**MINISTRY OF EDUCATION AND TRAINING**

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**COURSE REPORT**

**“Investment management with Python”**

**TOPIC:**

**Search for potential investment opportunities**

Lecturer: ThS. Võ Thị Kim Anh

Students perform:

Nguyễn Ngọc Thanh Trúc 215210404 21D1DA01

Nguyễn Cao Bằng 210051639 21D1DA01

Ho Chi Minh City, Wednesday, April 2nd, 2024

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# LIST OF SYMBOLS AND ABBREVIATIONS

|  |  |  |
| --- | --- | --- |
| No. | Symbols/Abbreviations | Stand for |
| 1 | ETFs | exchange-traded funds |
| 2 | NYSE | New York Stock Exchange |
| 3 | MA | Moving Average |
| 4 | CAPM | Capital Asset Pricing Model |
| 5 | MPT | Modern Portfolio Theory |

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# OVERVIEW

## Overview of the topic

### Introduction

To optimize returns and accomplish long-term financial goals, the process of identifying and assessing different investment possibilities is referred to as "searching for potential investment opportunities". This is the kind of activity that investors do to manage their capital effectively. They look for opportunities that fit their investing goals and give a positive risk-reward profile.

### Understanding Investment Opportunities

Stocks, bonds, real estate, mutual funds, exchange-traded funds (ETFs), commodities, and alternative investments like venture capital and private equity are just a few examples of the many assets that fall under the category of investment possibilities. Due investigation and thorough examination are necessary since every asset class has distinct qualities, risk profiles, and possible returns.

### Research and Analysis

To evaluate the potential and viability of different assets, extensive research, and analysis are required while looking for investment prospects. The financials of the firm, industry trends, risk concerns, valuation indicators, and the state of the economy are important considerations. Techniques including technical analysis, macroeconomic analysis, and fundamental analysis are frequently used to assess investment alternatives.

### Investment Objectives and Risk Tolerance

Before starting their hunt for investment possibilities, investors should identify their investment goals and risk tolerance. Goals might include income creation, capital appreciation, or capital preservation. The ability of an investor to tolerate volatility and possible losses is known as risk tolerance. The selection of appropriate investment possibilities is guided by these variables.

### Diversification

This is an important factor to consider while looking for investing alternatives. By lowering exposure to any one investment, diversifying among several asset classes, sectors, and geographical areas helps reduce risk. By reducing the impact of unfavorable occurrences on an investment portfolio, diversification can maximize return potential.

### Due Diligence

When looking into possible investment prospects, careful due diligence is crucial. This includes examining competitive advantages, evaluating management teams, examining financial documents closely, and examining legal and regulatory issues. Due diligence reduces the possibility of fraud or unanticipated hazards and assists investors in making well-informed selections.

### Emerging Trends and Technologies

As new trends and technologies take shape in markets and industries, they also have an impact on the hunt for investment opportunities. Biotechnology, blockchain, e-commerce, renewable energy, and artificial intelligence are a few examples. Determining these patterns and comprehending their possible influence might offer valuable perspectives on auspicious investing opportunities.

### Risk management:

In addition to looking for investment opportunities, risk assessment, and management are also necessary. Risks specific to a company, regulatory changes, geopolitical events, market volatility, and liquidity concerns are just a few of the variables that investors need to closely consider. Potential drawbacks can be reduced by putting risk management tactics into practice, such as using hedging strategies, diversifying portfolios, and establishing stop-loss orders.

### Conclusion

In summary, "searching for potential investment opportunities" is an essential job for people and organizations trying to increase their wealth and reach their financial objectives. It necessitates a methodical approach, extensive study, and a profound comprehension of investing goals and risk tolerance. Investors can increase their chances of seeing and seizing profitable investment opportunities by carrying out a thorough analysis, using diversification, and keeping up with new developments in the market. That’s the reason why we chose “searching for potential investment opportunities” as our topic for the report.

## Details about the topic

### Urgency and reason for forming the topic

#### Urgency of the topic

Time-sensitive Market Dynamics: Market dynamics, which are subject to quick changes, have an impact on investment prospects. Asset values change, market patterns change, and the state of the economy changes. Proactively seeking out possibilities regularly enables investors to take advantage of favorable market conditions and make timely investment selections.

The fiercely competitive nature of investing: is due to the large number of people looking to invest in lucrative possibilities. Investors stand a better chance of capturing beneficial positions before they are fully realized or become crowded out if they recognize and act upon prospective possibilities sooner.

Possibility of Missed Opportunities: If you put off or ignore looking for investing opportunities, you may pass up opportunities to profit from discounted assets or future growth. Opportunities could have short windows of time, and missed opportunities could result in lost opportunities.

Changing Risk Profiles: Investment opportunities' risk profiles are subject to alter over time. Variations in industry dynamics, regulatory changes, or market occurrences might modify an asset's risk-reward profile. Continually seeking out new prospects enables investors to stay current and modify their investing plans accordingly.

Long-Term Financial Objectives: Time is a crucial component for investors who have long-term financial objectives, such as saving for retirement or building wealth. The longer the possibility for compounding returns and reaching targeted financial results, the earlier appropriate investments are found and included in a well-constructed portfolio.

#### Reason for forming the topic

Financial Growth and Wealth Accumulation: One of the key motivations for developing this topic was the goal of attaining financial growth and wealth accumulation. The goal of investing is to find and seize opportunities for investments that have the potential to yield profitable returns in the long run. Individuals and institutions aim to improve their financial status and reach their long-term financial objectives by actively seeking out such chances.

Maximizing Returns: For many investors, one of their main goals is to invest in opportunities that present appealing risk-adjusted returns. People might find possibilities that meet their return expectations by investigating and assessing different investing options. By selecting investments wisely, investors can optimize prospective returns by concentrating on tactics and techniques related to this issue.

Portfolio Diversification: The significance of portfolio diversification is another rationale for investigating this subject. By distributing funds throughout several asset classes, sectors, and geographical areas, diversification lowers the risk associated with investments. Through their search for investment possibilities, investors can find assets that have low correlations to the holdings they currently own, increasing the diversity of their portfolio and possibly lowering overall risk.

Reacting to Market Circumstances: The financial markets are dynamic and prone to ups and downs. The necessity to be knowledgeable and aware of market conditions is covered in the section on looking for investment possibilities. Investors can adjust their investing strategy to take advantage of new trends, movements in the economy, and fluctuations in the market by actively seeking out opportunities.

Making the Most of New Trends and Technology: This issue recognizes the importance of how new trends and technology are influencing markets and industries. Those who actively seek out investment prospects can pinpoint growing and potentially disruptive sectors. Investors may position themselves to profit from the related investment possibilities by keeping up to date on these developments and technology.

Capital Preservation and Risk Management: Both capital preservation and risk management are necessary for successful investing. The subject of looking for possible investment possibilities acknowledges the need to carry out in-depth investigation and due diligence to evaluate the risks connected to various investment alternatives. Investors who actively seek out possibilities are better able to recognize any hazards and take the necessary precautions to safeguard their investment.

### Scientific and practical significance

Scientific Significance:

+ Academic study: The subject offers a starting point for financial and investment-related academic study. It provides a framework for investigating different investing approaches, examining market dynamics, and comprehending the elements that go into making wise financial decisions.

+ Empirical Studies: Empirical studies are made possible by a scientific examination of the process of looking for investment prospects. Researchers can find patterns and connections that help identify and assess investment possibilities by examining past data, market movements, and investor behavior. The comprehension of asset pricing models, decision-making biases, and risk and return dynamics may all be improved by these investigations.

Practical Significance:

+ Making Investment Decisions: Both individual and institutional investors can benefit from this topic. It offers direction on how to find possible possibilities, negotiate the complicated world of investments, and come to wise investment judgments. Investors may improve their capacity for efficient capital allocation and the achievement of their financial objectives by being aware of the practical elements of looking for investment possibilities.

+ Portfolio Management: By applying the topic's practical ideas, investors may build and maintain their investment portfolios. Investors may apply tactics to maximize risk-return trade-offs, improve portfolio performance, and match their investments with their risk tolerance and investing objectives by looking for a variety of investment options.

+ Risk Mitigation: The subject highlights how crucial risk management is while making investment decisions. It offers useful methods for determining and reducing the risks connected to various investing possibilities. By learning to recognize and control variables including market volatility, liquidity hazards, and company-specific risks, investors may improve their capacity to hold onto wealth and protect against unfavorable outcomes.

+ Financial Planning: By helping people create plans to reach their long-term financial objectives, this topic advances the profession of financial planning. People may match their investment choices to their financial goals, such as saving for retirement, paying for school, or hitting particular milestones, by looking for possible investment possibilities.

+ Economic Growth and Capital Allocation: This subject is practically significant for the entire economy. Economic growth is stimulated by the efficient deployment of resources through the identification and investment in potential possibilities. Investors assist in the effective use of resources, promote entrepreneurship, and assist creative projects by knowing where to look for possible investment possibilities.

### Topic’s main goal

The primary objective of the topic "Searching for Potential Investment Opportunities" is to locate and assess investment possibilities to maximize profits and meet long-term financial objectives. The main goal is to prudently manage capital by locating opportunities that meet the investor's investment goals and provide advantageous risk-reward profiles. Making wise investment choices with the potential to provide profitable results and support wealth creation and preservation is the ultimate objective.

### Report structure

* CHAPTER 1: Overview

Including research, a summary is a brief presentation of existing research and presents the project tasks and structure of the project concisely.

* CHAPTER 2: THEORETICAL BASIS

The chapter focuses mainly on explaining phrases of scientific concepts about the words that we will study in this topic.

* CHAPTER 3: Design analysis

This chapter will introduce programming languages and usage models.

* CHAPTER 4: Experimental results

This chapter shows a step-by-step analysis of the model and the run code to understand the details needed to produce the results.

* CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The final chapter of the report will conclude the analysis in Chapter 4. Then, the results will be presented as well as recommendations on the most potential investment opportunities.

# THEORETICAL BASIS

## What is investment?

Investment is the process of committing resources, such as money, time, or effort, into an asset or business with the hope of earning revenue or a good return in the future. It entails the acquisition, possession, or construction of an asset intending to earn money or appreciate it over time.

From a scientific standpoint, economic and financial theories may be used to understand investing.

Economic Theory: Investment plays a major role in aggregate demand in economics and is essential to economic expansion. Investment is defined as the production of new capital goods or the enhancement of the value of already-existing capital goods, such as infrastructure, machinery, and buildings. To explain investment decisions, economic theories—such as the neoclassical theory of investment—focus on variables including projected returns, interest rates, technical advancements, and company expectations.

Financial Theory: Risk and return are the main factors considered while analyzing finance investments. Financial theories offer frameworks for assessing investment decisions, such as the capital asset pricing model (CAPM) and modern portfolio theory (MPT). According to MPT, investors may maximize their portfolios by taking the trade-off between return and risk into account. Contrarily, the Capital Asset Pricing Model (CAPM) links an investment's systematic risk, expressed as beta, to its projected return.

## What is stock?

In the context of financial markets, stocks, also referred to as shares or stocks, are ownership stakes in a business. Acquiring stock in a firm entitles you to ownership or partiality in that business. Typically, stocks are purchased and sold on stock exchanges like the NASDAQ or the New York Stock Exchange (NYSE).

A stock's potential for capital appreciation—a rise in value over time—and dividends—regular payments of a company's earnings to its shareholders—are two benefits that come with owning equities for investors. It's crucial to remember, though, that stock investment is not without danger. A stock's value can change due to several variables, such as the performance of the firm, the state of the economy, the mood of the market, and other outside events.

## What is MA (Moving Average)?

A moving average is a mathematical formula that analyzes data points over a specific period. It is frequently used to spot patterns and even out transient swings in the domains of finance, economics, and other subjects.

A sliding window is used to advance one data point at a time, and the moving average is computed by averaging a group of data points within the window. The oldest data point is removed from the computation whenever a new one becomes available. Until the moving average is determined for each data point, this process is repeated.

Using a moving average helps to draw attention to longer-term trends or patterns in the data while lessening the impact of erratic oscillations. Moving averages can help visualize the underlying behavior or direction of a time series by smoothing out the data.

# Design analysis

## Programming language

In this project, we use "Python" as the main programming language for researching financial indicators of different stock codes.

### Python

Python is a popular and versatile programming language that is easy to learn and understand. Guido van Rossum was the creator, and it was originally published in 1991. Python is a fantastic option for both novice and seasoned developers since it places a strong emphasis on clear and succinct code. Numerous applications are supported by it, including data analysis, artificial intelligence, scientific computing, web development, and more.

Python is widely used and versatile due in part to its large ecosystem of libraries and frameworks, which includes NumPy, Pandas, Django, and TensorFlow. Python facilitates cooperation and maintainability among developers by allowing them to produce expressive and efficient code with its comprehensive documentation and simple syntax.

# Experimental results

## How do stock prices change over time?

We will use data on stocks taken from Yahoo Finance. We will use a total of 6 different tickers including:

+ AAPL (Apple).

+ GOOG (Google).

+ MSFT (Microsoft).

+ AMZN (Amazon).

+ NVDA (NVIDIA).

+ TSLA (Tesla).

Regarding the period of the data we use, we will take a period of 252 days from today forward (Not including weekends).

A screenshot of a computer

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Figure 4.1‑1: AMAZON stocks's data info

A screenshot of a computer screen

Description automatically generated

Figure 4.1‑2: AAPL (Apple) stock data

- Average price (mean) in the last 252 trading days: 180.6 USD.

- Price range from lowest to highest: from 159,7 USD to 199.62 USD.

**A screenshot of a computer screen

Description automatically generated**

Figure 4.1‑3: AMZN (Amazon) stock data

- Average price (mean) in the last 252 trading days: 138,7 USD.

- Price range from lowest to highest: from 99.7 USD to 181,7 USD.

A screenshot of a computer screen

Description automatically generated

Figure 4.1‑4: Google (Google) stock data

- Average price (mean) in the last 252 trading days: 134,4 USD.

- Price range from lowest to highest: from 102,38 USD to 155.2 USD.

A screenshot of a computer screen

Description automatically generated

Figure 4.1‑5: MSFT (Microsoft) stock data

- Average price (mean) in the last 252 trading days: 349,57 USD.

- Price range from lowest to highest: from 275,37 USD to 430,8 USD.

A screenshot of a computer screen

Description automatically generated

Figure 4.1‑6: NVDA (NVIDIA) stock data

- Average price (mean) in the last 252 trading days: 490,7 USD.

- Price range from lowest to highest: from 262,2 USD to 974 USD.

A screenshot of a computer screen

Description automatically generated

Figure 4.1‑7: TSLA (Tesla) stock data

- Average price (mean) in the last 252 trading days: 222,77 USD.

- Price range from lowest to highest: from 152,37 USD to 299,3 USD.

### Sales Volume of the six stocks

Sales Volume Volume is the amount of an asset or security that changes hands over a period of time, usually within a day. For example, the stock trading volume would refer to the number of shares of stock traded between the opening and closing of each day. Trading volume and changes in volume over time are important inputs for technical traders.

A graph of sales

Description automatically generated with medium confidence

Figure 4.1‑8: Stocks's sales volume

The charts above represent the sales volumes of the 6 stocks we mentioned earlier.

Looking at the charts, we can see that all 6 stocks have uneven fluctuations. Furthermore, the volume limits between stocks are also different. The volume limit of MSFT (Microsoft) is the highest with a limit of 8.0, while the lowest is AAPL (Apple) with a limit of only 1.25. This shows us that the selling volume of MSFT (Microsoft) is quite large and many times higher than the value of other stocks. This is also considered a round of positive factors for this stock.

But if compared to fluctuations, there is a quite significant difference when GOOG (Google) and TSLA (Tesla) have uneven fluctuations, easily rising high but also easily falling deeply. Meanwhile, NVDA (Nvidia) and MSFT (Microsoft) are more stable and the up-and-down cycle is not too volatile. This is also considered a good signal for a good investment opportunity.

### Historical view of the closing price

A graph of stock prices

Description automatically generated with medium confidence

Figure 4.1‑9: Stocks's closing price

The closing prices of the stocks show a quite clear trend. I will talk about these trends more clearly in the next section on MA, so we will take a general look at the trends.

There are 3 charts showing fairly stable growth: MSFT, NVDA and AMZN. Meanwhile, the 3 charts of the remaining 3 stocks are very unstable when the fluctuations are too large and the fluctuation amplitude is quite high. It is highly recommended to consider these stocks.

## What is the moving average of different stocks?

In chapter 2, we also mentioned the concept of the moving average (MA) model. A moving average (MA) is a simple technical analysis tool that smooths price data by creating a continuously updated average price.

In this topic, we use an average taken over a specific period of time, like 10 days, 20 minutes, 30 weeks or whatever period the trader chooses.

**10-day moving average**: Often used to identify short-term trends and react more quickly to recent price movements. It tends to change rapidly and is more sensitive to short-term fluctuations.

**20-day moving average**: Used to identify medium-term trends and help filter short-term price noise. It provides a better overview of the trend than the 10-day moving average.

**50-day moving average**: Often used to identify long-term trends and reduce short-term price noise. It provides a better overview of long-term trends and is less sensitive to short-term fluctuations.

A graph of different types of stock

Description automatically generated with medium confidence

Figure 4.2‑1: Moving averages for 10, 20, 50 days of 6 stocks

We can clearly observe all the fluctuations of the stocks.

Out of these 6 charts, there are 2 charts that clearly show negative fluctuations, which are AAPL (Apple) and TSLA (Tesla). These two stocks have very erratic increases and decreases. And the reason for this problem is basically:

- AAPL (Apple), Apple's reputation is at stake and the corporation is having to deal with a number of issues such as:

+ Decline in iPhone sales and profits: Declines in iPhone sales and profits have put pressure on Apple's stock.

+ Legal troubles: Legal issues are also affecting the company's reputation.

- TSLA (Tesla) is facing a big "storm" that is:

+ Increasingly competitive electric vehicle environment: A significant increase in competition in the electric vehicle sector is weighing on Tesla's stock.

+ The company's fundamentals are in question: Issues related to Tesla's operating principles are weighing on the stock.

Meanwhile, other stocks tend to increase quite well and have very little fluctuation, and the best can be mentioned as stocks of AMZN (Amazon) and NVDA (NVIDIA). These two stocks have quite stable growth across the lines and their MA lines also show quite positive fluctuations. Because NVIDIA and AMAZON are both companies that tend to develop AI and are large technology companies. Moreover, because they also grasp current AI trends, these two companies are both rising and less affected by the economic recession.

## What is the stock's average daily return?

### Average daily returns

A graph of data on a white background

Description automatically generated with medium confidence

Figure 4.3‑1: Average daily returns of stocks

With this average profit chart, we can see its similarity with the close price (Figure 4.1-8). The main feature shows that there is unusual variability in this data.

NVDA (NVIDIA) is still a stock with a very good trend as the average profit is evenly distributed between positive and negative values. Furthermore, the column limit of this stock is also quite high. Similarly, we also have AMZN (Amazon) which is also a stock with a very good average daily return.

On the contrary, stocks like AAPL (Apple) or TSLA (Tesla) have large fluctuations in distribution and tend to have negative values. This is a pretty bad signal.

### Daily return percentage of the six stocks (Histogram chart)

A graph of numbers and graphs

Description automatically generated with medium confidence

Figure 4.3‑2: Histogram of stock's daily return percentage

This histogram chart will help us observe whether the data we are using is normally distributed or not.

The image shows that all 6 stocks are normally distributed, which is quite good.

Among them, the stocks with the longest daily return amplitude are APPL (Apple) and MSFT (Microsoft). The shortest are AMZN (Amazon) and NVDA (NVIDIA). And in the count column, all 6 stocks have negligible differences.

Aside from those limits, allocation size is also an important factor in deciding on stock selection. Although MSFT (Microsoft) and AAPL (Apple) have long amplitudes, their distribution values are not too positive. But perhaps NVDA (NVIDIA) is the most positive stock because there is almost no negative value. Although the daily return is small, the majority of the distribution is positive.

## What is the correlation between the closing prices of different stocks?

### Compare daily returns of six stocks

A graph of blue dots

Description automatically generated with medium confidence

Figure 4.4‑1: General daily return correlation chart of stocks

We can now compare the daily return percentages of the two stocks to check how they correlate. Let's first compare a stock with itself. The first one is AAPL (Apple) v. AAPL (Apple). So now we can see that if two stocks are perfectly (and positively) correlated with each other then a linear relationship between the value of its daily returns will occur.

Seaborn and Pandas make it very easy to repeat this comparative analysis for every possible combination of stocks in our list of tech stocks. We can use SNS. pairplot() to automatically create this plot. The chart created is a scatter plot, where the x-axis and y-axis represent the daily profits of stocks. Each point on the chart represents one trading day, and the position of the point represents the respective daily profit values ​​of both companies for that day. The scatter plot shows the distribution of data points on the xy plane. If there was a linear relationship between daily returns, the points would represent a data pattern close to a straight line, indicating a correlation between the two variables. So now we can see that if two stocks are perfectly (and positively) correlated with each other then a linear relationship between the value of its daily returns will occur.

We will not analyze all stock pairs, but will only select the pairs with the highest correlation for analysis. And we have selected a total of 6 different pairs to research, including:

- NVDA – GOOG (NVIDIA – Google).

- AMZN – AAPL (Amazon – Apple).

- NVDA – MSFT (NVIDIA – Microsoft).

- MSFT – AAPL (Microsoft – Apple).

- MSFT – GOOG (Microsoft – Google).

- NVDA – AMZN (NVIDIA – Amazon).

A graph with blue dots

Description automatically generated

Figure 4.4‑2: NVDA – GOOG (NVIDIA – Google)

A graph of different sizes and colors

Description automatically generated with medium confidence

Figure 4.4‑3: AMZN – AAPL (Amazon – Apple)

A graph with green dots

Description automatically generated

Figure 4.4‑4: NVDA – TSLA (NVIDIA – Tesla)

A graph with pink dots

Description automatically generated

Figure 4.4‑5: MSFT – AAPL (Microsoft – Apple)

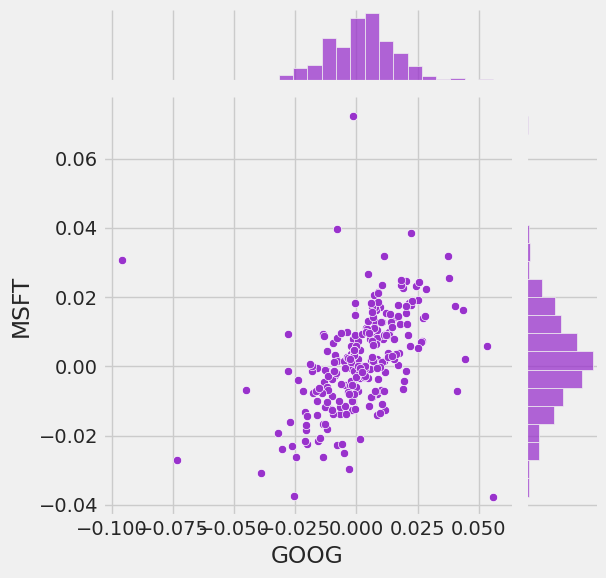


Figure 4.4‑6: MSFT – GOOG (Microsoft – Google)

A graph with yellow dots

Description automatically generated

Figure 4.4‑7: NVDA – AMZN (NVIDIA – Amazon)

Look at all 6 charts above to compare and choose the pair of stocks with the best and most stable correlation. We can see that in 4 graphs

- NVDA – GOOG (NVIDIA – Google).

- AMZN – AAPL (Amazon – Apple).

- NVDA – MSFT (NVIDIA – Microsoft).

- MSFT – AAPL (Microsoft – Apple).

The value dots all rotate around the "O" axis, showing instability and discrete dispersion. Meanwhile in 2 charts

- MSFT – GOOG (Microsoft – Google).

- NVDA – AMZN (NVIDIA – Amazon).

There is a certain concentration and dispersion in an upward trend, so these will be the two pairs of stocks with the best correlation.

### Correlation between stocks

The "Correlation between stock returns" chart and the "Correlation Between Stock Closing Prices" chart are the two types of charts we used to select the stock pairs above. They show more clearly the correlations between pairs of stocks across many different value variables.

#### Correlation between stock returns

A green and yellow squares with black text

Description automatically generated

With pairs of similar stocks, the correlation will be absolute, so we will not discuss this issue.

The lighter and brighter the color, the higher the correlation. Among them, there are 6 pairs of stocks with relatively high correlation (from 0.5 or 50% or more), which are also the 6 pairs that we analyzed above:

- NVDA – GOOG (NVIDIA – Google).

- AMZN – AAPL (Amazon – Apple).

- NVDA – MSFT (NVIDIA – Microsoft).

- MSFT – AAPL (Microsoft – Apple).

- MSFT – GOOG (Microsoft – Google).

- NVDA – AMZN (NVIDIA – Amazon).

#### Correlation Between Stock Closing Prices

A chart of a stock market

Description automatically generated with medium confidence

Similar to the chart above, 4.4.2.2 this "Correlation Between Stock Closing Prices" chart also shows correlation but will be about Closing Prices. And as special as the chart above, there are still 6 pairs of stocks with extremely high correlation (from 0.75 or 75% or more).

Although there are also other highly correlated pairs, to select pairs with high exploitation potential, the above 6 stock pairs are still the best. The simple reason is because these 6 pairs in both charts show their extremely good correlation.

## How much risk do we take when investing in a particular stock?

A graph with numbers and lines

Description automatically generated

Looking at this risk chart, we can clearly see that NVDA is the leading stock in terms of profits as well as having the highest risk among the 6 stocks.

There are 3 stocks that are at an average level in terms of both profit and risk: GOOG, AMZN and MSFT.

There is a stock that is at a very stable and almost not very promising level, AAPL, when the expected profit is only at a level that has not yet reached 0.001.

But above all, the stock with the biggest negative is TSLA when the current risk of this stock is extremely high but the profit it brings is too low, this is a quite dangerous stock at the present time.

# CONCLUSIONS

We can see that investing in Tesla will be extremely risky with an extremely high risk rate. Then, for the remaining 5 types of stocks, we can see that the risk ratio is proportional to the profit.

We see the potential of the following 2 stock pairs: 'GOOG' and 'MSFT' - 'AMZN' and 'NVDA'

In the pair 'GOOG' and 'MSFT', we see a strong development potential as these two stocks have an extremely high correlation index, we can clearly observe purple dots that are less than the signs. The remaining graph means the correlation is high. Then we see that there are many dots above the zero level indicating high daily profits. In the pair 'AMZN' and 'NVDA', although the yellow dots did not break through as strongly as the pair above, it will be a potential pair for those who want to invest safely. Looking at the position of the dot above and below the zero axis, we can clearly observe the even distribution of profits and risks always at a safe level. After that, Let's see a historical view of the closing price AMZN and NVDA are both showing signs of a steady increase after a period of time.

# REFERENCES

Dohmke, T. (2024, 4 2). Retrieved from Github: https://github.com/

Kelliher, C. (2022). *Quantitative Finance with Python.* CRC Press.

*Yahoo Finance*. (2024, 4 2). Retrieved from Yahoo Finance: https://finance.yahoo.com/