Group 2 Analysis

Project 1

Our group compared the performance of four investment opportunities over a 10 year period:

1) Nvidia (NVDA): Nvidia is a semiconductor and artificial intelligence company that has recently become one of the three largest companies on Earth, alongside Apple and Microsoft.

2) Tesla (TSLA): Tesla is an automotive and technology company.

3) NASDAQ: NASDAQ is an index composed of many technology-related stocks, including Nvidia and Tesla.

4) 5-year Treasury Bond yield: The 5-year Treasury Bond yield has significant implications for the stock market.

Leomar

Question: How does an investor visualize investment performance and risk?

To visualize and compare the relative performance of these investment opportunities, we graph the closing prices of each stock on line graph. However, to account for the skewing effect of NASDAQ's value, we utilize a linear transformation (Log) of the closing prices, making it easier to visualize the relative performance.

Our analysis shows the impact of tech stocks Nvidia and Tesla on the performance of the Nasdaq index fund over time. While there are many stocks in the index, we show that Nvidia and other stocks like it

are currently bringing NASDAQ up whileTesla and companies like it are dragging the index down.

The variance is the measure of squared deviation of variables from the mean. The utility of our variance data point is limited since each investment, to a large extent (but less so the 5-Year T-Bond and Tesla), exhibits persistent positive drift.

Refer : Slide 5 of Presentation Slides.pptx for graph, Slide 6 for code, Slide 8 for Variance Code

Sheralyn

Question: How do the mean and maximum values of NVDA, TSLA, Nasdaq, and 5 Yr. Treasury Bonds closing prices reflect their respective risk and return profiles?

The mean value of a stock's closing price provides insight of its average performance over time, serving as a gauge for expected returns. The maximum value showcases the peak performance, signaling the highest return an investor could have achieved during the period. The graphs show that NVDA and TSLA have mean values of around 200 and 125, respectively, with maximum values above 1200 and 400. While these findings may indicate high returns, they could also be a signal to high volatility. Nasdaq has a mean closing price of around 8000 and a maximum closing price above 16000. It can be inferred that this suggests steady, moderate returns with lower risk involved. The 5 Yr. Treasury Bonds display a mean closing price of around 2 and a peak near 4, reflecting stable, modest returns with lower risk. NVDA and TSLA offer substantial growth potential but come with greater risk. The Nasdaq provides a balanced option with reliable growth, while the 5yr. Treasury Bonds appear to be ideal for risk-averse investors seeking stability. These insights help investors

assess both the potential returns and the risk associated with different investments.

Refer : Slide 11-15 of Presentation Slides.pptx for graph & statistics

Bhagi

Question: 1) Is there a correlation between technology stocks and a technology index? If so what type of correlation would it be? 2) Is there a correlation between technology stocks and a 5 year treasury bond? If so, what type of correlation would it be?

We expect that technology stocks would be highly positively correlated with a technology index; in other words, the correlation of technology stocks to technology indexes measures the "techiness" of supposedly tech stocks. Our scatter plots with linear regression and correlation coefficients are visual representations of this correlation relationship.

The correlation coefficient for Nasdaq vs Tesla is 0.9 and the correlation coefficient for Nasdaq vs NVDA is 0.79 which shows that the correlation between Nasdaq and Tesla is highly positive and the correlation between Nasdaq and NVDA is also positive.

Correlations of stock price returns with 5 Yr. T-Bonds are another important metric since a company's cost of debt weighs heavily on its ability to generate a positive net return. For instance, a company with a high debt burden may be limited in their ability to raise new capital, as the company must now pay investors a higher coupon in return for the company collecting the investors premium. Additionally, if investors can receive a risk-free Treasury Bond, they might hesitate to take on additional risk by purchasing a Corporate Bond.

Therefore, we might expect to see negative correlation between T-bonds and stocks, however in reality we see that the correlation between a 5 year treasury bond and Tesla is 0.41 and the correlation between a 5 year treasury bond and NVDA is 0.61 which is still

positive but less positive than the relationship between the technology index and stocks. It is also important to note that for the time horizon we took into consideration, the effect of higher T-Bonds were offset by record high Federal stimulus.

Refer : Slide 18-21 of Presentation Slides.pptx for graph & scatter_plot.ipynb for code

Maher

Is there a stronger relationship between TSLA closing log price vs. NASDAQ closing log price or TSLA closing log price vs. 5-Year Treasury Bond closing log price?

We examine the relationships between the closing log prices of Tesla (TSLA), NASDAQ, Nvidia (NVDA) and the 5-Year Treasury Bond to determine which pairs exhibit stronger correlations

Our analysis shows a stronger relationship between TSLA closing log price and NASDAQ closing log price, with a correlation coefficient of 0.93. This strong correlation can be attributed to Tesla's foundation in advanced technology, aligning it closely with the tech-heavy NASDAQ index. Although Tesla is primarily a car manufacturer, the company's emphasis on electric and self-driving vehicles positions it within the technology sector. On the other hand, the correlation between Tesla and the 5-Year Treasury Bond is weaker, reflecting less influence from bond market movements on Tesla's stock price.

Taking the logarithm of stock prices helps eliminate or reduce skewed data, making the analysis more robust. Different companies have varying stock prices, and to compare them effectively, their values need to be normalized. Log transformation achieves this by stabilizing variance and making the relationships between different stocks more linear. This approach ensures that percentage changes are compared rather than absolute price changes, which is especially useful when dealing with stocks that have significantly different closing prices.

Is there a stronger correlation between NVDA closing log price vs. NASDAQ closing log price or NVDA closing log price vs. 5-Year Treasury Bond closing log price?

Our analysis indicates that there is a stronger relationship between NVDA closing log price and the 5-Year Treasury Bond closing log price, with a correlation coefficient of 0.44. This is higher than the correlation between NVDA and NASDAQ, which has a coefficient of 0.25. The stronger correlation with the 5-Year Treasury Bond could be due to macroeconomic factors that influence both bond yields and Nvidia's stock performance.

Refer : Slide 24-27 of Presentation Slides.pptx for graph & Scatter_Log.ipynb for code

Noah

Can we use a statistical test to quantify the non-uniform variance seen in the Line Plots and NVDA-to-Bond and TSLA-to-Bond scatter plots; is the non-uniform variance statistically significant?

Yes; Autoregressive Conditional Heteroskedasticity (ARCH) is a statistical model used to analyze variance (one measure of volatility and risk) in time series data. It was designed to improve econometric models by replacing assumptions of constant volatility with conditional volatility by identifying periods where volatility makes significant deviations from the norm.

Mathematically, this is accomplished via comparing the lagged squared residuals to the current squared residual. Residuals refer to the difference between the observed value and the predicted value. Presence of Conditional Heteroskedasticity indicates standard errors which are too low, t-stats which are too high, and type I error: ie. false positives. Given the resulting p-values, Conditional Heteroskedasticity is present in all of our datasets.

Refer : Slide 29-34 of Presentation Slides.pptx for graph & code

Return on Investment of $100 invested over a ten year period

- Investment amount = $100
  - Nvidia = Return on Investment on 06/06/2024 if invested on 06/06/2014
    = $ 25,433.00
  - Tesla = Return on Investment on 06/06/2024 if invested in 06/06/2014
    = $ 4,088.00
  - Nasdaq = Return on Investment on 06/06/2024 if invested in 06/06/2014
    = $ 397.00
  - *10 Year Treasury Bond = 2.59% Return on Investment today – low value compared to stocks but little to no risk