

Pinnacle Scholars Summer 2020 Research Proposal

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Project Title: Safely Implementing Volatility into Investor's Portfolios

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COVID-19 Update: We have spoken to Dr. Simaan about working remotely and he is supportive of us working remotely.

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Overall Project Goal: Find a way to safely implement volatility to protect investor's portfolios in times of crisis, while still maximizing portfolio returns.

- For this project, I will be collaborating with Vincent Cortese and our advisor will be Dr. Simaan. We chose this project to help investors during times of market uncertainty. Most portfolios stay away from volatility products due to the risk they pose; however, we believe we can find ways to safely implement volatility to both protect investors' downside risk and maximize returns on the upside.
- To accomplish our goal, we will be using Python to develop ways to construct investment portfolios that include volatility in them to hedge against crisis events. Including volatility means having assets in the portfolio that follow the VIX index which tracks stock market volatility.

List of specific tasks to be accomplished to reach the goal:

- *Research Ways to Include Volatility in Portfolios*
 - To include volatility in investor portfolios, we must research how volatility is calculated and find ways to offer investors safe exposure to volatility. We will use the VIX index and VXX ETF as a baseline for volatility.
- *Data Collection*
 - To find ways to implement volatility in investor portfolios, we must gather stock and volatility data from financial databases to test our methodologies. Along with this, we plan to gather data across assets to build portfolios that are not only U.S. equities.
- *Finding Different Portfolio Optimization Techniques*
 - To create various optimal portfolios, we will be using many different types of optimization methods to maximize portfolio returns and minimize risk. The methods will include machine learning and matrix algebra among other techniques.
- *Creating Robust Portfolio Backtests*

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- In order to test the portfolios we generate through machine learning, matrix algebra, etc., we will have to create a portfolio backtesting system which will check the effectiveness of the portfolios we created. The backtests will show how are portfolios would have performed in the market as well as the statistical significance of our findings.

Approximate timeline to accomplish the specific tasks:

May – Start data collection and figuring out which assets are going to be in the various portfolios. Once data is collected and cleaned, begin building portfolio optimization models and ways to implement volatility in the portfolios

June – Build portfolio backtesting code to test the performance of portfolios with and without volatility. Find statistical significance of our findings, and find different dates of crisis events to test our portfolios in.

July – Gather concluding results and begin to create visuals that highlight our findings. Begin work on final poster.

August– Finish up poster.

List of special skills you will have to develop or special equipment you will have to learn to use

- Our project will be done primarily in Python using libraries like Pandas and NumPy. We will need to develop strong data gathering and data manipulation skills in Python to use the data from the financial databases. Along with this, our numerical linear algebra skills will need be grown because our backtesting and results will depend largely on applying matrix algebra to large datasets. Lastly, we will develop machine learning skills that will help us determine the best ways to implement volatility in our portfolios.