

**BT4016  
Final Report**

AY21/22 Semester 1

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### **1**

For our four portfolios, our optimal portfolios with subjective adjustments did the best, followed by our optimal portfolio without adjustments, our best portfolio, and our worst portfolio. The standard deviation of our portfolios also follows the same order. The return and standard deviation of our optimal portfolios did significantly better than the actual mutual funds, as we increased the weight heavily on stocks that did well in 2021, such as NVDA which more than doubled its price. The higher YTD returns inevitably led to a higher standard deviation for our optimal portfolios. For the return in October 2021, the portfolio with optimal adjustments and optimal portfolio came in first and second respectively. However, The return of our worst portfolio, BFOCX, in October 2021 was better than that of our best portfolio (FELAX). This was because BFOCX had dipped to an all-time low in May 2021, and only rose back to its original price again in October 2021.

Comparing the YTD return of our best portfolio and our adjusted portfolios, the adjustments definitely did help us to increase our returns. Many of the stocks that we analysed to perform better had their weights drastically increased, just below the threshold, while many stocks that we analysed to perform poorly were dropped from the portfolio entirely.

Another reason why the returns might seem so large as compared to the original FELAX portfolio was that in calculating the returns, the stock prices from 2020 (from mid-term report) of the project were used. Meaning, these stocks were purchased much cheaper, and in a larger quantity when we adjusted the portfolio for 2020.

|  |  |  |  |
| --- | --- | --- | --- |
| Portfolio | YTD Return | Standard Deviation | Oct 2021 Return |
| Best (FELAX) | 93772739 | 23296553 | 31781319 |
| Worst (BFOCX) | 33904436 | 17206881 | 38111112 |
| Optimal (FELAX) | 144661057 | 27592050 | 68370087 |
| Optimal + Adjustments (FELAX) | 224194511 | 49089542 | 94941764 |

### **2**

|  |  |  |  |
| --- | --- | --- | --- |
| Security Name (Arranged in order of decreasing weight) | ticker | Weightage rank change (negative = decreased, NA= newly added) | Price change in 2021 mar compared to 2020 oct (%) |
| NVIDIA CORP | NVDA | 0 | 6.496329982 |
| MICRON TECHNOLOGY INC | MU | 7 | 75.22844656 |
| N X P SEMICONDUCTORS N V | NXPI | 1 | 49.00828893 |
| LAM RESH CORP | LRCX | 6 | 74.00608045 |
| INTEL CORP | INTC | -2 | 44.53477868 |
| ON SEMICONDUCTOR CORP | ON | 5 | 65.84296532 |
| MICROCHIP TECHNOLOGY INC | MCHP | 1 | 47.71602589 |
| QUALCOMM INC | QCOM | -6 | 7.482166018 |
| MARVELL TECHNOLOGY GROUP LTD | MRVL | -3 | 30.5785124 |
| BROADCOM INC | AVGO | -5 | 32.61447816 |
| TEXAS INSTRUMENTS INC | TXN | 2 | 30.70751781 |
| Fidelity Cash Central Fund | LP4020 | 15 | -0.00000006552513644 |
| ADVANCED MICRO DEVICES INC | AMD | -1 | 4.263514411 |
| APPLIED MATERIALS INC | AMAT | 7 | 125.5613709 |
| TERADYNE INC | TER | NA | #N/A |
| CIRRUS LOGIC INC | CRUS | -2 | 23.11601568 |
| K L A CORP | KLAC | NA | #N/A |
| CADENCE DESIGN SYSTEMS INC | CDNS | NA | #N/A |
| INPHI CORP | IPHI | -3 | 27.65455066 |
| JABIL INC | JBL | -1 | 57.3928787 |
| XILINX INC | XLNX | -14 | 4.389586317 |
| NOVA MEASURING INSTRUMENTS LTD | NVMI | NA | #N/A |
| ANALOG DEVICES INC | ADI | -5 | 30.83607526 |
| DIODES INC | DIOD | -1 | 38.05983054 |
| MACOM TECHNOLOGY SOLS HLDS INC | MTSI | 3 | 58.95890411 |
| ADVANCED ENERGY INDUSTRIES INC | AEIS | 0 | 61.80524678 |
| MONOLITHIC PWR SYS INC | MPWR | NA | #N/A |
| Samsung Electronics Co Ltd ORD | 005930 | 4 | 44.77966707 |
| FLEX LTD | FLEX | -5 | 29.39929329 |
| SYNAPTICS INC | SYNA | 1 | 76.62710317 |
| ARRAY TECHNOLOGIES INC | ARRY | NA | #N/A |
| MAXLINEAR INC | MXL | -2 | 28.89561271 |
| ALPHA & OMEGA SEMICONDUCTOR LTD | AOSL | 1 | 106.1790668 |
| SMART GLOBAL HOLDINGS INC | SGH | -1 | 74.38423645 |
| UNIVERSAL DISPLAY CORP | OLED | -15 | 19.39387827 |
| ENPHASE ENERGY INC | ENPH | -21 | 65.3175655 |
| A S E TECHNOLOGY HLDG CO LTD | ASX | -1 | 68.49015317 |
| SKYWORKS SOLUTIONS INC | SWKS | -3 | 29.86057046 |
| TTM TECHNOLOGIES INC | TTMI | -17 | 22.15669756 |
| Diamond Foundry Inc PFD P/P |  |  | #N/A |
| Smart Global Holdings Inc 2.25% 15-FEB-2026 | 83205Y | -2 | 45.11529145 |

positive 7 in priority means the weight increased over 7 other stock

Portfolio manager: Adam Benjamin

Versus the MSCI industry index, stock selection in the semiconductors group was the primary reason for the fund's outperformance. Picks in semiconductor equipment helped to a lesser extent.

Chip-related stocks got an additional boost from the early-January passage of the National Defense Authorization Act, which included authorization – but not actual funding – of federal incentives to promote semiconductor manufacturing and federal investments in chip research via the CHIPS for America legislation embedded in the broader defense act.

The biggest change was that Adam decided to lessen the fund's underweighting in semiconductor equipment and take down its non-index exposure to electronic manufacturing services. This is because of the recent global shortage of semiconductors, as well as concerns regarding the significant reliance on Taiwan for foundry capacity and the previously mentioned CHIPS legislation, are all pointing to the likelihood of a significant increase in production capacity in the U.S., Europe and Asia, driving the need for more semiconductor capital equipment. Thus, he decided to open new positions in Teradyne, Nova Measuring Instruments and KLA, and added to stakes in Lam Research and Applied Materials.

There was success with a previous overweighting in Enphase Energy. The company designs and manufactures software-driven home energy solutions that span solar generation, home energy storage, and web-based monitoring and control. The fund's position had increased greatly amid a strong rally in solar stocks, aided by Joe Biden's victory in the November 3 presidential election. Biden is a strong advocate of alternative energy. Adam considerably reduced this position as the stock advanced.

Underweighting semiconductor equipment, by far the stronger of the two primary MSCI index groups, detracted, as did exposure to several non-index groups, such as electrical components & equipment, technology hardware, storage & peripherals, and electronic manufacturing services. The fund's small cash position also hurt in a strongly advancing market. Among individual holdings, a meaningful underweighting in Applied Materials made this semiconductor equipment manufacturer the largest relative detractor, as it advanced roughly 125% during the period. The stock was another beneficiary of Joe Biden's success in the 2020 presidential election, as most investors believed he would have a more tempered stance toward China, which could help chip equipment sales to that country. The fund did have exposure to this theme through other holdings, but unfortunately, as a group, they mostly underperformed Applied Materials. Underweighting PC chipmaker Advanced Micro Devices also worked against the fund. Demand for PCs was strong during the depths of the pandemic, as people bought additional computers to accommodate working and learning from home.

Risk-Return of Portfolio vs New portfolio:

To calculate the risk-return of the new portfolio and original portfolio of FELAX, we used the sharpe ratio, which was calculated here by taking the (percentage returns - risk-free rate)/ percentage standard deviation.

Original FELAX Sharpe Ratio for 1 Jan 2021- 31 Oct 2021: 3.329

New Portfolio Sharpe Ratio for 1 Jan 2021- 31 Oct 2021: 4.310

### **3 Hedging by Options**

#### **3.1 Highest Downside Risk: QCOM**

From the perspective of 18th October:

The stock price ofQualcomm Inc. had a strong 2020 and reached its 52-week high of $168 in early-2021, but has since dropped from that level, bleeding to a bottom of $122 in 12-Oct with an almost 17% drop between September and mid-October. We suspect that this was due to the announcement in mid-September 2021 that Qualcomm’s mmWave technology was not included in non-US iphone 13 models, which drove down prices given that Apple contributed to over 10% of it’s revenue for the past 3 fiscal years.

Qualcomm earned 63% of its core QCT segment revenue from handsets. This heavy reliance on the smartphone industry and Apple is worrying. The handset industry is a mature market with mid-single digit growth at best.

The Q3 End July earnings report showed continued stagnation in earning per share at $1.90 compared to $2.17 in its Q1 February earnings report.

Qualcomm’s key risks are slower than expected growth in the handset industry and a longer than expected time to diversify into non mobile-industries.

The next earnings report is due on the 3 November, options expiry on 5th November. The uncertainty in the future of Qualcomm, along with its relatively poor year to date performance compared to its competitors like Nvidia and AMD, give us reason to believe that the upcoming Q4 earnings report might be a buy the rumour, sell the news event which could lead to further capitulation. As such we decide to buy protective puts to hedge against the possible downside risk.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 18/October | Exercise Price | Implied Volatility (annual) | Daily Volatility | Sample Volatility (18 days) |
| ATM Puts | 130 | 36.65% | 2.308% | 9.792% |

|  |  |
| --- | --- |
| Number of Shares of QCOM in Portfolio | 210726 |
| QCOM Adjusted Close (on 18/10/21) | $130.12 |
| -1 Standard Deviation of Return from the Current Stock Price (Puts) | $117.37 |

Based on our estimates of sample volatility from the implied volatility of ITM options, we have decided to purchase these options on 18 October 2021 that expire on 5 November 2021.

|  |  |  |
| --- | --- | --- |
|  | Exercise Price | Cost |
| Puts | $117 | $0.5 |

During the sample period from 18 October 2021 to 5 November 2021,

|  |  |  |
| --- | --- | --- |
| Date | QCOM Adj Close | % Change |
| 18/10/2021 | $130.12 | - |
| 5/11/2021 | $163.03 | 25.29% |

Profits without protective put = 0.2529\*(130.12\*210726) = $6,934,443.82

Profits with protective put = 0.2529\*(130.12\*210726) - (0.54\*210726) = $6,820,641.77

From November 5th perspective:

QCOM closed up almost 25.29% in our sample period as investors continued to rally after the company’s strong Q4 earnings report on 3rd November that exceeded expectations with Earnings per share jumping up to $2.55 from the Q3’s $1.92. This rally was likely also spurred by strong optimism by Qualcomm CEO Cristiano Amon that it expects it’s semiconductor supply issues to be materially better by December, especially compared to its rivals like Intel which predicts shortages will last through 2023 or AMD which says chip supply challenges will persist until mid 2022.

This was a gamble by Qualcomm that paid off when in early 2021 it decided to direct resources to manufacturing their own processors and expanding their ability to source from multiple suppliers; This is in contrast to companies like Apple which relies on one supplier - TSMC for its own SOC’s.

#### **3.2 Most Uncertain Stock: NVDA**

We expect NVDA to be the stock with the highest volatility (uncertainty) in October 2021.

There is a possibility of a strong bullish trend in the price of NVDA with high upward volatility in October 2021 given the strong positive sentiment as we approach the Q3 earnings announcement. In August 2021, NVIDIA revenue was reported to be up 68% from a year ago, strongly driven by gaming and data center revenue which saw an annual increase of 85% and 35% respectively. Earnings per diluted share was also up 24% from the previous quarter. In addition, NVIDIA continues to innovate and upgrade its products as they introduced new and better performing GPUs and AI software and interfaces in the same quarter, further building positive sentiment.

Furthermore, the high demand for advanced chips in trending applications such as AI and cloud computing along with the increased digitization and transition towards 5G due to COVID-19 has fueled revenue for NVIDIA’s various enterprise hardware and software. As the industry races to revolutionize, the demand for more cutting-edge and better performing chips may continue for a long time to come, possibly stimulating NVIDIA’s further growth and expansion in the long run.

However, NVDA continued to trade around its 1-year high in the first few weeks of September and dropped 12% in the last week of September giving us reason to expect high volatility in the upcoming weeks and a strong trend reversal is still a possibility. This uncertainty and volatility leads us to implement an options straddle and purchase one put and one call for each stock of NVDA in our portfolio with the exercise price one standard deviation from the current stock price that expires on 5 November.

As of 18 October 2021,

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Exercise Price | Implied Volatility (annual) | Daily Volatility | Sample Volatility (18 days) |
| ATM Calls | 225 | 32.83% | 2.07% | 8.77% |
| ATM Puts | 220 | 31.38% | 1.98% | 8.37% |

\*Exact ATM options unavailable. Approximated using slightly ITM options.

|  |  |
| --- | --- |
| Num Shares of NVDA in Portfolio | 174023 |
| NVDA Adjusted Close (on 18/10/21) | $222.22 |
| +1 Standard Deviation of Return from the Current Stock Price (Calls) | $241.70 |
| -1 Standard Deviation of Return from the Current Stock Price (Puts) | $203.62 |

Based on our estimates of sample volatility from the implied volatility of ITM options, we have decided to purchase these options on 18 October 2021 that expire on 5 November 2021.

|  |  |  |
| --- | --- | --- |
|  | Exercise Price | Cost |
| Calls | $240 | $1.23 |
| Puts | $205 | $0.52 |

During the sample period from 18 October 2021 to 5 November 2021,

|  |  |  |
| --- | --- | --- |
| Date | NVDA Adj Close | % Change |
| 18/10/2021 | $222.22 | - |
| 5/11/2021 | $297.52 | 33.89% |

NVDA stock price rallied 33.89% during this sample period, showing that the upward trend has not lost momentum yet. A possible catalyst being Meta’s announcement to increase spending in data centers, servers and network infrastructure, driving share prices up 7% for the week. Meta also mentioned dedicating significant resources into developing the ‘Metaverse’ which would require augmented and virtual reality products and the chips that they run on. Such timely news seemed to keep the upward momentum going.

Without implementing the straddle, our holdings of NVDA would have gone up by 33.89% (i.e. dollar profit of $13,103,931.9) during this sample period.

With the straddle, our holdings of NVDA would have a dollar profit of $22,809,194.61 accounting for costs of purchasing the options and the profits of exercising the call options.

Profits = 13103931.9 – 174023(1.23 + 0.52) + 174023(297.52 – 240) = 22809194.61

Implementing the options straddle to hedge against uncertainty of NVDA stocks gave us a 74.1% increase in profits.

**APPENDIX**

<https://nvidianews.nvidia.com/news/nvidia-announces-financial-results-for-second-quarter-fiscal-2022#:~:text=Second%2Dquarter%20revenue%20was%20a,percent%20from%20the%20previous%20quarter>.

<https://www.forbes.com/sites/greatspeculations/2021/09/30/semiconductor-stocks-that-stand-to-gain-through-the-chip-shortage-and-beyond/?sh=3f0df27c6dee>

<https://www.nasdaq.com/articles/why-nvidia-stock-surged-23-in-october-2021-11-03>

<https://institutional.fidelity.com/app/literature/item/RD_QAA_121.html?pos=R>