

The Comparison of Technology Stocks between America and China in Portfolio Management

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Abstract. The difference in technology stocks between different countries has been a topic that has been well thought out. This paper analyzes six representative stocks in the US and China, such as APPL, META, GOOG, and NTES, BIDU, and BABA in the US, and the paper analyzes them in depth by CAPM model and FF3F model. The paper calculated the expected return for the CAPM model and FF3F model and balanced the risk and expected return by the Sharpe ratio to find the technology stocks with the least risk and the most benefit. The results show that the CAPM model and FF3F model can balance the risk and expected return very well. Second, on balance, U.S. technology stocks generally perform better than Chinese technology stocks, with APPL and GOOG being two of the best performing U.S. technology stocks, as seen in both previous data and current expected return, beta and weights. These findings should be useful for investors interested in China and the US technology stocks.

Keyword: CAPM; FF3F; APPL.

1. Introduction

Over the past decade, Chinese tech stocks have started to grow at a rapid pace and various tech stocks from China have started to become internationally active and there is no doubt that Chinese tech stocks have started to become a world class presence. “China tech's global expansion will be a great long-term development”, according to Anand Batepati, portfolio manager and co-founder at GFM Focus Investing. As Batepati said, the growth of Chinese tech cannot be ignored, and it is growing at an alarming rate. In contrast, US tech stocks have been on a solid footing since the beginning and have been the subject of much discussion since the beginning. U.S. tech stocks have been at the top since the beginning. The value of the fast-growing Chinese tech stocks and the top-ranking U.S. tech stocks are both very valuable, and this value has attracted the attention of many people. Although both are at the top, depending on the policies of different countries, and geographical location, it is also indecisive which of the two is more valuable. Thus, in order to give investors a broader perspective, this paper is very valuable.

The paper finds that currently, there are numerous studies regarding the technology comparison between China and America. Nevertheless, only few scholars aim to research on the tech companies' comparisons between China and America. In the current situation, many techs comparison analysis is according to the overall country conditions. For example, Haiyong Sun researched the tech war between China and America, he emphasized the technology industries and governments [1]. And Noah Barklin, researched the export controls and the economies of countries [2]. In the meantime, some scholars focused on certain aspects, such as Satoru Mori, the paper researched the competition between China and America tech in military, industrial, and digital network dimensions [3]. Some scholars focused on tech stocks, but not comparison between countries, such as Székely, Gábor and Donald St.P Richards [4]. And JH Cochrane [5]. Some people also did some comparisons in economic markets between different areas, such as Chi Min Ho [6]. Some scholars, like Sung S. Kwon compared different kinds of tech stocks, high tech stocks and low-tech stocks instead of comparing tech stocks from different countries [7].

This paper focuses on analyzing stocks from the past five years (2017/9-2022-11) of stock performance. The stocks analyzed are the six most typical stocks, BIDU, BABA, and NETS in China, and META, APPL, and GOOG in the U.S. This paper uses the CAPM model and FF3F model to calculate the maximum Sharpe ratio as well as maximize the stocks' weights in the portfolio to get

the most valuable tech stocks under the risk-return trade-off. Ultimately, U.S. tech stocks are better values than Chinese tech stocks in almost all the areas mentioned in the article. In terms of risk vs. reward, U.S. tech stocks are better than Chinese tech stocks

2. Data

Yahoo Finance is where the data in the paper comes from. The paper selects the typical companies. e.g., AAPL, GOOG, META, TCECY, BIDU, BABA, as the research objects, and the paper uses the data of closing prices from Yahoo finance, from September 1, 2017, to August 1, 2022. Moreover, in order to carry out further exploration, the paper does data cleaning. Finally, 1148 data are collected. Some fundamental information is shown in the following Tables 1 and 2, respectively.

Table 1. Corporate indicator of the chosen stocks

	APPL	GOOG	META	TCECY	BIDU	BABA
Current ratio	0.9	2.8	2.5	2.2	2.7	1.7
CAPM beta	1.173	1.036	1.218	0.413	0.731	0.547
CAPM E(r)	0.008	0.007	0.009	0.003	0.005	0.004

Through visualizing the data, the paper has discovered that the ‘GOOG’ has the highest current ratio, while the ‘APPL’ has the lowest current ratio. What’s more, the ‘META’ the highest CAPM beta, while the ‘NTES’ has the lowest expected return and the lowest beta.

Table 2. Descriptive statistics of the selected assets

	AAPL	GOOG	META	NTSE	BIDU	BABA
mean	0.027	0.016	0.003	0.013	-0.001	-0.004
return						
variance	0.007	0.004	0.009	0.008	0.014	0.010
max	0.214	0.165	0.271	0.203	0.555	0.229
min	-0.184	-0.176	-0.326	-0.233	-0.338	-0.226

Through visualizing the data, the paper has discovered the ‘APPL’ has the greatest mean return, whereas the ‘BABA’ has the smallest mean return. In terms of variance, ‘BABA’ is the highest and ‘GOOG’ is the lowest. When it comes to maximum return throughout the 5 years, the ‘BIDU’ has the smallest minimum return while having the greatest maximum return. The ‘GOOG’ has the greatest minimum return while having the smallest maximum return.

3. Methods

In 1964, the CAPM model is invented by William Sharpe, John Lintner, Jack Treynor and a few other people to define capital asset pricing, it allows modern investors to better value stocks by combining risk and expected return.

The CAPM model, or Capital Asset Pricing Model in full, was invented by a series of researchers based on both the capital market theory and asset portfolio theory. The CAPM model is the backbone of price theory in modern financial markets and has a very important and indispensable position, lots of models are formed on the basis of CAPM model [8].

3.1 Capital Asset Pricing Model

The CAPM model, or Capital Asset Pricing Model, was developed by a series of American scholars on the basis of asset portfolio theory and capital market theory. The CAPM model research and analyze the connection between systematic risk, or the general risk of the market, and the

expected return. The CAPM model is the backbone of price theory in modern financial markets and has a very important and indispensable position. The related equation is showing below:

$$E(r_i) = R_f + \beta_{im}(E(R_m) - R_f) \quad (1)$$

In the equation, the risk-free rate is represented by variable R_f , the beta coefficient is stood by variable β_{im} , the expected market return on market m is represented by variable $E_{(Rm)}$, and the market risk premium is represented by $E_{(Rm)} - R_f$.

3.2 The FF3F Model

The FF3F model, or Fama-French three-factor model in full can be used to explain stock returns. Fama and French in 1993 showed that stock returns could be explained and illustrated by a three-factor model. The model gives out a brand-new suggestion that there are three factors that could explain and illustrate a portfolio's excess return, they are: the market asset portfolio, the market capitalization factor, and the book-to-market ratio factor. FF3F model is so commonly used so that it is popular to be discussed [9-10]. This model can be expressed as,

$$E(R_{it}) - R_{ft} = \beta_i[E(R_{mt}) - R_{ft}] + s_i E(SMB_t) + h_i E(HMIt) \quad (2)$$

In this equation, the risk-free rate of return during a period of time of t could be expressed as R_{ft} . The market rate of return during a period of time of t could be expressed as R_{mt} . The rate of return of asset i during a period of time of t could be shown as R_{it} . The market risk premium could be shown as $E(R_{mt}) - R_{ft}$. The hypothesized portfolio return of the market value factor during a period of time of t could be expressed as SMB_t . The hypothesized portfolio return of the book-to-market factor during a period of time of t could be expressed as $HMIt$.

3.3 The Mean-Variance Model

Mean-Variance Analysis could be used to help investors determine which financial investment to purchase by analyzing the tolerance of risk of the investors. Generally, investors bear more risks in order to eager higher returns. In Markowitz's analysis, risks are defined as the volatility of returns. Markowitz was the first to apply mathematical and statistical methods to cope with the study of the selection of portfolios. This method helps to optimize the return and balance the risks. The mean can be calculated in the following formula,

$$R_p = \sum_i x_i \mu_i \quad (3)$$

The variance can be written in the following formula,

$$\sigma^2 = \text{var}(\sum_i x_i r_i) = \sum_{ij} x_i x_j \text{cov}(r_i, r_j) \quad (4)$$

The sharpe ratio can be expressed in the following expression,

$$SR = \frac{E(R_p) - R_f}{\sigma_p} \quad (5)$$

4. Results

Using the FF3F model, we calculated the betas of the FF3F model of each stock, which is represented in Table 3.

Table 3. Details for FF3F

	AAPL	GOOG	META	TCECY	BIDU	BABA
FF3F MKT BETA	1.243	1.079	1.295	0.483	0.471	0.544
FF3F SMB BETA	-0.388	-0.258	-0.459	-0.425	1.546	0.041
FF3F HML BETA	-0.514	-0.056	-0.130	0.011	0.357	-0.310

In this table, in association with table 1, the paper can conclude that in FF3F model, all technology companies in America all perform better than Chinese technology companies. Using the CAPM model, the paper calculated the CAPM model betas and expected return for each stock, which is represented in table 4.

Table 4. Details of the beta and expected return in CAPM model

	AAPL	GOOG	META	TCECY	BIDU	BABA
CAPM beta	1.173	1.036	1.218	0.413	0.731	0.547
CAPM E(r)	0.008	0.007	0.009	0.003	0.005	0.004

In this table and combines this table with table 1 and table 2, the paper can conclude that in FF3F model, all technology companies in America all perform better than Chinese technology companies, there is something to do with the government policy.

Table 5. The weights in Maximum sharpe ratio portfolio

	CAPM portfolio weight	ff3f portfolio weight
APPL	0.241	0.034
GOOG	0.496	0.546
META	0.153	0.206
NETS	0.035	0
BIDU	0.073	0.212
BABA	0	0

In this table, the paper infer that in both CAPM model and FF3F model, the sum of the weights of the companies from America weigh more. Which means the technology companies in America must be more valuable than technology companies in China.

5. Conclusion

This paper uses CAPM model and FF3F model to weigh the risk and return of stocks and find the stocks with the lowest risk and highest return, so as to compare Chinese tech stocks with US tech stocks. The paper used the beta, Sharpe ratio, and portfolio weight of the FF3F model to find out the most valuable assets, i.e., GOOG, META, and BIDU, of which only BIDU is the only tech stock from China, while the US accounts for two. The paper used the CAPM model's beta, Sharpe ratio, and portfolio weight to find out the most valuable assets, i.e., GOOG, APPL, and META, of which stocks from the U.S. accounted for the highest weights. tech stocks are generally more valuable than Chinese tech stocks. This allows investors to have a clearer understanding of each country's stocks and thus make better choices. This paper is relatively innovative, comparing Chinese tech stocks with US tech stocks for the first time, which is a new topic. However, the comparison is shallow in terms of risk and return, but not in terms of other aspects, which makes this research rather limited.

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