

Station 3: Model Design

a. What model have you designed and aiming to use in the implementation

Our model considers all features that we established in the last stage. This mainly includes historic price changes, investor sentiment, media sentiment and economic data. We take our portfolio that we established by the efficient frontier as starting point. Depending on the clients' risk appetite, either variance will be minimised or return maximised. As the client can select among multiple risk levels, intermediate allocations will be offered. The investor sentiment, which was calculated by assessing the weighting of other investors' portfolios will impact the weighting by up to 5% of every asset. We normalised the client data to modify our portfolios' allocation by only a moderate degree. The media sentiment on the other hand, was calculated by taking the average of all news for one asset on any given day and then subtracting the media sentiment score of the last working day. By doing that, we do not assess the absolute sentiment but the change in sentiment because we believe that this score is more predictive for future performance. We add up these changes in sentiment for the last 30 days to get our final media sentiment score that will be calculated into the portfolio. The media sentiment score can theoretically change the allocation of one asset by up to 10%. As sentiment is more important for a trend following strategy rather than a buy & hold strategy, we decided to weigh the media sentiment only half when applying it to our low-risk portfolios and we do not consider the investor sentiment for our low-risk portfolios at all. By doing that we remain more diversified on average, which will lower the volatility.

b. Any model assumptions and associated restrictions

We naturally assume that the data that was fed into our model is accurate and timely.

Given that lots of trading algorithms account for sentiment changes in lightning speed, some of the news will have already changed the stock price before our allocations are adjusted. We considered all news of the last 30 days because we assume that news will affect the stock price longer-term.

We also assume that the market dynamics will only change slowly over time. Our base portfolio before adjustments is based on the covariance of assets, which are naturally dynamic. To maintain a portfolio with relatively low risk and high return, the dynamics between assets must not change drastically within short time frames. To mitigate this trend, the efficient frontier needs to be recalculated regularly.

c. Any restrictions, computing speed, capacity, accuracy issues

So far, only significant delays occurred when visualising our portfolio strategy in Station 4. In that case we calculated the theoretical risk, return and Sharpe ratio for 5000 different allocations that we plotted in a graph that we display in the wireframes. Due to the low number of assets that we currently use in our model, the delays are relatively small. Despite that, we assume that as more assets will be added in the future, more delays will occur. Particularly when calculating the allocations that maximise the return, the time will exponentially increase, as we add more assets.

While, our portfolios are pretty accurate at any given time, due to the constantly changing covariance, accuracy is only theoretical in our case. We believe that monthly rebalancing is a good compromise between accuracy and transaction costs. Regardless, modern portfolio theory is viewed upon very critically in this day and age. The 5 year timeframe that we used for our model is hardly enough to establish a long-term correlation between our assets. Lastly, the influence of the sentiment was modified in a way that it's impact is neither too strong nor too little. However, it is difficult to exactly determine the right amount of influence that the sentiment should have, particularly because the efficient frontier that was calculated based on historical prices considers all factors including sentiment. Hence, we do not want to strengthen the multicollinearity that we experience as part of the efficient frontier and the current news. At the same time, no back tests were performed to ensure that the adjustment of the sentiment score is reasonable.

d. What do you expect to see in model implementation

When implementing our model, we will use all features from the previous station 2. Not all of the information obtained in station 2 will be directly displayed to the user, even though the final portfolio weights that are displayed on the platform will be shown. We try to dynamically integrate all useful information obtained in station 3 in our final product. Most of the information will be used to create suitable graphs in station 4. These include graphs that display investor sentiment, media sentiment, a donut chart that displays the industries that the companies work in, historic performances and expected returns and volatility. These charts include most of the information calculated in station 3. In some cases, such as the expected return and the economic data, we provided additionally the hard numbers but considering that the platform should promote a more passive investing approach, we tried to be as visual as possible.

e. Do you see any boundaries of the model

Currently, there is only a number of 10 assets implemented. This number will naturally increase to offer more choices, higher returns and more diversification. At the same time however, this will slow the system down and make the calculations of optimal portfolios more expensive. We previously discussed many boundaries that include the limitations of modern portfolio theory, the fact that sentiment adjustments in response to news are implemented very fast and the fact that we do not even now if the sentiment score is improving the model. Regarding the sentiment, we could also assume that all news are immediately priced in and by the time our model updates the allocations, we prefer to increase the allocations to stocks that are out of favour as we expect a comeback (mean reversion). These 2 strategies do the exact opposite and both can be justified easily. Hence, it is risky to implement our current strategy without doing further tests that confirm the outperformance of our strategy over a longer period of time.

f. How would you define Station #3 from Data Management Perspective

We use station 3 to aggregate the results of our station 2. Station 2 outputted various features independently. However, as these are independent, there is no unanimous solution. We import all the DataFrames and other data structures that we established in station 2 into station 3 and try to combine the features by concatenating DataFrames or adding up the changes in allocations. In our case, we commonly had to normalise the data, as well as divide them by common factors to be able

to combine the scores. At the end we will return only the weightings to the main function as this is the result that is needed by the client. Practically, station 3 will also return other objects that we will use in our implementation to give the user additional information.

Station 4: Model Implementation

a. Product Design

The frontend of our model has a modern and colourful touch. This is because it is directed at alternative and young people that do not want to spend too much time with their investments. After logging in with an email and password, the user has a bar on the left, where they can be redirected towards the risk, asset or sentiment page. For the risk page, the user can move a slider, which indicates, which risk is selected. Information regarding the allocations that are suitable for the selected risk can be found. These include a summary and core features such as expected returns, the weighting of each asset, the historic performance of that strategy and the industry exposure. This information will naturally change when a different risk is selected.

The asset page will display the historic performance of each asset, the fluctuations of daily returns of each asset, as well as information about macroeconomic factors. If these macroeconomic factors indicate a poor outlook, then the user will be informed by these trends. At the top of the page, there is a bar where users can select an asset that they would like more information on. When clicked, the same information will be displayed for that one asset in particular

The sentiment page has a similar structure. On the top, the sentiment for each asset is displayed, both verbally and graphically, for both investor and media sentiment. When one of the assets is selected, then the bottom part of the page shows how the allocation of that asset changes as sentiment is added to the original unadjusted portfolio using a waterfall diagram.

b. What steps you took when implementing this solution

To implement this solution, we first asked ourselves what customers we would like to attract and what solutions these customers are looking for. As stated earlier, we would like to attract young people that are not interested in spending time to invest actively. When our target customer was established, we asked ourselves what these clients would be interested in and what information we should display to give the user enough information so they can make an informed decision about what strategy and risk level they want to take. Also, the information displayed should inspire confidence in our product. We are particularly transparent, so that our customers understand and appreciate what we are doing.

In practice that meant that we calculate the weighting of the portfolio according to modern portfolio theory first. Then we use our scores of the different features that were calculated in station 2 and modify our weightings accordingly. We can create graphs displaying these changes. Similarly, we can make graphs specifically to point out what output we get from our features. For example, we specifically display the investor and media sentiment, while at the same time we show how these sentiment scores change the weighting of the asset.

The frontend started by deciding on what colours are primarily used to make the program homogenous. We agreed on using purple, silver and yellow to give the site a modern feel while also

offering strong contrasts. We decided to use a bar to help the user navigate through all different pages of the program. We wanted to allow the user to give inputs on every page while not overwhelming them with too much input or too much information. That is why we decided to allow inputs on the top or top left corner, while delivering information around it.

c. What difficulties you faced

Our main challenge was to determine what information is useful to provide. We considered displaying more graphs such as a normality check. However, we ultimately believe that this information will not be useful for the clients that we are trying to attract. We would like to deliver enough information to convince our clients that our model considers enough factors without overwhelming the customer. Other difficulties were the balance between a modern, juvenile look and a professional clean interface. It is easy to make the interface too colourful, so it repels customers. To avoid that we consider allowing other colour options in future iterations of the project.

d. What steps do you recommend applying when introducing this financial tool/product to your clients

We think that the most important step when introducing this program is to select the right prospective client. The correct prospective client is the person, who would rather not want to interact with it at all, but at the same time is reasonable enough to understand the importance of long-term investing.

Additionally, we would try to show all prospective customers how simple the program is to use. The whole software can be used by applying only 3 steps: 1) register, 2) transfer money, 3) select your risk profile. Every customer should have 5 min to help themselves to a better financial future.

Lastly, we would introduce some simple research that confirms that our strategy is valid and that our platform is trustworthy. At the same time, we need to stress that investing responsibly is key, and every platform including ours has limitations. Past returns do not guarantee future returns.

Once a customer is willing to try it, the importance of selecting the right risk profile should be stressed. The rest of the program is very intuitive with the navigation bar on the left, so we doubt that much further explanation is needed.

e. Describe your customer journey

The customer is initially reluctant to use the service as they are not interested in money management and have difficulties trusting in financial institutions. The customer will slowly familiarise themselves with the product by registering and looking at the information provided on the website. Due to the information found on the "About us" page, the user feels more comfortable due to the professional approach taken and the methods deployed. They decide to transfer some small amount of money onto the platform. On the risk page the user then selects their risk appetite. As there is a short summary explaining what the risk level indicate, the user feels confident that they made the right choice. They can immediately see in which companies and industries they invest. As the user heard about all companies but does not know anything about the company as an investment, they continue to click on the next page, where they inform themselves about the

different assets that they could invest into. They then watch TV in the evening and realise that there were some negative news about one of the companies that they invest into. They go back to the platform to check the sentiment of the company. They happily realise that our program already adjusted the weighting because of the unfavourable outlook. Due to the automation of the platform our user decides to only check his portfolio from time to time. One month later, when they log in they realise that their portfolio already grew by 5%. Pleased with the results, they decide to inform their friends about the platform, who are happy to take their friend's advice and check out the platform themselves.

This is a typical story that a typical target user of our platform would experience. Obviously, there might be initial losses but as the market trends upwards, profits are likely to occur after some time.

f. Wireframes / FIGMA design

Our wireframes were implemented in MS PowerPoint as we were more familiar with the tool. We implemented one bar on the left that serves as navigation pane. We usually allow some kind of input in the upper half or upper left corner of each page. Then we split the rest of the page in a rectangular fashion, in which we put some information that is related to the information displayed on the page. The information displayed changes depending on the input given. Users can select which asset they would like information to, and then the information provided specifically addresses this one asset. We broadly have 4 categories: One page providing information about our service, one page on which the user can select their risk appetite, one page devoted to the assets and one page devoted to the sentiment. Further details were explained above.

The design is very prominent and should indicate a different feeling than financial platforms typically have. We did this specifically to address our clients, who do usually refrain from accepting too many financial services.

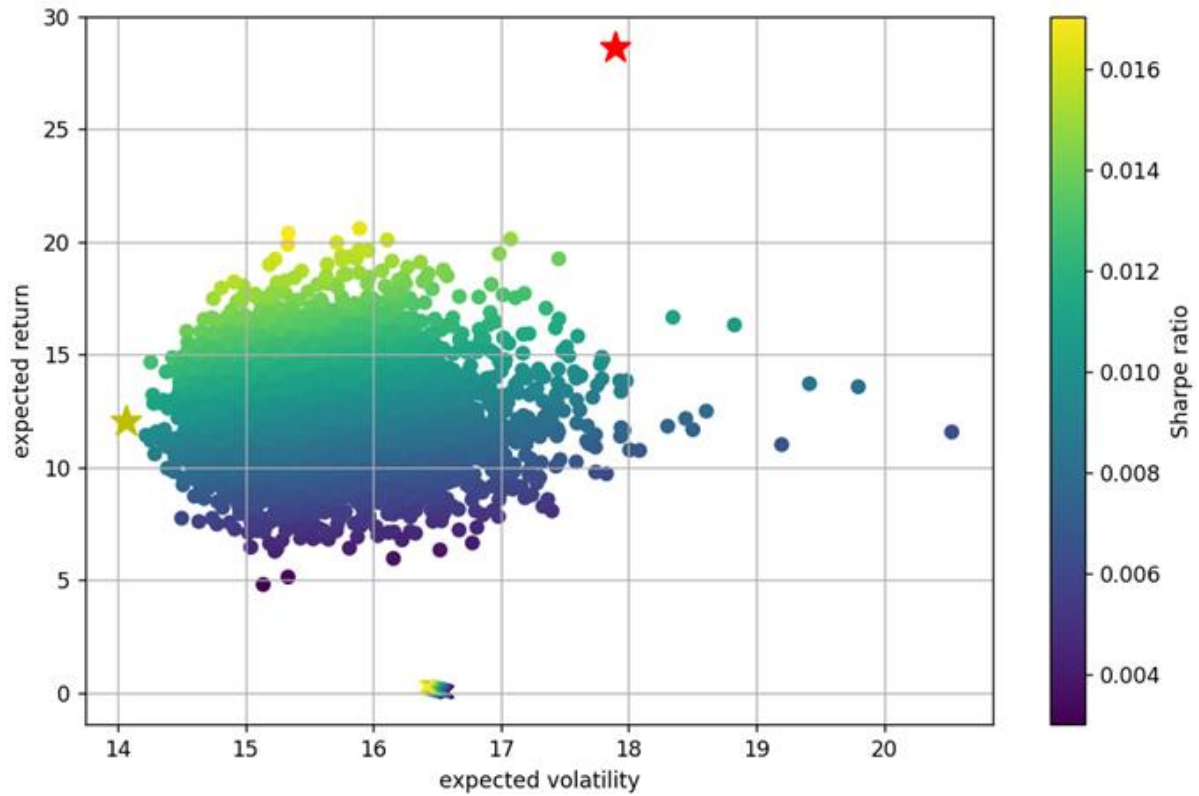
g. How would you define Station #4 from Data Management Perspective

Our station 4 uses the input from station 3 and develops ways how to display the information obtained. While all the information obtained in station 3 are sufficient to theoretically explain the program to someone else and provide solutions, they are just numbers, that are hard to visualise. Hence, we need to create graphs and other tools that illustrate our results better. We use the results to create a homogeneous product that the user can interact with. This includes the frontend, graphs and navigational tools. By developing the wireframes, we get a clear picture about how our end-product will behave and investors can assess how promising the final product will be.

Appendix:

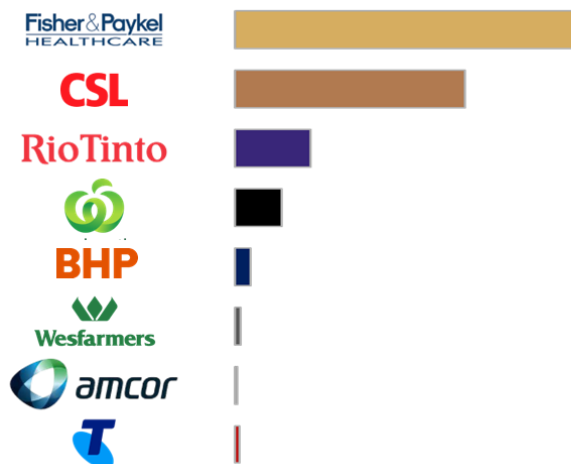
Most of the appendices can also be found in the wireframes.

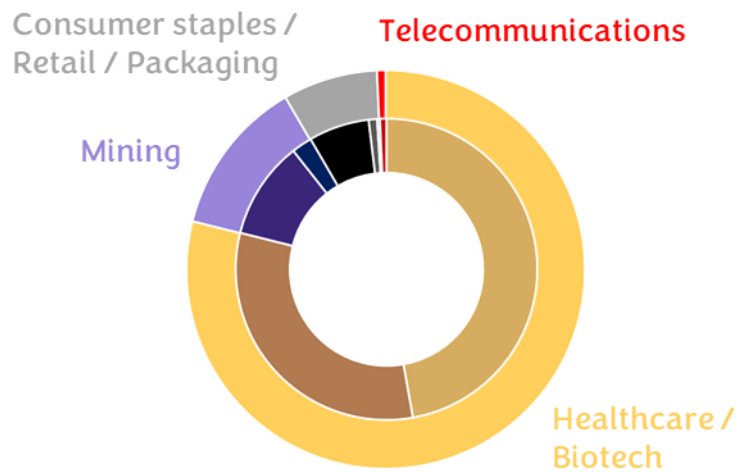
Appendix 1: Efficient frontier



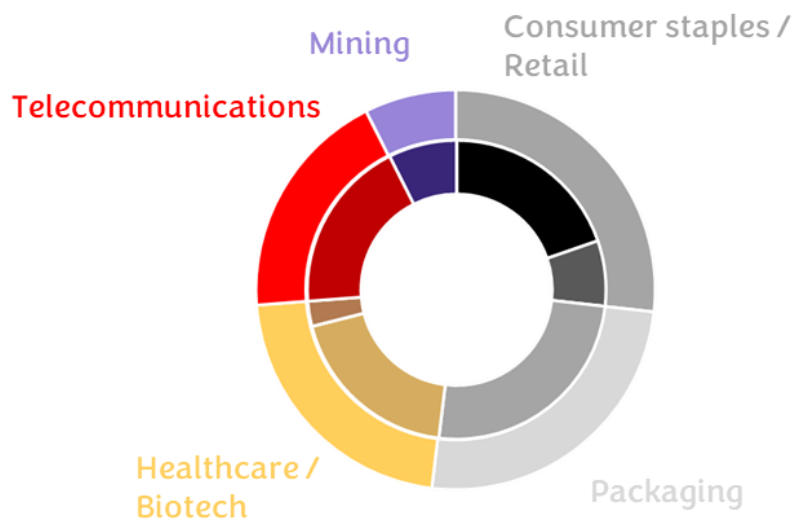
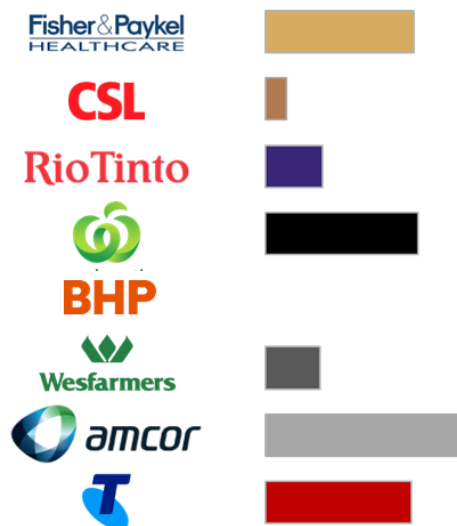
Appendix 2: Portfolio allocations

High-return portfolio allocations:

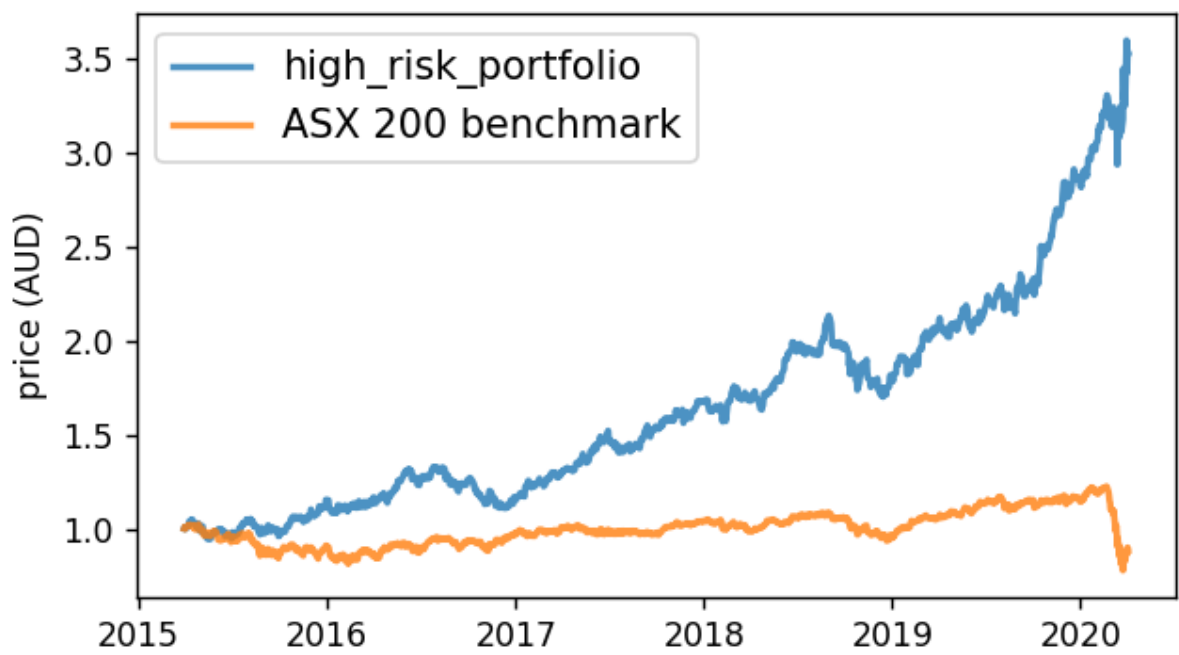
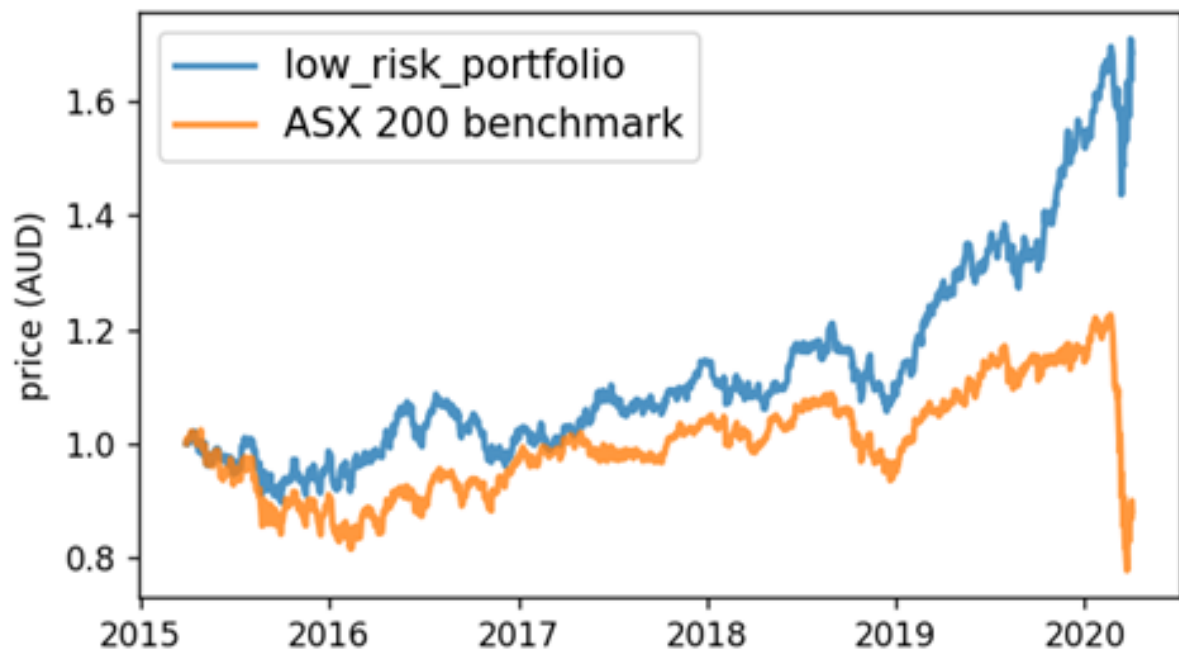




Low-risk portfolio allocations:



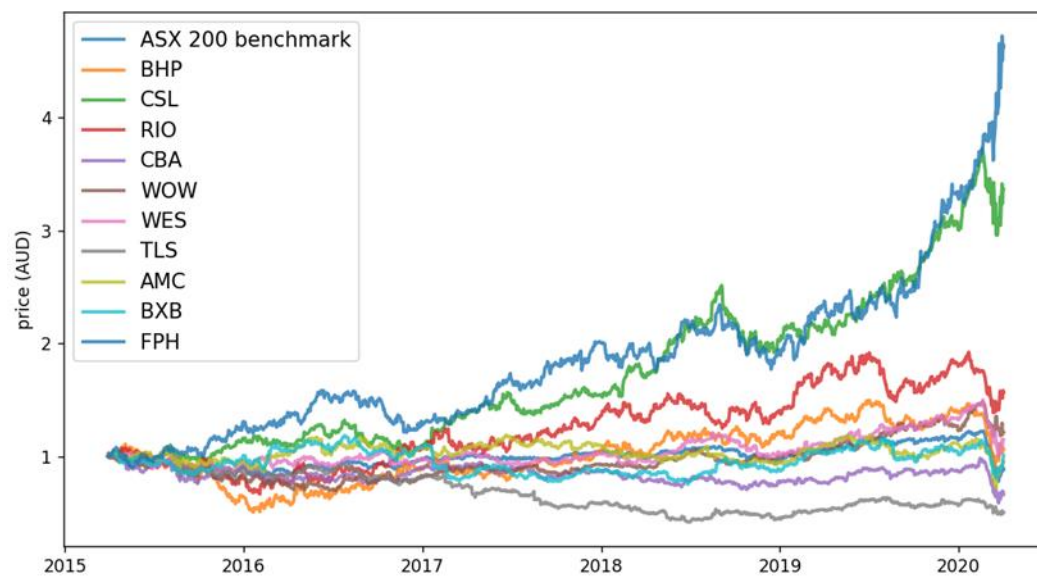
Appendix 3: Historic returns



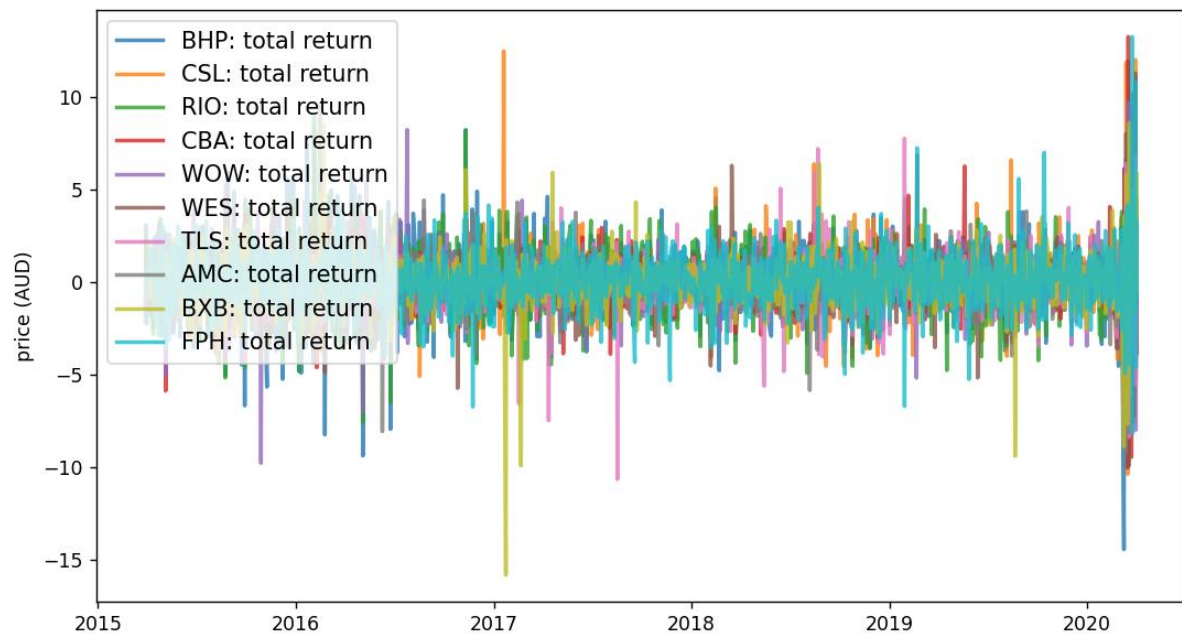
Appendix 4: Portfolio comparison



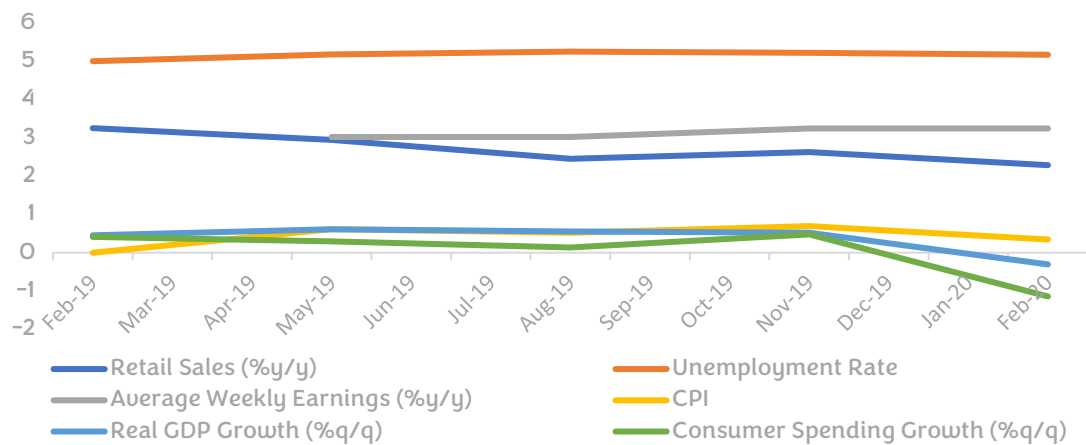
Appendix 5: All asset historic performances



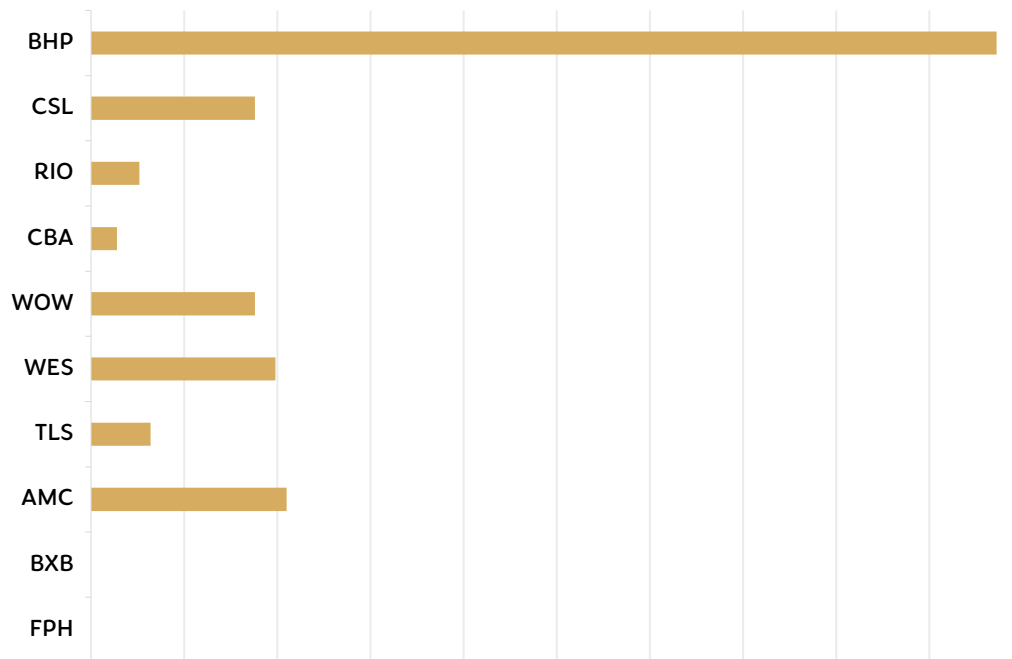
Appendix 6: All asset daily return fluctuations



Appendix 7: Macroeconomic trends



Appendix 8: Investor Sentiment



Appendix 9: Media Sentiment

