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# INVESTMENT PORTFOLIO ANALYSIS

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10 Tech Stocks in NASDAQ



JANUARY 3, 2025

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## 1. Introduction

This report delves into the development and analysis of an investment portfolio to explore key financial concepts and tools. The primary objective is to construct a unique collection of at least 10 stocks, conduct in-depth detailed market research, and evaluate their historical performance. Using programmatic financial data extraction, the analysis will cover aspects such as stock returns, risks, correlations, and the validity of financial theories like the Capital Asset Pricing Model (CAPM) and the Efficient Market Hypothesis (EMH). Through detailed visualizations and statistical assessments, this project aims to offer actionable insights to enhance investor decision-making

## 2. Market Overview

For my analysis, I have selected the **U.S. Technology and Growth Stock Market**, particularly stocks listed in the NASDAQ Composite Index. The NASDAQ is widely regarded as a technology-heavy index, composed of many of the world's largest and most influential tech companies (Brock, 2024). The companies within this market are often characterized by high market capitalizations, rapid growth, and innovation in fields such as AI, cloud computing and e-commerce.

### Stock Selection

The portfolio includes 10 tech- stocks. (yahoo finance, 2016)

1. **Apple Inc. (AAPL)** – Consumer electronics and services.
2. **Microsoft Corporation (MSFT)** – Cloud computing and AI services.
3. **Alphabet Inc. (GOOGL)** – Cloud computing, Digital advertising, AI, and other tech innovations.
4. **Amazon.com Inc. (AMZN)** – E-commerce, cloud computing, logistics, and entertainment.
5. **Tesla Inc. (TSLA)** – energy storage, electric vehicles and autonomous driving technology.
6. **NVIDIA Corporation (NVDA)** – Semiconductor technology, GPUs, and AI hardware.
7. **Meta Platforms Inc. (META)** – Social media, virtual reality, and digital advertising.
8. **Adobe Inc. (ADBE)** – Creative software solutions.
9. **PayPal Holdings Inc. (PYPL)** – Digital payments and fintech solutions.
10. **Netflix Inc. (NFLX)** – Streaming services and entertainment content.

## **Rationale Behind the Portfolio Selection**

The rationale behind selecting these stocks is based on their market leadership, consistent growth, and innovation. Firstly, each company dominates its industry with strong brand recognition and significant market share, have demonstrated consistent revenue and profit growth over the past several years. Despite being in the technology sector, the portfolio is diversified across various sub-sectors, including e-commerce (Amazon), software (Microsoft, Adobe), hardware (Apple, NVIDIA), fintech (PayPal), and entertainment (Netflix), offering exposure to different growth drivers. Additionally, these companies are innovators that have transformed consumer behavior and business models. For example such as Apple and Amazon reshaping how we shop and interact with technology. (yahoo finance, 2016)

## **Steps for Distinctive Selection**

To ensure a distinctive portfolio selection, the main focus was on U.S tech stocks listed in NASDAQ, excluding sectors like energy and healthcare which are a common selection. This helped to create a portfolio that is focused but diversified. The selected companies are the leaders in their respective fields as well as represent a diverse mix of tech sub-sectors.

## **Benchmarking with ^IXIC**

Including the NASDAQ Composite Index (^IXIC) in the analysis provides several key benefits. First, it serves as a benchmark, allowing for the comparison of individual stock performance against the overall market. This helps to assess how each stock is performing in relation to market trends. Additionally, analyzing the correlation between the stocks and the index offers valuable insights into how closely each stock tracks the broader market movement. Finally, incorporating ^IXIC into the portfolio analysis enables an evaluation of whether the selected stocks are outperforming or underperforming the market, providing a clearer picture of the portfolio's effectiveness. (Brock, 2024)

### **3. Stock price performance of the stocks and market in one standardised chart**

The plot comparing stock prices of different companies, such as NVDA, is based on **normalized price (%)**, where each stock's price is shown as a percentage relative to its price on the first day. This method allows for an easy comparison of growth across stocks, eliminating the impact of varying initial prices. A steep upward curve indicates strong growth, while a flat or downward curve suggests weaker performance. The market index is included as a benchmark to assess whether individual stocks are outperforming or underperforming the overall market.



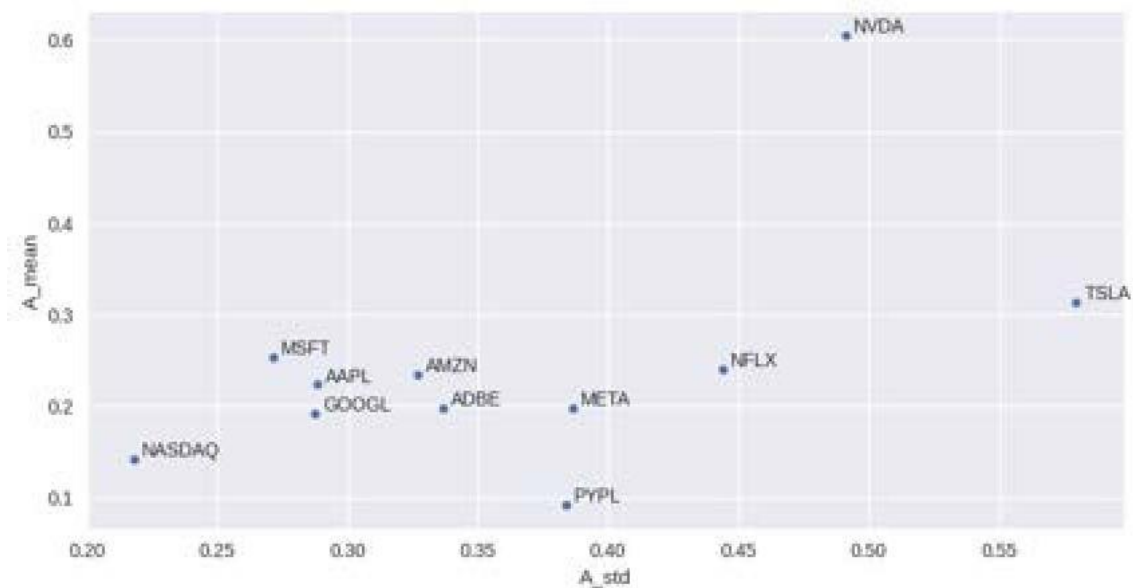
The chart shows **NVDA** with the highest growth, driven by strong demand for AI and GPUs.

**AAPL** and **MSFT** display consistent, stable growth due to their solid market positions. **TSLA** is volatile, reflecting its high-risk, high-growth nature in the EV sector. **GOOGL** and **AMZN** show moderate growth, benefiting from their diverse business models. **PYPL**, **META**, and **NFLX** underperform, facing challenges from competition, market shifts, and regulatory issues. The **NASDAQ** index provides a benchmark, highlighting how these stocks compare to broader market trends.

Closing price data is valuable for investors as it allows them to assess historical performance, track growth, and evaluate volatility. By analysing the price movements over time, investors can identify consistent growth, like with **AAPL** and **MSFT**, or spot high volatility, as seen with **TSLA**, helping them assess risk and potential return. The data also enables comparison against market benchmarks, such as the **NASDAQ** index. By comparing each stock's performance to the broader market index, investors can determine whether a stock has been outperforming or underperforming the market, such as NVDA, may indicate strong growth potential. Conversely, underperforming stocks could suggest risks or inefficiencies.

#### 4. Historic performance of the Individual Stocks in your Investment Analysis Portfolio:

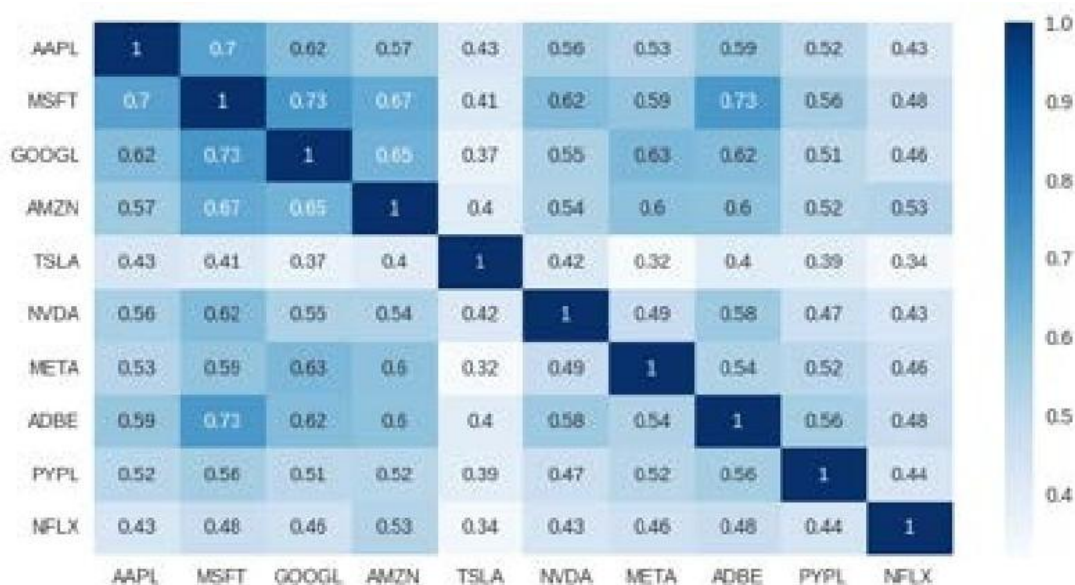
To visualize and discuss the historic returns and risk of individual stocks and the market, we first calculate the **average log return** (mean) and **volatility** (standard deviation) of each stock's returns over the given time period. These metrics provide insights into both the potential return and risk involved with each stock. (Chen, 2024)



The scatter plot shows the relationship between each stock's potential returns (A\_mean) and risk (A\_std). NVDA and TSLA offer high returns but come with greater volatility, appealing to risk-tolerant investors. MSFT, AAPL, and GOOGL provide moderate returns with lower risk, making them suitable for conservative investors. Stocks like PYPL, META, and NFLX have lower returns and higher volatility, suggesting higher risk. The NASDAQ serves as a benchmark with balanced risk and return.

This data helps investors in decision-making by highlighting the trade-off between risk and return. Investors can assess whether they are comfortable with higher volatility for potentially higher returns, as seen with TSLA and NVDA, or whether they prefer stable, steady growth with lower risk, as exemplified by MSFT and AAPL. By understanding both A\_mean and A\_std, investors can align their choices with their financial goals, risk tolerance, and investment strategy, ensuring their portfolio matches their preferences for risk and reward.

## 5. Visualization and discuss the correlation of the stocks in your report.



The correlation between stocks provides valuable insights into their performance relative to each other. **AAPL** and **MSFT** have a strong correlation of **0.7**, indicating that they often move in the same direction, likely responding similarly to market conditions. **MSFT** and **ADBE** exhibit the highest correlation of **0.73**, suggesting they are closely linked, likely due to their similar business models in technology and software. **GOOGL** and **MSFT** also share a high positive correlation of **0.73**, implying their performance often aligns. On the other hand, **TSLA**, along with **NVDA** and **AAPL**, displays relatively lower correlations (below **0.5**), indicating that their price movements are more independent. **PYPL** shows moderate correlations with stocks like **AAPL**, **MSFT**, and **META** around **0.52**, reflecting some relationship, but not a strong one. This information is crucial for investors looking to optimize portfolio diversification and minimize risk. (Chip, 2024)

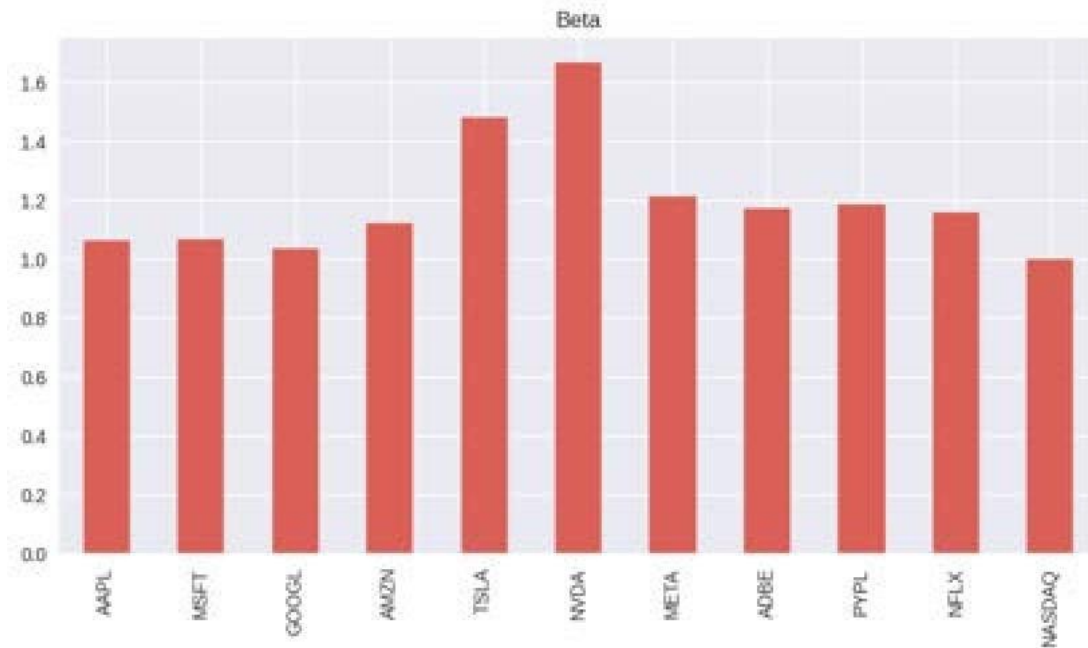
A **heatmap** of the correlation matrix can be used to visualize these relationships clearly. In the heatmap, stronger correlations would appear in darker shades, while weaker correlations would appear lighter. (Chip, 2024)

Understanding the correlation between stocks is crucial for diversification. If two stocks have a high correlation, investing in both may not provide as much diversification benefit, as they are likely to move in tandem. In contrast, stocks with lower correlation can help reduce risk, as they may not be affected by the same market factors.

For example, **AAPL** and **MSFT** are highly correlated, meaning investors might not benefit much from holding both in the same portfolio. On the other hand, stocks like **TSLA** and **PYPL** show weaker correlations with other stocks, offering potential diversification benefits and reducing overall portfolio risk. By considering these correlations, an investor can strategically choose stocks that enhance portfolio stability while aiming for optimal returns.

## 6. Visualization and discuss the beta of the stocks in your report

**Beta** is a measure of a stock's volatility relative to the market (in this case, the **NASDAQ**). It shows how much a stock's price moves in relation to the market's movements. (Kenton, 2016)



Stocks with a **beta higher than 1** (such as **TSLA**, **NVDA**, and **AMZN**) are more volatile than the **NASDAQ**, while those with a **beta lower than 1** (like **AAPL**, **GOOGL**, and **PYPL**) are less volatile. This information helps investors gauge the risk of individual stocks relative to the broader market, allowing them to make more informed investment decisions based on their risk tolerance.

Understanding **Beta** is essential for investors to assess the risk profile of stocks. A **higher Beta** stock is more sensitive to market movements, meaning it can offer higher returns during market upturns but can also experience larger losses during downturns. **Lower Beta** stocks, on the other hand, offer more stability and are less affected by overall market volatility. By comparing the **Beta** of individual stocks, investors can align their investments with their risk preferences, choosing higher Beta stocks for growth potential or lower Beta stocks for stability and reduced risk exposure.

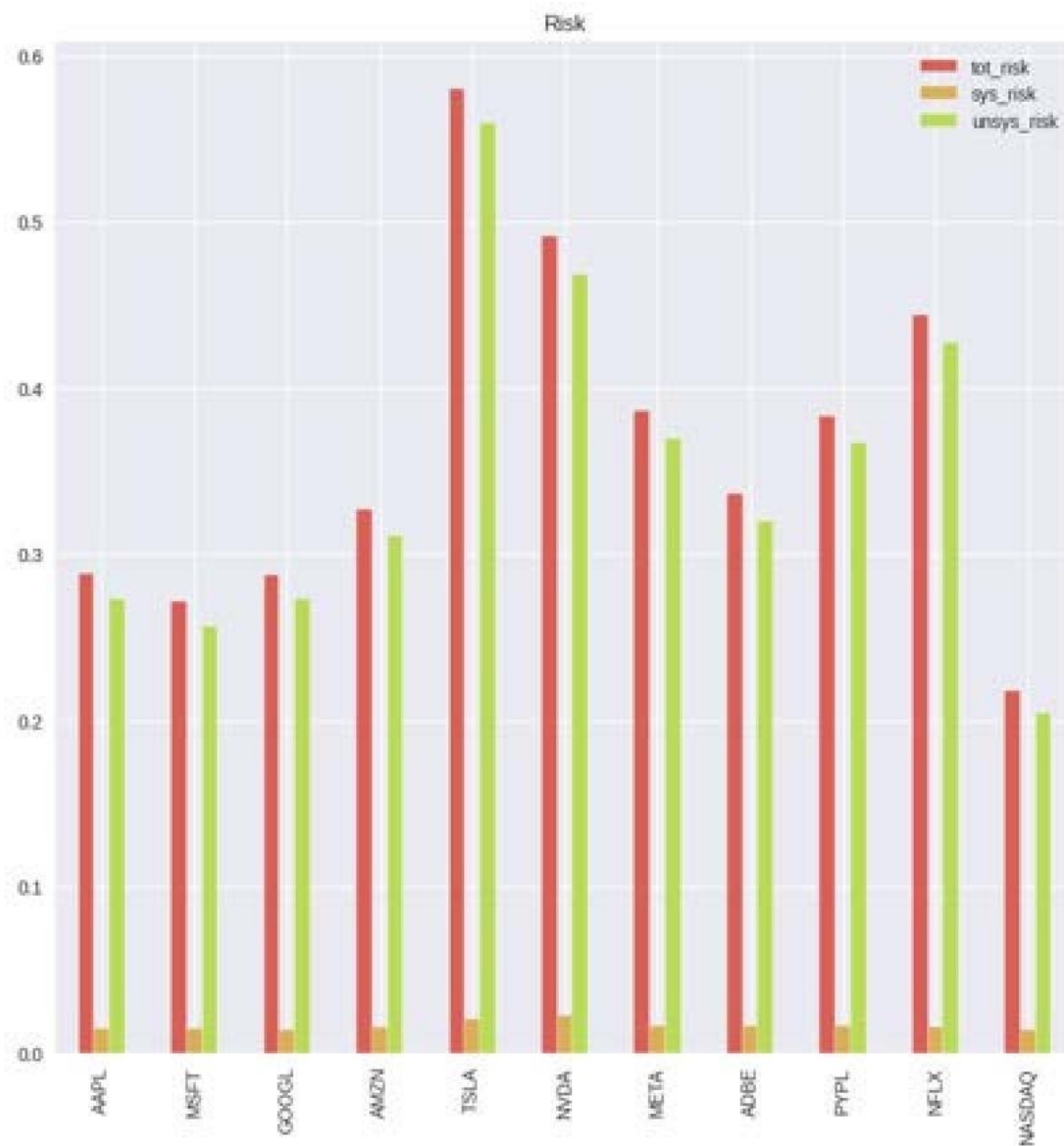
## 7. Visualisation and discuss the unsystematic risk of the stocks in your report

The total risk of a stock is composed of two components:

1. **Systematic Risk (Market Risk):** The risk that affects the entire market or a segment of the market, represented by **Beta**.



2. **Unsystematic Risk (Specific Risk):** The risk specific to a stock or industry, which can be diversified away by holding a variety of assets. (Chen, 2024)



- **AAPL, MSFT, and NVDA** exhibit lower unsystematic risk compared to their total risk, meaning a larger portion of their risk is attributable to market-wide factors (systematic risk). These stocks are likely to have more consistent performance that aligns with market movements.
- **TSLA** shows a higher unsystematic risk, indicating that much of its total risk is company-specific. This could be due to the volatility in the electric vehicle sector, production delays, or management changes. Investors in **TSLA** should be prepared for greater potential fluctuations driven by these factors.

- **GOOGL**, **AMZN**, and **META** also show relatively higher unsystematic risk, meaning their performance may be more influenced by internal business or sector-specific factors than by broader market movements.
- **PYPL** and **NFLX** exhibit a mix of unsystematic and systematic risks, suggesting that both market-wide factors and individual company performance contribute to their overall risk.

The **NASDAQ** itself is shown as having 0 unsystematic risk since it represents the market as a whole.

Understanding **Unsystematic Risk** is key for investors aiming to build a diversified portfolio. High unsystematic risk in a stock means it is more sensitive to company-specific events or sector performance, making it riskier. If an investor holds several stocks with high unsystematic risk, their portfolio could experience more volatility. (Chen, 2024)

For example, an investor who is risk-averse might avoid stocks with high unsystematic risk like **TSLA** and **AMZN** and opt for stocks with lower unsystematic risk, such as **AAPL** or **MSFT**, to reduce the overall risk exposure. By focusing on **unsystematic risk**, investors can balance their portfolios, ensuring they are not overly reliant on individual stock performance. Proper diversification allows investors to reduce risk without sacrificing potential returns, making it a crucial strategy for long-term success in the market

## 8. Capital Asset Pricing Model (CAPM)

The validity of the Capital Asset Pricing Model (CAPM) was tested by performing an Ordinary Least Squares (OLS) regression on the stock returns of tech companies (AAPL, MSFT, GOOGL, AMZN, TSLA, NVDA, META, ADBE, PYPL, NFLX) against the NASDAQ market return. (Kenton, 2024). The results show that the beta coefficient for each stock is positive and statistically significant ( $p\text{-value} < 0.01$ ), indicating that these stocks move in the same direction as the market. The R-squared value of 0.685 suggests that market returns explain 68.5% of the variation in stock returns.

These findings support the validity of CAPM for these stocks, as their returns are closely linked to market movements. However, a high condition number points to potential multicollinearity, which may affect model precision. Despite this, the overall results align with CAPM's expectations, showing a strong relationship between stock and market returns. However, some multicollinearity concerns exist due to a large condition number.

The validity of CAPM helps investors assess the risk-return trade-off by using beta to understand stock volatility. It supports market-based decisions, where monitoring overall market performance guides portfolio adjustments. CAPM also aids in diversification by showing how stocks correlate with market returns, reducing risk. Additionally, it helps in stock valuation, allowing investors to compare expected returns with actual performance to identify undervalued or overvalued stocks. Overall, CAPM provides a framework for better risk management, portfolio construction, and stock selection.

## 9. Validate the Weak Form of the Efficient Market Hypothesis

### a. Efficient Market Hypothesis (EMH) and Its Forms

The **Efficient Market Hypothesis (EMH)** suggests that financial markets are efficient, meaning all available information is already reflected in stock prices. It has three forms:

- **Weak Form Efficiency:** Stock prices reflect all past trading data, meaning technical analysis can't predict future returns.
- **Semi-Strong Form Efficiency:** Stock prices incorporate all publicly available information, making both technical and fundamental analysis ineffective.
- **Strong Form Efficiency:** All information, including private (insider) information, is reflected in stock prices, so no one can consistently outperform the market. (2024)

### b. Test of Weak Form EMH

To test the **weak form** of EMH, we analyzed autocorrelations in stock returns. The results showed small autocorrelations, suggesting that past returns don't predict future prices. The **Run Test** and **Variance Ratio Test** also indicated randomness in stock price movements, supporting weak-form efficiency.

The results of testing the weak-form Efficient Market Hypothesis (EMH) imply important insights for investors. First, there is no advantage in relying on **technical analysis** to predict future stock prices, as historical price data does not consistently lead to abnormal returns. This means that strategies based solely on past price movements are unlikely to provide a reliable edge in the market. Investors should consider adopting a **passive investment strategy**, such as investing in index funds, which are based on the idea that it is difficult to consistently predict stock movements. Additionally, understanding **market behavior** is crucial—stock prices already incorporate all available information, including past trading data. Therefore, active investment strategies that rely on past prices are unlikely to outperform the broader

market in the long run. In essence, the weak-form EMH suggests that basing investment decisions solely on historical price data is ineffective

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