

Portfolio Selection in the Field of Social Media

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Abstract: With the development of the Internet and the popularity of smart phones, social media has become the new mode of communication in the global world and covered many aspects of live of people such as working and education. The rise of the e-commerce economy has also increased the economic value of social media platforms. Therefore, this market is growing rapidly and has great investment value. This paper has created a portfolio of five stocks including Meta, Twitter, Tencent, Pinterest and Match Group in social media market to analyze the viability. Portfolio diversification plays an important role in reducing risk, and the capital asset pricing model (CAPM) explains the relationship between market and unsystematic (portfolio) risk. In Excel sheet, it builds two models to find the optimal weights of portfolio and Sharp ratio by using the Solver tool and the CAPM. The research shows that there is a certain correlation between each asset of the portfolio, and it is easily affected by the uncertainty of social media, which increases the risk of the portfolio. When investing a portfolio in real life, investors could select assets with slight correlation in different industries, which could reduce risk and uncertainty effectively.

Keywords: portfolio diversification, CAPM analysis, social media

1. Introduction

With the proliferation of smartphones and the Internet, social media has replaced the old mode of communication such as sending letters with pen and paper, especially among young people. According to the research of Newman, in the current market, social media is a new concept and is difficult to be defined, because its existence and usage methods are diverse [1]. For example, it could be a release of new content, a social software, or a chat on a social platform. The concept of social media determines that there are broad development prospects and unfilled market gaps in this market. The social media market has developed to cover many aspects of live of people. In politics, candidates could communicate with voters directly via Twitter to obtain their recent news. In economic life, Alberghini, Criceli and Grimaldi have investigated Eni that is an Italian company and discovered that social media is recognized as an internal support to stimulate the enthusiasm of employees [2]. Greenhow, Sonnevend and Agur have discussed the uses of social media in education area such as Email and believed the integration of education and social media is likely to dominate the future [3]. Lin took Facebook as the example and analyzed its revenue margin metrics to determine the investment prospects of the market. The study discussed that its gross revenue margin ranged from 9.71% to 52.28% during 2010-2013, which showed the incredible level of development and investment potential of the market [4]. Therefore, the research aims to create a portfolio of social media market

including Meta, Twitter, Tencent, Pinterest and Match Group to analyze its feasibility. This paper will review the literatures of diversification and CAPM analysis and build models in Excel to discuss the feasibility and applications of portfolio in real life.

2. Literature Review

When investing in stocks, investors are often faced with the consideration of risks and profits, and high-risk investments are often hidden behind high-profit investments. In finance, many experts and scholars are studying how to reduce the risk and uncertainty while maximizing profits. There are three foundational methods to reduce risk. First, collecting sufficient data is important for investors to gain the latest information and risky sellers and stocks. The second one is hedging such as insurance. People use hedging to protect themselves from negative events. In this paper, it will focus on portfolio diversification.

2.1. Portfolio Diversification

Lhabitant has written that portfolio diversification is the strategy of investing quantitative money in different securities and stocks rather than a single one [5]. This process could minimize the riskiness of this portfolio and obtain the most favorable profits. The risks are divided by two types: unsystematic risk and systematic risk. Unsystematic risk is intrinsic in each investment that exists in a company or industry, which could be reduced by portfolio diversification. Systematic risk is the market risk, which means that this risk could affect the entire market such as interest rate, inflation, and recession. It cannot be removed by portfolio diversification. As for the idea of portfolio diversification, Lyu has summarized two main ideas: native and optimal portfolio. Native portfolio considers that the higher the number of assets in the portfolio, the lower the investment risk. Optimal portfolio believes that the risk is related to return, and there is an optimal investment proportion to minimize the risk under the certain conditions [6]. Based on risk-averse assumptions, Harry Markowitz founded modern portfolio theory and established the analytical model. He identified the two variables of a portfolio as expected return and variance. The expected rate of return and variance of each security or stock should be calculated and evaluated. Through mathematical programming, the proportion of each security or investment in the portfolio should be determined [6].

2.2. Beta and the Capital Asset Pricing Model

Beta (β) can be used to explain the relationship between the return of an asset and that of market. When beta is greater than 0, it shows that the asset has a positive correlation with the market, and vice versa. Moreover, beta could measure the market risk. When beta is greater than 1, the price of securities is more sensitive than that of market, which reflects that the securities are riskier than market, and vice versa.

The capital asset pricing model (CAPM) is $E(r_i) = rf + \beta_i * (rm - rf)$, where $E(r_i)$ is expected return of security, rf is risk-free rate of return, and rm is the return of market. This formula shows how the expected return of security is explained by the risk of market (systematic risk). In this method, the systematic risk could be quantified and converted into expected return of security [7].

3. Methodology

This paper aims to analysis the viability of the portfolio in the social media market. In this part, it will explain in detail why the social media field is chosen as the research market and describe the research value of the data sample. Moreover, it will state how the models are built and work in Excel based on Excel-Solver tool and the CAPM analysis.

3.1. Research Market

The Boston Consulting Group Matrix is a strategic tool to analyze the business performance to flexibly adjust decision-making. It has four symbols representing different business capabilities. The stars represent that the business has a fairly high market share in the market and is growing rapidly. The cash cows represent that although this business occupies a dominant position in the market share, it has gradually lost its growth space. The question marks generally show the new enterprise with high market growth and low share. The dogs express the unsuccessful business with low market share growth [8]. From the research of Alberghini, Criceli and Grimaldi, they found that 95% of employees participated in the social networking sites. 70% of them are identified as active accounts to actively display themselves and will put forward precise and unique suggestions and solutions for new projects, which is conducive to creating a harmonious working atmosphere and efficient output [2]. From this example, social media has been widely used in work. In addition, social media allows people to communicate with relatives and friends anytime and anywhere and reach larger groups in virtual networks. This phenomenon has become the social mode of young people. Over the past two decades, the number of people using social media has grown from less than 500 million to more than 2 billion [9]. It could be concluded that the social media is the star in BCG matrix with high market share and growth. Therefore, this market has a strong investment nature, and analyzing the portfolio of this market could be a guidance for investors.

3.2. Data Sample

The data sample is the historical prices of Meta (META), Twitter (TWTR), Tencent (TCEHY), Pinterest (PINS), and Match Group (MTCH) from 1st January 2020 to 1st August 2022. Meta Platforms, Inc. is an American Internet technology company with social network, virtual reality and metaverse as its core business. It has well-known social media platforms such as Facebook, Instagram, WhatsApp, etc. that play an important role in people connecting and showing their life. Twitter is a social networking platform that sends out content similar to microblogs called tweets. It has become an important source of information in the global world today. Tencent Holdings Limited is the greatest internet company in China similar to Meta, and it has the most active social media platforms in China such as WeChat and QQ. Pinterest is a photo-sharing social platform popular among young people with remarkable growth potential. As for Match Group, it is the earliest dating service platform and has become an internet company which runs the largest dating service in the world. These five companies have a stable source of income and great growth potential, so they have high investment value.

3.3. Research Technique

The historical prices of the five stocks and S&P 500 were collected between 1st January 2020 and 1st August 2022 from yahoo finance and integrated into Excel. Data preparation and processing work is divided into the following steps:

- (1) Use $(R_t - R_{t-1}) / R_{t-1}$ to calculate the return for each month
- (2) Use the Average formula and STDEV formula to calculate the average return and the standard deviation of returns separately
- (3) Use the CORREL formula to calculate the correlation coefficient to identify the correlation between each stock
- (4) Subtract the average return from the monthly return to get the monthly demeaned return
- (5) Use the MMULT (TRANSPPOSE (demeaned return), demeaned return) / (the number of data - 1) to get the covariance matrix.

When the data preparation was completed, the models could be built by the Excel-Solver tool to calculate the optimal weight of each stock in this portfolio and to maximum the sharp ratio. The steps required are as follows:

- (1) Assume the average return as the expected return
- (2) Assume the weight of every stock is 20%, which is the foundation to calculate the optimal weights and maximum the sharp ratio, and the total weights are 100%
- (3) Use the SUMPRODUCT formula to calculate the portfolio return
- (4) Use the function of $w'\Sigma w$ and the MMULT formula in excel to calculate the portfolio variance, and take the root of variance to get portfolio standard deviation
- (5) Find the risk-free rate (in 30/08/2022 from U.S. department of the treasury), and use the function of (portfolio return-risk-free rate) / portfolio standard deviation to get the sharp ratio
- (6) Use the Excel-Solver to find the optimal weights and sharp ratio. In data section, open the solver tool and set the objective as portfolio return to maximum the value. Select the variable cells as the weight of each stock. Add “the sum of weights is equal to 1” in the subject to the constraints. Tick the option of making unconstrained variables non-negative to avoid extreme data.
- (7) Calculate the portfolio covariance of each stock and use the function of covariance/portfolio variance to find implied beta.

Since the average return is assumed as expected return, the reference is portfolio in this model. To keep the data accuracy, a model whose reference is market is needed. First, the SLOPE formula is used to calculate the beta between each stock and the market (S&P 500). Second, the CAPM function is used to calculate the actual expected return. Then, the Solver tool is applied to build the model again, and two results are compared.

4. Results

In this part, it will show the results of the average return and standard deviation, explain the relationship between each stock, and compare the outcomes of two results.

4.1. Average Return and Standard Deviation

Average return can represent the average level of a stock over this period. In Table 1, the average returns of Meta, Tencent, Match group are less than 0, which shows that these three stocks have posted modest losses during the Covid-19-impacted period, with poor gains, probably because the three companies are diversified companies that do not just run the business of social media platforms. As for Twitter and Pinterest, their average returns are greater than 0, which implies that the two stocks were on the rise overall, because people worked, studied, and use social platforms to inquire about new information and socialize at home during the pandemic of Covid-19.

Table 1: Average return and standard deviation of five stocks.

| | META | TWTR | TCEHY | PINS | MTCH |
|---------------------|--------|--------|--------|--------|--------|
| average return | -0.09% | 1.76% | -0.06% | 1.64% | -0.26% |
| standard deviations | 10.72% | 16.24% | 8.98% | 18.57% | 12.48% |

For measuring risk mathematically, the standard deviation can explain the degree of dispersion of the stock to obtain the degree of stability of the stock and infer its risk, but this method is too rough. As companies centered on social media, meta and Tencent have lower standard deviations, indicating that these two stocks have a lower degree of dispersion, are more stable, and have less risk. This also means that these two companies are mature companies with more stable development. The values in standard deviation of Twitter, Pinterest, and Match Group are high, stating that these three stocks

have a higher degree of dispersion, are more volatile, and have more risk. Twitter, as a single social networking platform, is more susceptible to market and other external factors, and is more volatile than diversified companies. For a new concept company based on photo socialization, Pinterest has more development potential but also means risk. Although the Match group operates the world's largest dating service, it has also suffered from reputational issues due to safety issues such as rape cases, which could affect the trust of users in the service and lead to fluctuations in the stock, making the investment riskier.

4.2. Correlation

In Table 2, the correlation coefficients of Meta and other stocks have ranged from 0.12 to 0.41, which shows that they have weak positive correlation and when meta stocks move, other stocks are affected based on the strength of the correlation. The correlation coefficients of Twitter and other stocks (Pinterest and Match Group) are around 0.23 and 0.45, expressing the weak positive correlation between them. Twitter has almost no correlation with Tencent, because the coefficient is -0.0782 which is too small and almost 0, and Tencent and Twitter have different markets in the world where they mainly operate. The correlation coefficient of 0.38 between Tencent and Pinterest indicates the mild correlation, and there is almost no correlation between Tencent and Match Group like Twitter and Tencent. As for Pinterest and Match Group, they also have slight correlation with the coefficient of 0.3235.

Table 2: Correlation.

| | META | TWTR | TCEHY | PINS | MTCH |
|-------|--------|---------|---------|--------|------|
| META | - | - | - | - | - |
| TWTR | 0.2221 | - | - | - | - |
| TCEHY | 0.1219 | -0.0782 | - | - | - |
| PINS | 0.4104 | 0.4452 | 0.3815 | - | - |
| MTCH | 0.2975 | 0.2265 | -0.0152 | 0.3235 | - |

4.3. Two Models

The first model assumed the average return as the expected return and use the Solver tool to find the optimal weights and maximize the sharp ratio. The results of optimal weights are shown in the Figure 1.

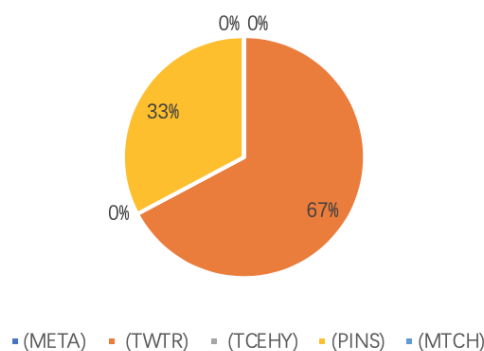


Figure 1: The optimal weights of first model.
(Photo credit: Original)

After removing extreme data, this model suggests that Twitter accounted for 67% and Pinterest accounted 33% in this portfolio under this condition. The Sharpe ratio represents the additional benefit from the additional risk that investors have assumed, and it is calculated by (portfolio return-risk-free rate) / portfolio standard deviation [10]. In this portfolio, the maximum sharp ratio is 9.87%, indicating that the 1 additional unit of risk that an investor takes on investing in this portfolio will bring an additional 9.87% in profit. Implied beta represents the relationship between each stock and this portfolio, and the results are shown in Table 3. The five stocks have positive correlation with the portfolio. Twitter and Pinterest have stronger relationship than other stocks. If the portfolio increases by 1%, each stock will increase the corresponding coefficient of implied beta.

Table 3: Implied beta for the first model.

| | META | TWTR | TCEHY | PINS | MTCH |
|--------------|------------|-----------|-------------|------------|-------------|
| covariance | 0.00510664 | 0.0214127 | 0.001275073 | 0.01967059 | 0.005363506 |
| implied beta | 0.2450 | 1.0274 | 0.0612 | 0.9438 | 0.2573 |

The second model uses the CAPM to calculate the actual expected return in the market and set the portfolio again by Excel-Solver tool. In the CAPM, it assumed return on the market (rm) as 8% per year, because the average annual growth is about 8% of over the past 100 years in the U.S. stock market. The function of $E(ri) = rf + \beta i * (rm - rf)$ is applied to calculate the actual expected return, and the result is derived in Table 4.

Table 4: CAPM analysis.

| | META | TWTR | TCEHY | PINS | MTCH |
|-----------------|--------|--------|---------|--------|--------|
| beta | 1.2581 | 0.8583 | -0.2167 | 1.1647 | 1.1344 |
| expected return | 0.76% | 0.61% | 0.21% | 0.73% | 0.72% |

Except for Tencent, the other stocks have a strong positive correlation with the market, indicating that they are strongly influenced by market factors such as inflation. The expected returns of these stocks have ranged from 0.21% to 0.76% which are positive. By using the Solver tool again, the optimal weights are shown in Figure 2. In this portfolio, the proportions of Meta, Twitter and Match group are 61%, 8% and 32% individually. Under this condition, the sharp ratio is 5.05% which stated that for each additional unit of risk people take, they get an extra return of 5.05 percent.

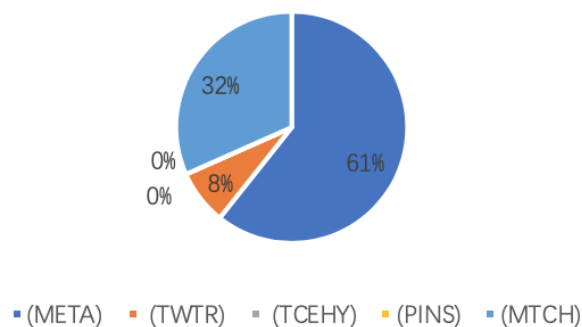


Figure 2: The optimal weight of the second model.
(Photo credit: Original)

The first model indicated the relationship between the portfolio and each stock, while the second model explained the relationship between the market and each stock. However, compared the two models in Table 5, investors are suggested to choose the second one. There are two reasons to explain. First, the first model assumed average return as expected return, which is not accurate and could mislead subsequent calculations such as sharp ratio. Second, the portfolio variance and standard deviation of first model is greater than those of second model, stating that the second model has less dispersion, more stable profits, and less risk.

Table 5: Portfolio variance and standard deviation of two models.

| | Portfolio variance | Portfolio standard deviation |
|--------------|--------------------|------------------------------|
| First model | 2.08% | 14.44% |
| Second model | 0.78% | 8.83% |

5. Discussion

When performing diversification to reduce risk, it is necessary to pay attention to the correlation between each asset. When two assets are closely or strongly correlated, they are not suitable for a portfolio, because these variables move with the same percentage and trend as the market moves, and it defeats the purpose of allocating risk through the portfolio. Looking at the correlation in the Result part, the correlation coefficients between every two stocks have ranged from 0.1219 to 0.4452 (ignore tiny values), which shows that there is still a certain correlation between these stocks. When one stock is affected, the other will also change according to the strength of the correlation. This portfolio is flawed because it does not perfectly reduce the correlation and risk between the two stocks. As for portfolio return, the first model is 1.72% and the second model is 0.74%. The values are too small to satisfy rational and profit-seeking investors demand for revenue. The figures of Sharp ratio could also reflect this point.

Li has explored the economic value of social media platforms through the consumer behavior of user combinations and found that platform economy has now almost become an e-commerce economy, with social media attracting users for products by reaching out to a wider audience. He also discovered user behavior pattern and obtained the result that people are cross-platform users and choose different social platforms based on how much they like them. This research has shown that exploring social media portfolios are more research-worthy than a single social platform [11]. However, the attribute that the target group is a cross-platform user would bring risk to this portfolio. When the target group chooses the platform to use according to the degree of preference, the stock movement of the unpopular platform will be affected. In the same market, other stock movements are also subject to volatility because they are correlated. Such uncertainty violates the purpose of portfolio diversification by increasing the risk of diversion, despite the large potential profits in the social media market.

From the investigation of Li, social media is a market that seems to have economic potential but contains huge risks. Reviewing the beta between each stock and the market, except for Tencent, which showed a negative correlation with the market, the other four stocks showed a strong positive correlation with the market, indicating that they fluctuate strongly as the social media market changes. The uncertainty in this market will increase the volatility of each stock, thus introducing more risk to the portfolio. Finally, the result has summarized that many seemingly lucrative stock markets often attract investors to put their money into the same industry such as social media, smartphones, and new energy vehicles, but this behavior carries risks. When the market declines or the stock trend changes, investors tend to take too much risk and lose money, defeating the purpose of the portfolio.

6. Conclusion

This paper aims to create a portfolio of social media market to analyze its feasibility. After data analysis in Excel, this portfolio is lack of viability and effectiveness, because the asset correlation in the portfolio cannot be too strong, to reduce the risk. In this portfolio, there is a certain correlation between each stock, which increases the level of risk. The correlation between the market and every stock is strong, so the volatility of social media markets also increases the uncertainty. Although in the stock market, risk is proportional to profit (for a single stock), the core purpose of portfolio is to reduce the correlation between stocks, resulting in reducing risk and increasing profit. In this portfolio, smaller profits are not risk-averse because the stocks are sourced from the same market. There is a positive correlation between stocks, and changes in one stock will cause fluctuations in another stock. In conclusion, when creating a portfolio, investors are suggested to select the stocks that are not highly correlated and do not belong to an industry to reduce the risk effectively and maximize the profits.

There are limitations in this research method. The research only draws relevant conclusions based on historical price data and does not consider dynamic and realistic factors such as the business model of companies and the systemic risk of market. Therefore, in the future investigation direction, researchers can combine data analysis with dynamic real factors such as inflation and economic recession for in-depth analysis. At the same time, researchers can refer to the real-time news of stocks to analyze the future trend of stocks, which can better simulate the expected value and dispersion degree of stocks to determine the expected return and stability of stocks.

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