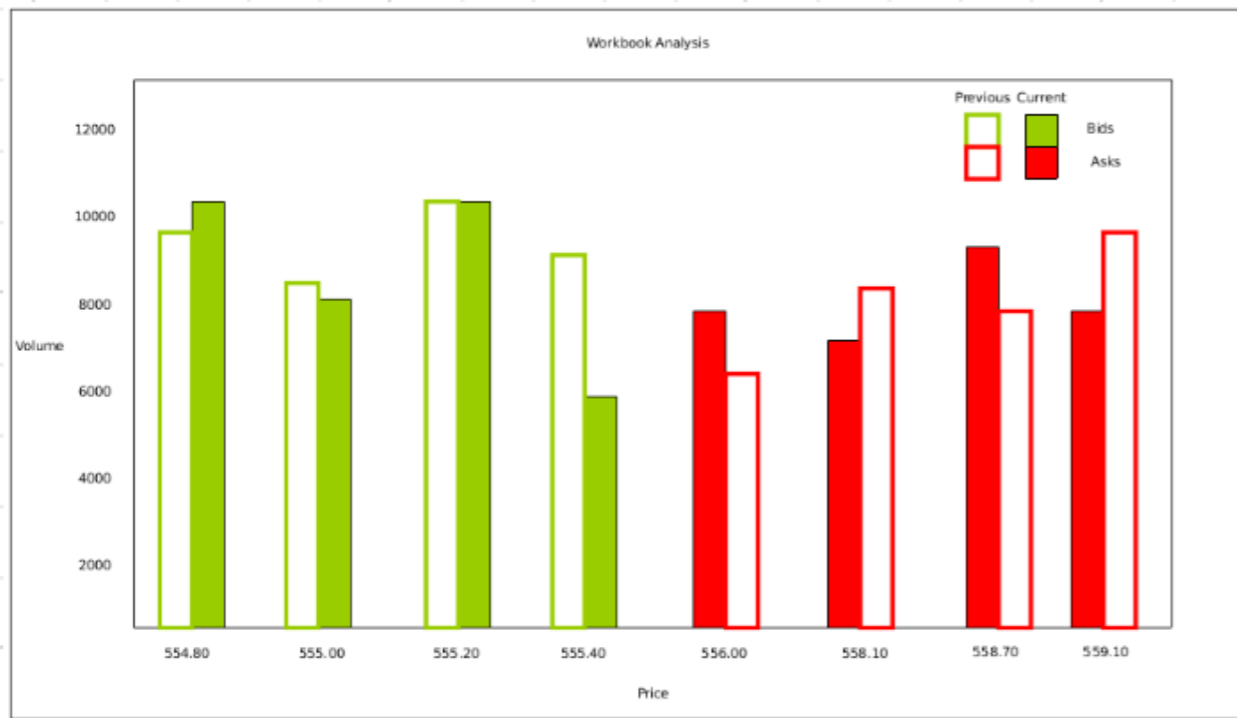


Levels:

Show Volume



This mockup attempts to provide an easy overview of the best bid and ask and its evolution over time while still providing an overview of the volume. The change in volume over a period of time is also shown side by side for comparison with an additional view which shows what contributed to the change in volume.



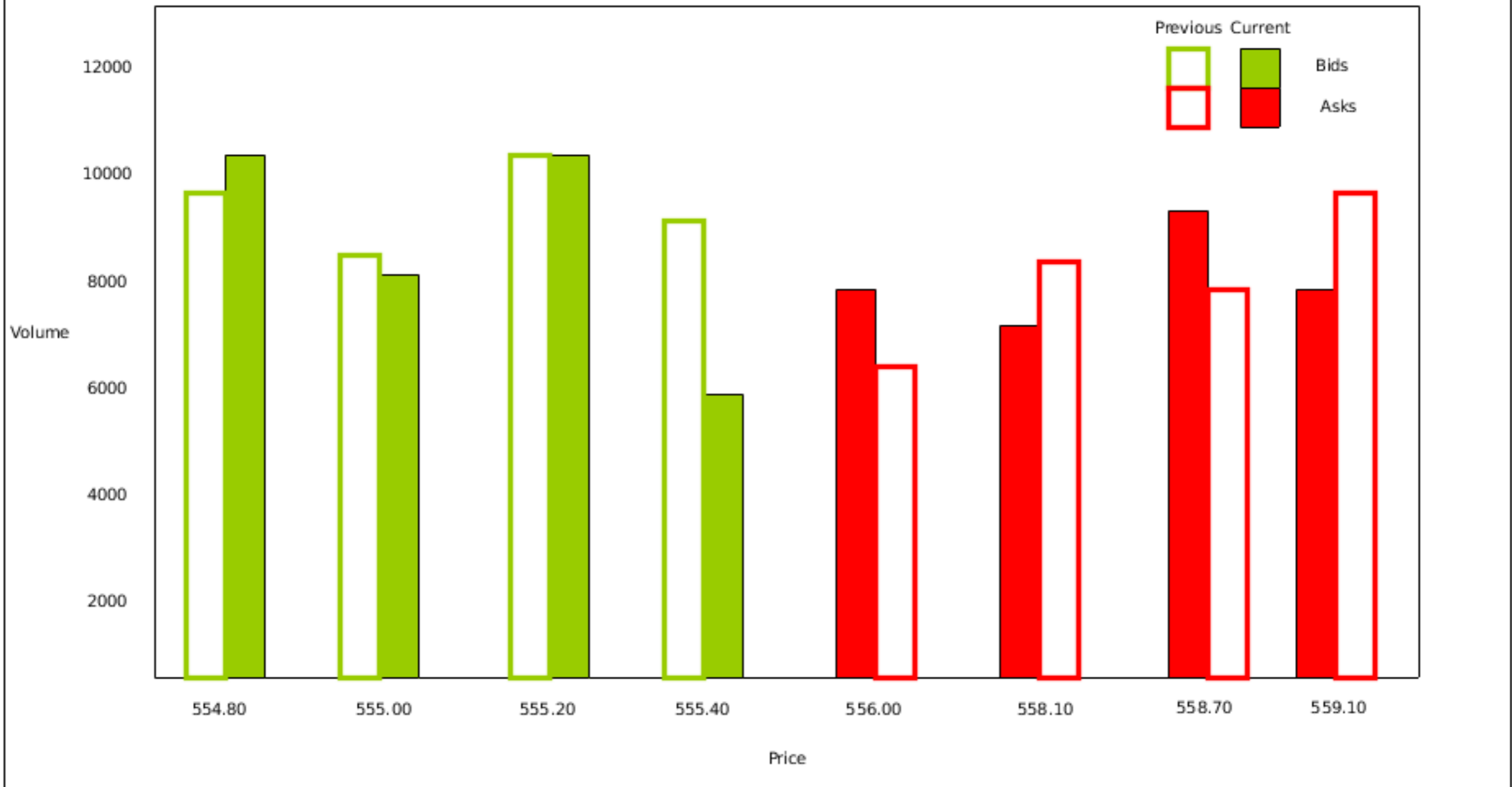
10

Levels: 5

The second view presents the user with a more detailed view of the order book at its chosen depth. The view shows the volume at the specific depth and keeps the last time periods volume for comparison. This allows for a clean overview to allow for analysis.

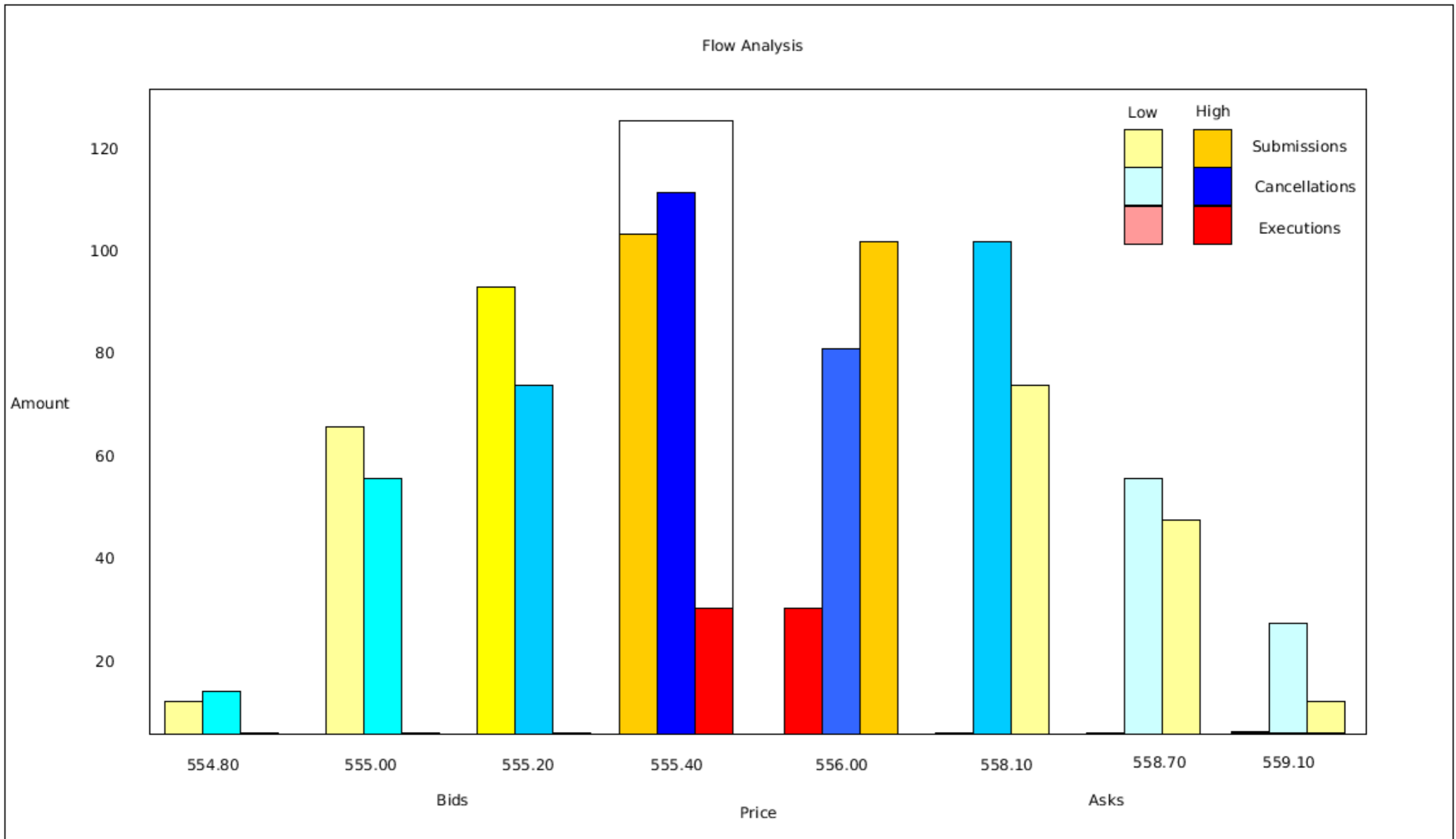
The last view allows one to look at a moment closer by providing details about the flow of events that lead to the change in volume. This view not only provides a comparison between the types of events but using shades of colors to indicate the cumulative recent activity of the specific type of event.

Workbook Analysis



Pros:

- Clean
- Provides an informational overview



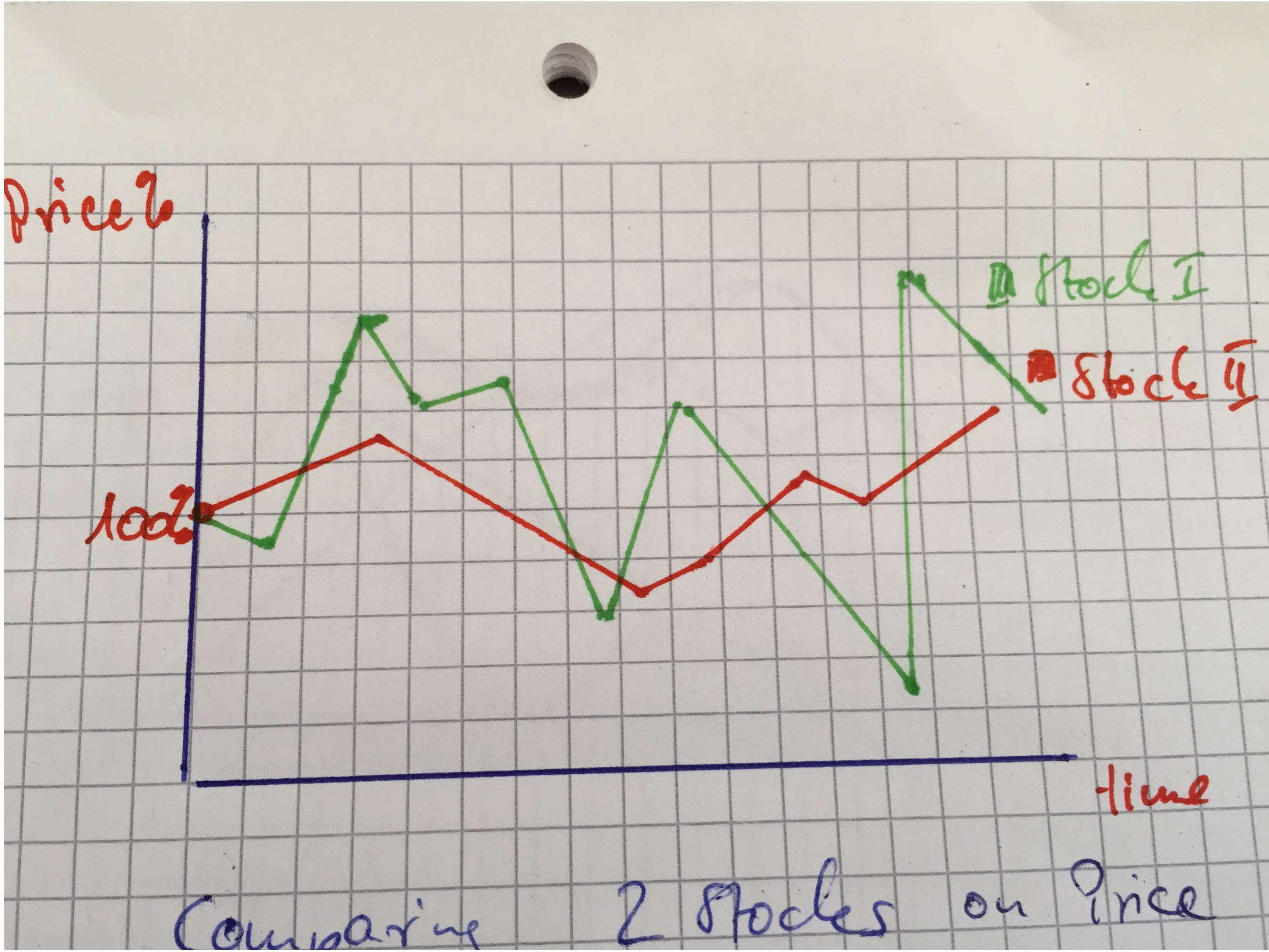
Cons:

- May get messy with many depths (limit depths to certain value)
- Can be confusing if legend is not followed
- If the prices changes drastically, many charts will appear to show the

Scenario 3

Comparison between multiple stocks

Comparison of 2 stocks on price



For an overview of multiple stocks a possible scenario could be to directly compare 2 stocks over a certain time frame, starting both at a base value of 100% and how they change over time. This could be used to determine if they somehow correlate and are influenced by each other as seen in this figure.

Comparison of 2 stocks on spread

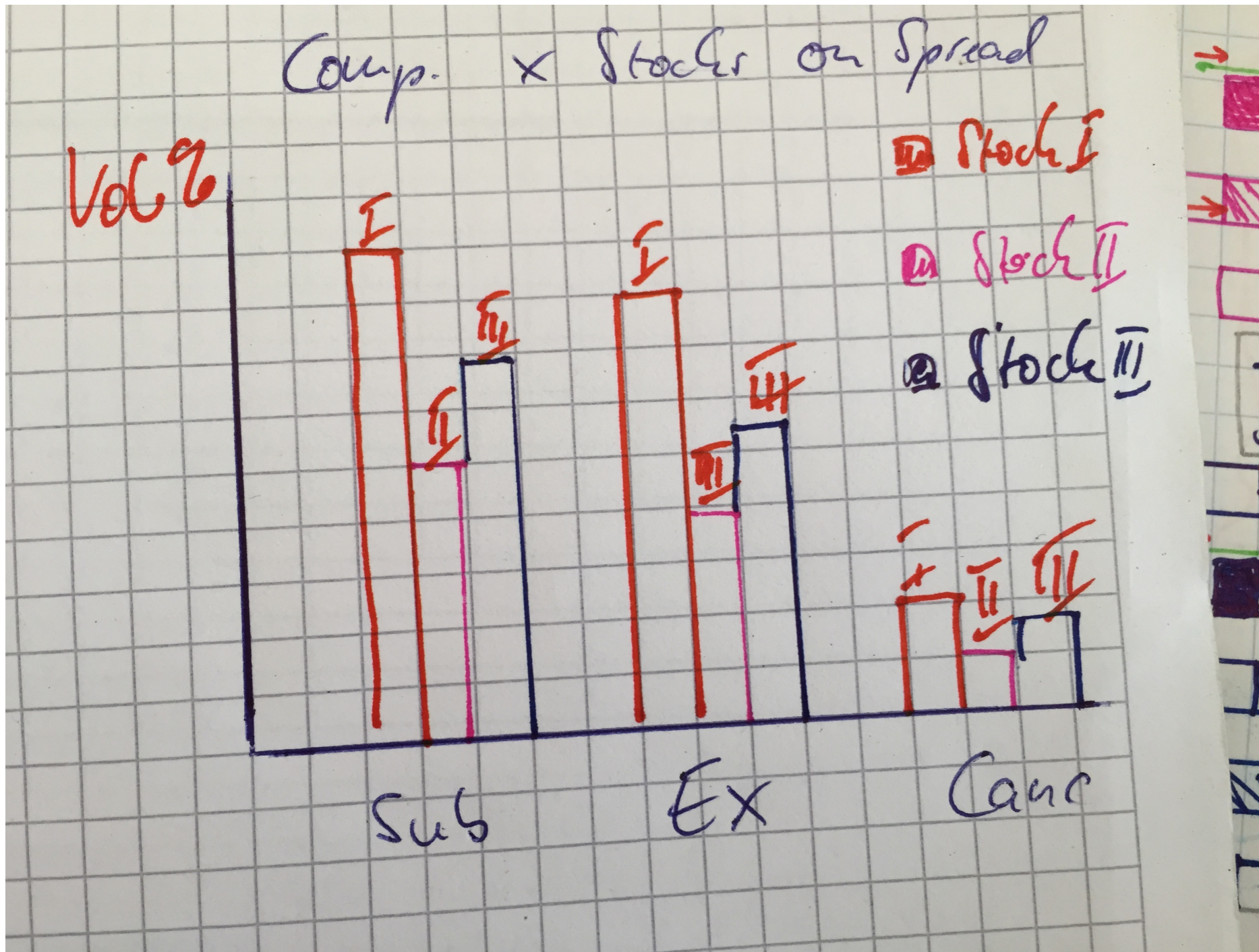
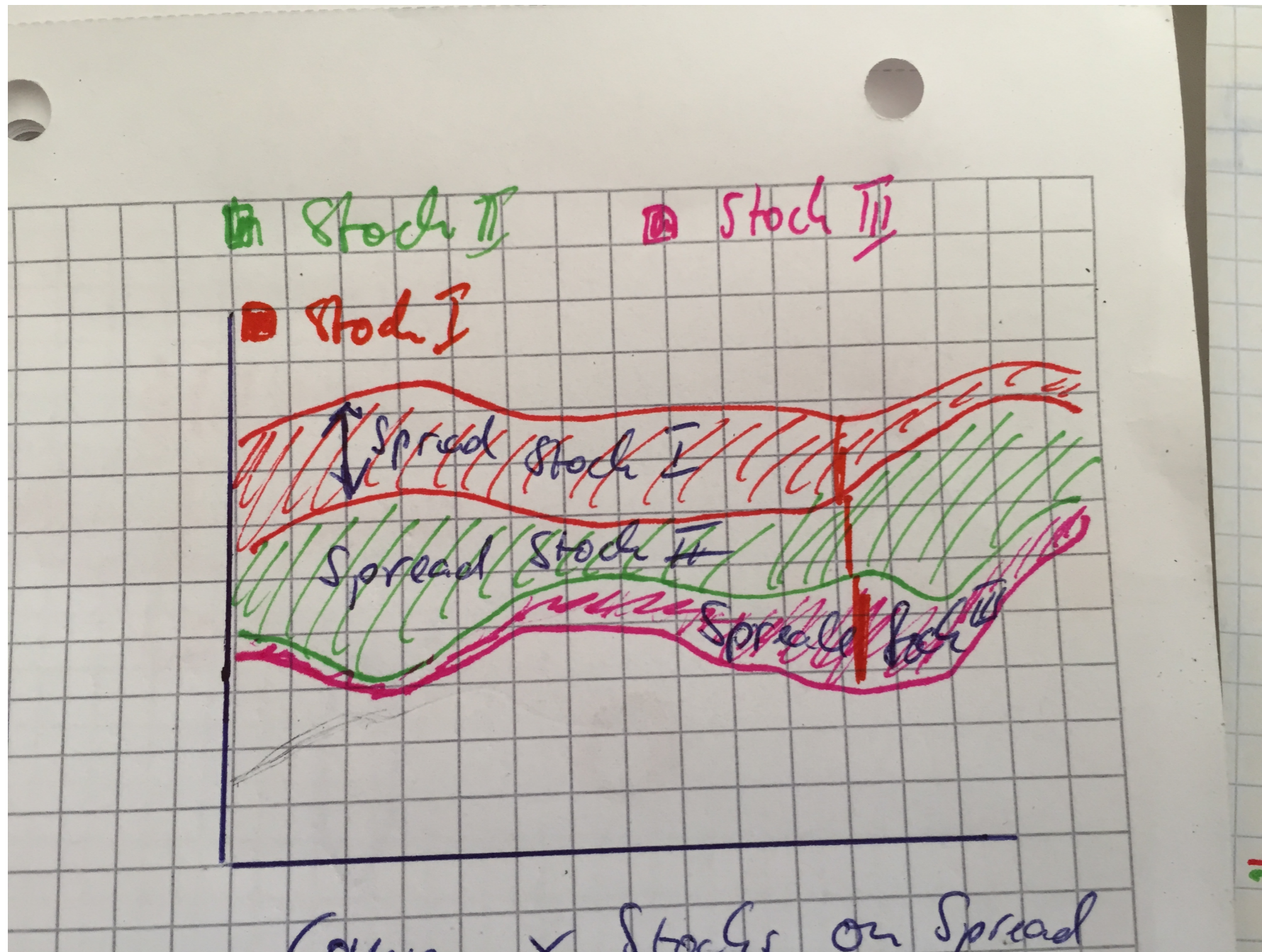


Figure 2 shows a comparison of 2 Stocks on relative volume and relative spread. The height of the bars show what percentage each bid and ask consumes in the current order book row analysed.

Stream graph of multiple spreads of stocks



Another view to propose could be a visualisation of different spreads of two or more stocks in a stream graph. The x-axis shows a variable time scale whereas the spreads of all stocks in a certain time is piled up as shown in this figure.

Multiple Stocks compared on the rel. volume of submitted, cancelled and executed orders

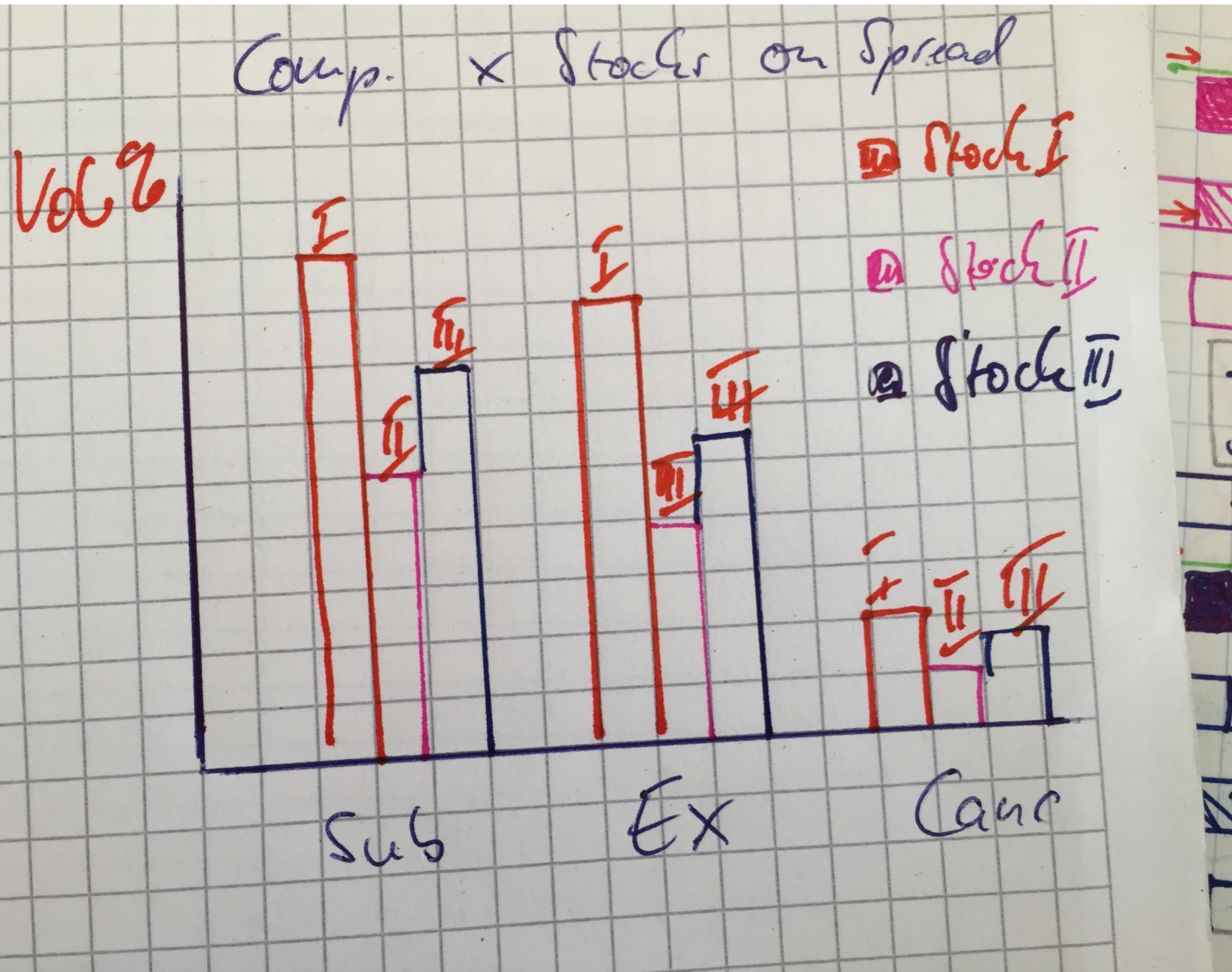
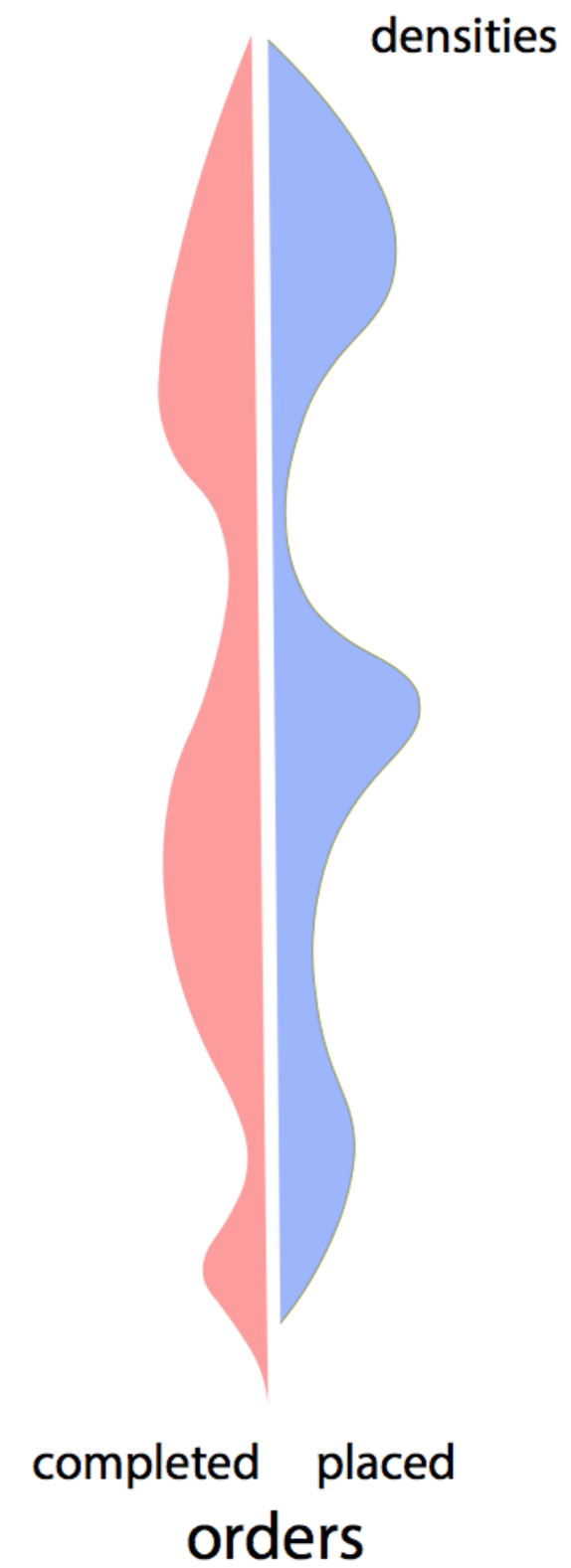
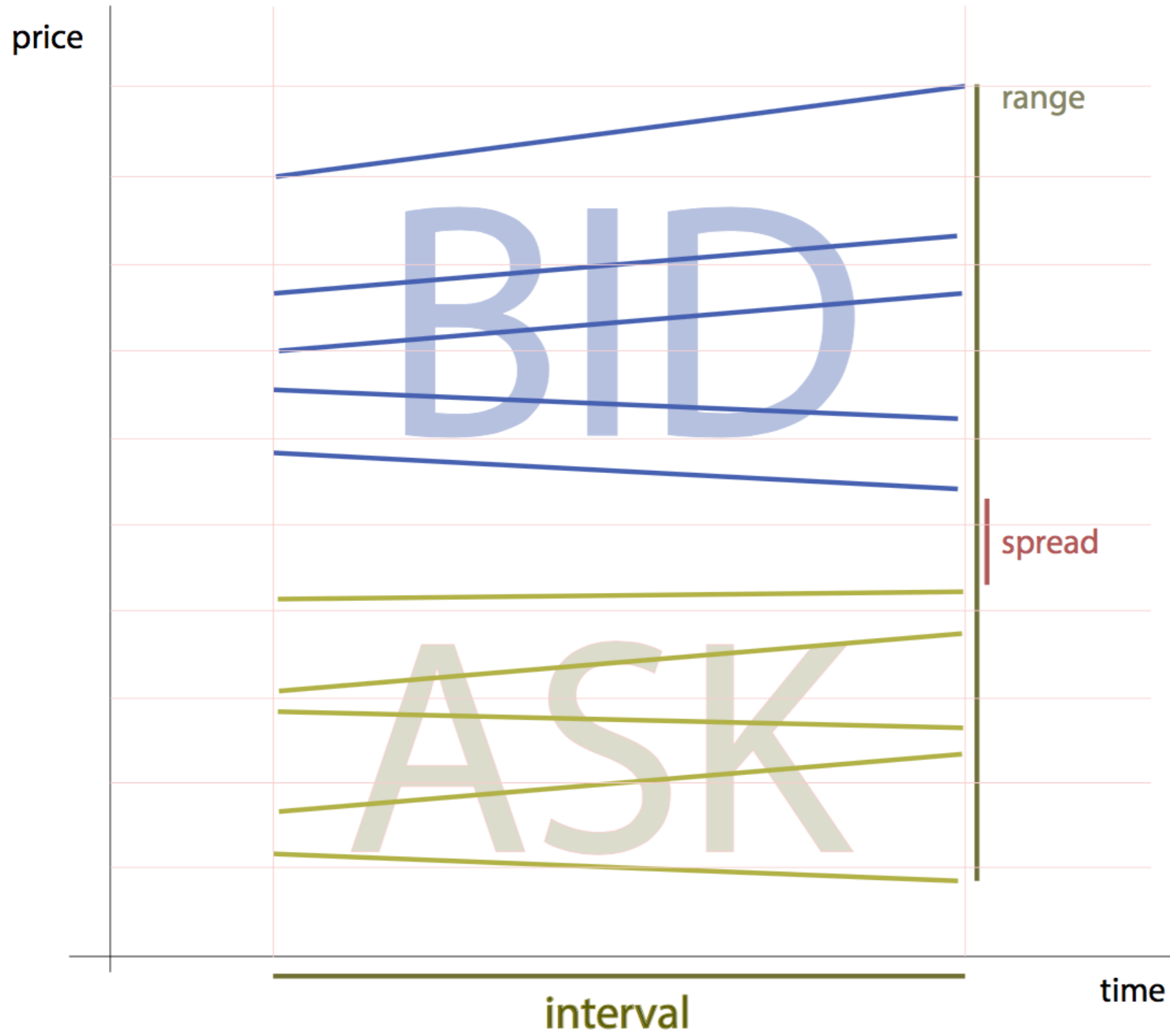


Figure 4 shows and compares multiple stocks on submitted, cancelled or executed orders in a certain time frame.

Scenario 4



Struggles with the data

normal interval data will be shown using standard line plots that allow us to detect possible correlations between the order distributions. the statistics will be visualized using a method that's inspired by the classic boxplots (mid of figure). the range is somewhat similar to the whiskers, the spread to the box, it should be easily understandable and is part of the general visual vocabulary - e.g. it's already used within many domains.

the last approach is the use of kernel density plots to visualize the distribution of placed and completed orders within the interval. the distributions can easily be compared utilizing humans perception of symmetry, multiple stocks can be compared by superimposing the specific densities. our main concern is that this might be a little bit harder to grasp at first, nevertheless the basic concept is very simple and shouldn't be that hard to understand.

another idea basically takes the last concept back to the line plots. looking at many different intervalls after another might give the impression of a film. in previous lectures we already heard that humans in general have some problems keeping multiple frames in memory so comparison is relatively / very hard. our idea was that there might be a way to include the information of previous interval summaries, so one gets an idea where we are coming from. we chose to add some sort of "heatmap" displaying the information of the past by decaying color intensity - e.g. cooling steel, etc... depending on the chosen weights one is able to infer on the past trading activity. we created an R toy example to assess whether this will work / be perceived as expected.