Portfolio

GE2260 Introduction to Finance

Group 7

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Investment strategy

- The portfolio is divided into two parts i.e.: fixed income and growth stocks.
- The fixed income assets have minimal risks involved and reasonable returns.
- We believe there should be some amount invested in potential growth stocks with adjusted risk tolerance as they have high potential.
- The growth stocks have a high annual return with moderate risk involved. However, the industries chosen have huge growth potential in the future and can give very good returns in the long-run.

Formation of the portfolio

- 40% of the capital invested in Growth Stocks and ETF’s
- These Stocks and ETF’s have a high return rate with a moderate amount of risk.
- To mitigate the effects of risk even more hedging strategies may be used to off-set any potential losses with the trade-off of limiting returns.
- 60% of the portfolio is invested in fixed income assets
- The fixed income assets include bonds from different regions and territories with strong credit ratings.

Portfolio Overview

Security	Portfolio (%)
VanEck Semiconductor ETF (SMH)	6.96%
Green Energy Technologies ETF (NBET)	8.44%
Defense & Aerospace ETF (PPA)	2.68%
Metals & Mining ETF (XME)	2.48%
S&P500 Technologies (SPDR)	10.96%
Pharmaceutical ETF (PPH)	8.48%
US Treasury Bonds	30.00%
HK Green Bonds	30.00%

**Please refer to Appendix for clarity on data sourcing and calculations*

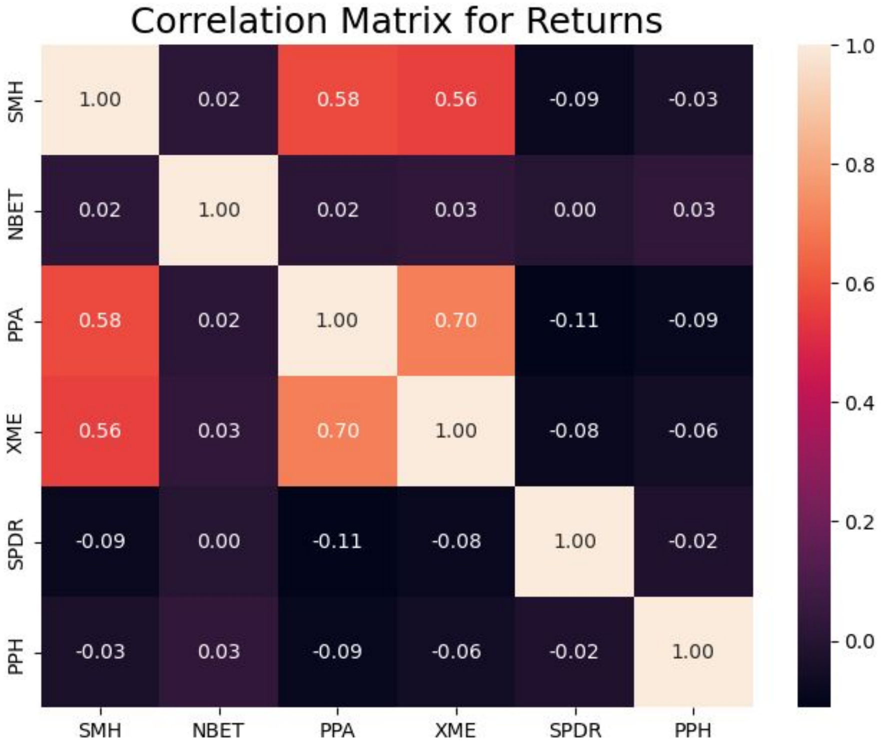
Fixed Income

- Fixed income investments are essential for providing stability and predictable returns in our portfolio.
- This segment focuses on minimizing risk while ensuring steady income.
- US Treasury Bonds:
  - Backed by the U.S. government, making them one of the safest investments available.
  - Regular interest payments offer predictable cash flow.
- Hong Kong Green Bonds:
  - Fund projects aimed at enhancing environmental sustainability and renewable energy.
  - Increasing interest in ESG (Environmental, Social, Governance) investments boosts the appeal of green bonds.

Growth Stocks

- These are stocks that have a very positive outlook for the future as they involve emerging technologies and industries.
- Such industries are chosen by considering the direction the world has taken for the future.
- Such directions include Environmental Sustainability through green energy and technologies.
- Moreover, technology sectors that include both hardware and software which will be used to fuel emerging technologies like Data Science and AI.
- Recent geopolitical tensions are also expected to rise, which is why investment in Defense and Aerospace sectors is also made.
- Some stable and essential securities are also taken that include precious metals and pharmaceutical.
- These stable securities may be affected less by recessions and downturns as they are essentials.

Diversity of our portfolio



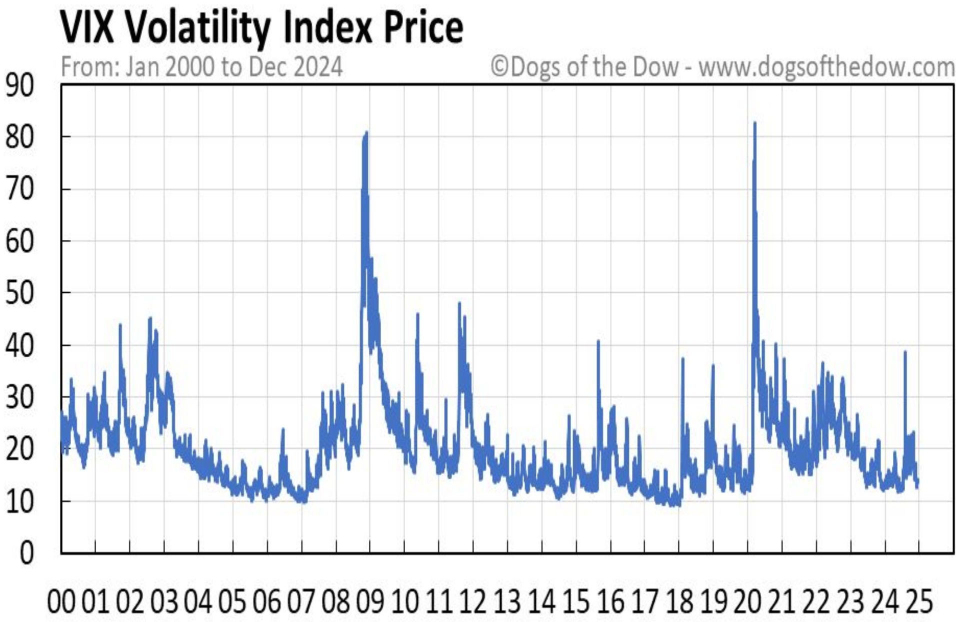
**Please refer to Appendix for clarity on data sourcing and calculations*

- Using the 5 year historical data, we found the correlation between the returns of each ETF.
- Taking a look at the correlation matrix of all the ETFs and securities in our portfolio have almost no or weak correlation.
- This proves that the portfolio is sufficiently diversified as no two securities move together in the market. (except the metals ETF and the Defense and Aerospace ETF which is why they have lower weightages)
- Moreover, no two securities seem to significantly move against each other mitigating the profit of one by the loss of another.

Further risk aversion strategies

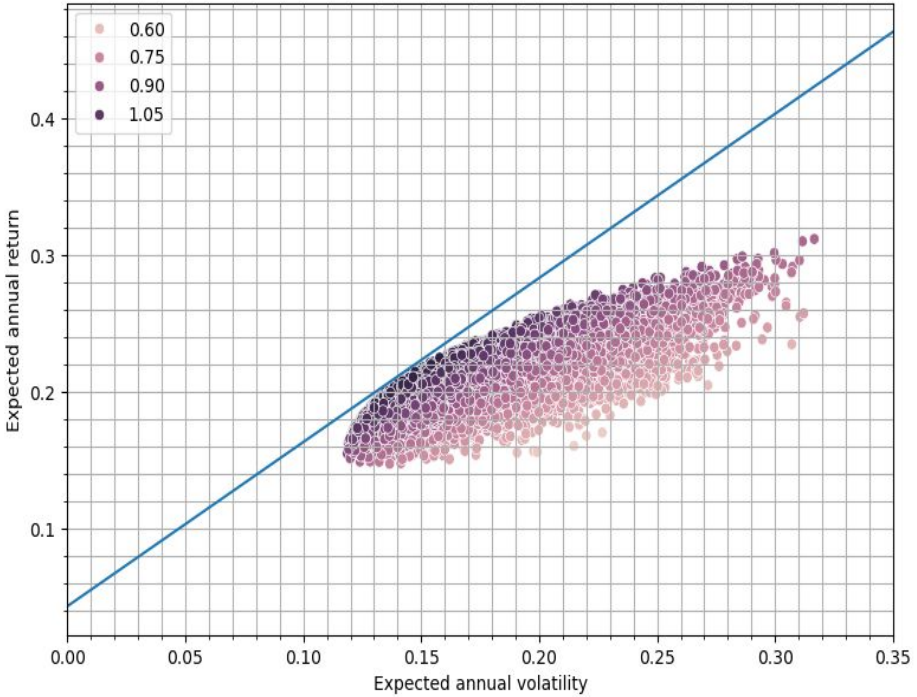
- To further avoid any risk associated with the stocks some hedging strategies can be employed.
- One example of such a strategy is entering a collar position when the market may seem too volatile.
- In this strategy, we long put options (purchasing the right to sell the stock at a fixed strike price) on the stocks while at the same time shorting the call options (promising to sell the shares at a fixed strike price).
- This creates an interval that is more narrow compared to the movement of the stock. Limiting the loss of the stock to the strike price of the put while also limiting the returns earned by the stock by the strike price of the call.
- It is a case of low-risk and low-return strategy for risk-adverse investors.

Further risk aversion strategies (continued…)



- However, the collar position strategy should only be employed when the market is very volatile and investors' risk sentiment is high.
- This is to avoid unnecessary limitation in our potential returns when the market is less volatile.
- We can track the volatility of the market using the VIX index of the S&P 500 that tracks the volatility of the NYSE. It is also known as the "fear index" as it reflects the investors' sentiment on the market.
- The collar position should be entered when the VIX is high.
- The VIX usually spikes near times of recession or increased investor anxiety.

Choosing the optimal weightages for the Growth Stocks



**Please refer to Appendix for clarity on data sourcing and calculations*

- The optimal weightages for securities was decided by finding the portfolio with the highest return to risk ratio.
- This was done using Markowitz optimization, 20,000 simulations were run assigning random weightages to the stocks portfolio and finding the annual return and volatility of the stocks portfolio. The sharpe ratio was then calculated for the portfolio and that simulation was plotted for the graph.
- Next, a risk-free asset is introduced in the analysis and so a tangent line is drawn with the y-intercept being the return of the risk-free asset (US treasury bonds) and the slope being the maximum sharpe ratio of the simulations.
- The average of portfolio weightages was found near the region the tangent intersects the efficient frontier line so that the optimal weightage is more robust.
- The return for the optimal configuration turned out to be 18.3% annual return with a 11.5% annual volatility.

Results of the optimal weightages

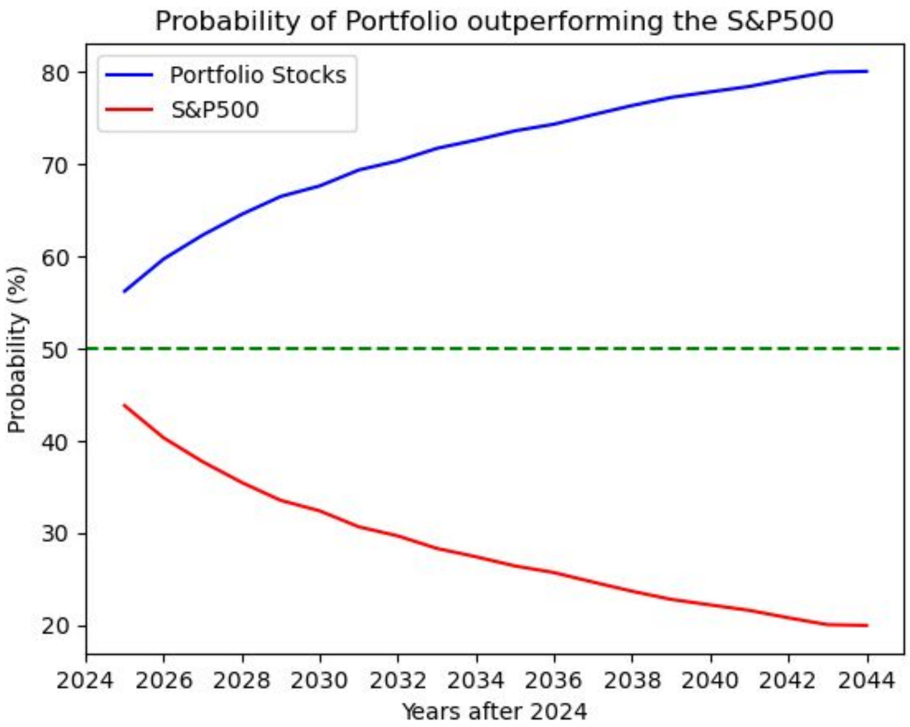
Security	Growth Stock Capital (%)	Portfolio (%)
VanEck Semiconductor ETF (SMH)	17.39%	6.96%
Green Energy Technologies ETF (NBET)	21.11%	8.44%
Defense & Aerospace ETF (PPA)	6.69%	2.68%
Metals & Mining ETF (XME)	6.21%	2.48%
S&P500 Technologies (SPDR)	27.40%	10.96%
Pharmaceutical ETF (PPH)	21.20%	8.48%

**Please refer to Appendix for clarity on data sourcing and calculations*

Analysis

- Based on the optimal return and volatility of the stocks, 18.3% expected return for 11.5% expected annual volatility is considered a good return for moderate risk portfolio.
- This equates to an expected return of 10.06% for 4.6% expected annual volatility accounting for the weightage of the growth stocks in the portfolio.
- Most of the volatility stems from the accelerated growth these stocks experience due to being in the technology sector so the outlook seems more optimistic.
- Based on these numbers, we can conclude with 95% confidence level that the annual return from the growth stock can be anything between -4.24% and +40.84%.
- After including it in our portfolio however, this value can be from -0.8% to +17.17% return on the overall portfolio with 95% confidence interval adjusted for inflation.

Comparing to the benchmarks



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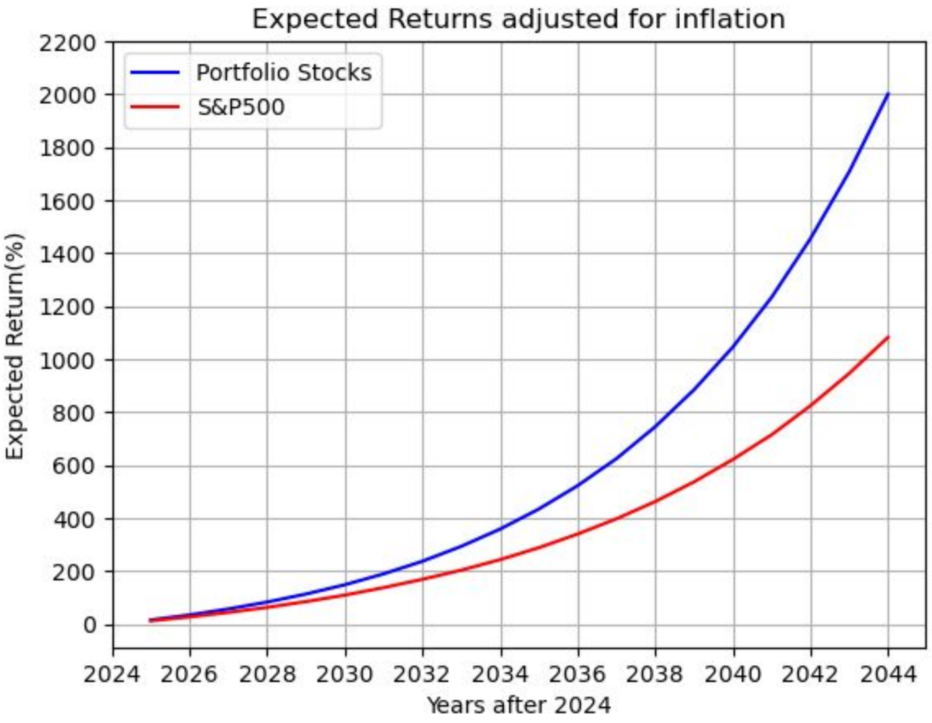
- The S&P500 is a common benchmark for comparing performance of returns.
- 20000 simulations were run tracking the cumulative returns in both the S&P500 and the Growth Stocks
- Based on the simulation, the portfolio has outperformed the S&P500 most of the time.
- The longer the time period, the more likely that the portfolio outperforms the S&P500

Comparing to the benchmarks (continued…)



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- Comparing the cumulative expected returns, the portfolio growth stocks clearly outperform the S&P500 with a huge margin.
- After about 20 years, the portfolio growth stocks beat the S&P500 with double the returns of the S&P500.
- The Growth Stocks outperform the S&P500 because they have a higher expected return and a substantially lower volatility allowing it to perform consistently better.

Comparing the benchmarks (continued…)

Metric	S&P500	Growth Stocks
Expected Annual Return	14.98%	18.30%
Expected Annual Volatility	17.68%	11.50%
95% Confidence Interval	(-19.67% ; +49.63)	(-4.24% ; +40.84%)
2.5% Value At Risk (VAR)	19.67%	4.24%
Pearson Correlation	0.07 (No Correlation)	

**Please refer to Appendix for clarity on data sourcing and calculations*

Why our Growth Stocks are better than the S&P500

- It is more diversified with investments in regions like Europe, USA and Asia Pacific and in terms of industries.
- More focused approach on industries with future growth potential and emerging markets instead of the currently best performing industries in the case for S&P500.
- Exposes lesser value to risk 4.24% compared to 19.67% for the S&P500.
- Has lower volatility so can perform more consistently, giving it a higher probability of exceeding in terms of cumulative returns.
- Is more liquid as it performs consistently, it will be easier to withdraw at any point as at that point the portfolio will most likely be in profit

Target Industries/Sectors in our Portfolio

Technology

- **Rising Importance of AI:** Artificial Intelligence is becoming increasingly central across various sectors, enhancing efficiency and innovation.
- **Data Explosion:** Continuous surge in data production, driven by digitalization and interconnected devices.
- **Data Utilization by Enterprises:** Businesses are increasingly leveraging this abundant data to gain insights, improve decision-making, and enhance operational efficiencies.
- **Growth of Cloud Services:** Cloud computing and storage services are expanding, offering scalable solutions for data handling and processing.
- **Semiconductor and Hardware Demand:** The semiconductor and hardware industries are experiencing growth, driven by the need for advanced computing devices to support AI and cloud services.

Technology

- The SPDR is chosen as one of the technology ETF’s that tracks the performance of Technology companies (mostly software) listed on S&P500 like Amazon, Google, Meta etc.
- 27.4% of the capital for growth stocks is invested in SPDR stocks (or 10.96% of the portfolio)
- The VanEck SMH is chosen as an investment for the semiconductor industry (mostly hardware) in technology sector.
- 17.39% of the capital for growth stock is invested in VanEck (or 6.96% of the portfolio)

Sustainability

- **Public concerns** Internationally there has been pressure on industries to be more sustainable and care more for the environment by reducing the carbon footprint.

- **Policy** Those concerns have lead to many initiatives by the government to introduce incentives for industries to be more environmentally friendly.

- **Preference** Under the joint influence of policies and public opinion, more people are choosing to drive electric cars and becoming optimistic about new energy, which will definitely drive the electric vehicle and new energy related industries.

Sustainability

- **HK** The Hong Kong Government launched its new green bonds securities in 2023 to promote sustainability in Hong Kong. Being fairly recent, this security has potential to rise up in value as the security has yet to establish itself in the market. The Hong Kong Government is also offering competitive interest rates on this bond to incentivize it.

- **Europe** Moreover, in Europe there has been increasing need to convert all energy sources to green energy. This has lead to the boom in sustainable technologies like Solar and Wind energy. Thus, green energy utilities and technologies have also seen an increase.

- These factors will definitely promote a significant increase in sustainability related stocks.

Metals

- The metals and mining industry has potential for growth as it is predicted to have growing demand in the future for several reasons
- Essential for Infrastructure Development: Metals like steel, aluminum, and copper are critical for construction, transportation, and energy projects, driven by increasing urbanization and global infrastructure expansion.
- Key to Renewable Energy and EV Growth: The energy transition has boosted demand for metals like lithium, cobalt, and nickel for EV batteries and renewable energy technologies, alongside copper for electricity transmission.
- Hedge Against Economic Uncertainty: Precious metals like gold and silver act as safe-haven assets, offering stability during periods of inflation and market volatility.

Defense

- Rising Geopolitical issues are causing an increase in defense expenditure as countries try to outcompete each other military.
- Moreover, power vacuums that are left behind give rise to even more security concerns fueling expenditure.
- The current geopolitical state suggests that more conflicts are likely to arise which will increase demand of defense related goods.
- Also, the improvements in technology make the current defense goods obsolete so countries would like to modernize their militaries even more.

Pharmaceutical Industry

- Increasing Global Demand for Healthcare: With an aging population and the rise of chronic diseases, the demand for pharmaceutical products is steadily increasing worldwide.
- Innovation Driving Growth: Breakthroughs in biotechnology and personalized medicine are unlocking new revenue streams and growth opportunities.
- Massive Market Potential for Weight-Loss Drugs: Financial research platform Morningstar projects the market size for weight-loss drugs to grow from $6bn in 2023 to $200bn by 2031, driven by rising obesity rates (10% of Americans severely obese, 32% obese).
- Cancer Drugs Leading Development: Cancer is one of the most complex and challenging diseases, and thus it is researched widely and over 50% of drugs in development are for cancer. Market research firm Spherical Insights predicts the global cancer drug market will grow from $190bn in 2023 to $565bn by 2033, with a Compound Annual Growth Rate of 11.5%.

Pharmaceutical Industry (Continued..)

- Resilient Investment with High Growth Potential: The industry’s essential nature ensures stability, while expanding markets in emerging economies provide significant growth opportunities.
- Government and Institutional Support: Strong public and private investment in research and development is accelerating the introduction of new therapies.
- Sustainability Focus: Pharmaceutical companies are adopting environmentally friendly practices and expanding access to healthcare globally, aligning with ESG priorities.

Fixed-Income

- Interest rates on US treasury bonds is high as of today.
- The current risk-free interest rate is 4.36% which is a very good rate especially compared to Hong Kong (where the interest rate lies just over 3%) and it is also risk-free.
- For the first time in history after the 1960’s to 1980’s rise in interest rates, there seems to be an increasing trend for interest rates now.
- Such upward trends usually don’t last too long and reverse within a year or two.
- But this time the interest rates have been on the rise since the past 4 years due to increased government spending.
- Last time the interest rates were this high was in 2008 and it took 12 years for that to settle at a low rate but it only took 4 years for the rate to get back up to the same level which shows an increased momentum in the rise.

Fixed-Income (continued…)

- The Hong Kong green bonds also offer lucrative interest rates to the investors.
- These bonds offer 4.76% interest for the USD tranche (which is better than the US treasury bonds offering).
- These bonds also have a good credit rating of “AA+” which indicates the strong creditworthiness of the Hong Kong government.
- These bonds have good potential as we have already observed that the government has been working on green initiatives by offering recycling facilities in public and electric buses/green transport etc.
- To manage such infrastructure and upgrade it, large amounts of funding will be needed which means more bonds will be issued with even more attractive rates.

Conclusion

- We built our portfolio with a **long-term focus** by investing in ETFs featuring **growth stocks** that have strong future potential, while also including **fixed-income assets** with low risk and excellent credit ratings.
- By **diversifying** our portfolio and using **optimal weightages**, we were able to **maximise return** and **minimise risk**.
- Our portfolio's growth stock's expected return beats the average return of S&P500, while having much **less volatility and expected losses**.
- Our portfolio stocks are expected to **outperform S&P500** in the long term, the probability of doing so increasing over time.
- The fixed income assets along with the stocks give the portfolio a **low-risk moderate-return** profile

APPENDIX

(Data Source)

- **Data Source:** Yahoo Finance API in Python (yfinance) package (uses Yahoo's publicly available API's to stream data) https://pypi.org/project/yfinance/
- **Project source code on GitHub:** https://github.com/ibitec7/portfolio/
- **Time Period chosen for Analysis:** 5 year historical data for each of the securities in the analysis except for fixed income assets. (we did this because some securities have been introduced recently so data for 10 years is not available).
- **Timeframe for Analysis:** Daily close prices for the securities (these are the default timeframe from the yfinance API and were converted when needed).

APPENDIX

(Calculations)

- **Expected Annual Returns:** Mean Daily Returns * 252 (trading days in 1 year)
- **Expected Annual Volatility:** Standard Deviation of daily returns over 21-day window (no. of trading days in 1 month) * √(252)
- **Portfolio Returns:** Σ (Mean Daily Returns of securities * 252 * weights of securities)
- **Portfolio Volatility:** √(weights.**T .** (Covariance of Daily Returns * 252 **.** weights))
- **Sharpe Ratio: (**Portfolio Return - 0.436 (risk-free rate)) / Portfolio Volatility

APPENDIX

(Securities)

Security	Ticker	Issuer	Exchange	No. of Shares outstanding	Net Assets	ISIN
Semiconductor ETF	SMH	VanEck	NASDAQ	95,991,874	USD 24.00 B	US92189F6768
Green Energy ETF	NBET	Neuberger Berman	NYSE ARCA	500,001	USD 16.20 M	US64135A1016
Defense & Aerospace ETF	PPA	Invesco	NYSE ARCA	39,130,000	USD 4.598 B	US46137V1008
Metals & Mining ETF	XME	State Street	NYSE ARCA	28,300,000	USD 10.59 B	US78464A7550
S&P500 Technologies	SPY	State Street	NYSE ARCA	1,085,630,000	USD 656.12 B	US78462F1030
Pharmaceutical ETF	PPH	VanEck	NASDAQ	6,838,138	USD 607.08 M	US92189F6925