

Portfolio Construction Based Minimum Variance Model and Big Data Analysis for the U.S. Giant Company

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Abstract—In brief, the term portfolio investment denotes for the act of investing indirect means of financial market, normally through buying financial securities get expectations of earning returns or growth value at a period of time. This paper analyses the feasibility to construct the portfolio with several giant U.S. companies. To be specific, this paper first turning daily returns to several companies to monthlies. Subsequently, the correlations between several giant companies are calculated in the excel. Afterwards, maximum variance of every firm's as well as minimum variance are obtained and the results are visualization including the efficient frontier. According to the analysis, technology enterprises will continue to grow with constantly innovating, while the risk level will also be reduced. Besides, service-oriented companies from the perspective of consumers will eventually be accepted by the market and continue to grow. These results shed light on guiding portfolio designs for investor to hedge the risk and obtain extra returns.

Keywords-Portfolio; data analysis; investors; bigdata analysis.

1 INTRODUCTION

Contemporarily, internet era breaks in in full fury, and all kinds of data are beginning to explode especially with financial industry [1-4]. As the economic situation grows exponentially, human beings' income levels are getting higher, and investors are paying more attention to their investment portfolios. One can easily connect with all over world through mobile phones and computers. Undoubtedly, more and more people start to learn financial knowledge. On this occasion, this passage represents several companies stock with graph based on various methods to clarify a clear relationship. In addition, finance become more and more popular, consequently, there will be more investors seek for help about how to correct investment with minimize risk. The paper is trying to combined portfolio with minimum efficient frontier and maximum frontier with graph to represent a cleared project for several investors.

The modern portfolio theory has been developed for decades, and since the introduction of Markowitz portfolio theory has received a lot of attention from scholars at home and abroad, and a lot of research has been conducted on it [5-8]. The article first reviews the research of domestic and foreign scholars on it. In the investment decision, risk and return are mutually affected, and investors always pursue the goal of high return and low risk, modern portfolio theory fully considers the psychology of investors and lays down the idea of diversification. Primarily, it is necessary to clarify the fact that investor's final goal when they start to invest. In reality, the

overall results were profit maximization, maintain constantly return but avoid risk. Return and risk are eternal topic for investors, and it is crucial to investigate the ways to minimize or hedge their risk, which is also known as portfolio's effect. Optimal portfolio is jointly determined by the investor's preference for risk and the state of suitable assets in the market. The non-differentiable curve and the efficient frontier together determine the optimal portfolio. Meanwhile, through the mean-variance model, the portfolio selection theory scientifically account for that the key to build an effective portfolio and reducing risk lies in the interrelationship among the portfolio components. The covariance profile, only by selecting assets with low or negative correlation can one truly achieve risk diversification.

In 1927, portfolio first be raised by Harry Markowitz. In the mean-variance model proposed by Markowitz, the expected return to a security or portfolio is used to express its return [8-10]. Besides, the variance between expected return is used to measure its risk. In addition, the method of determining the most satisfactory portfolio of securities for investors by building a quadratic programming model to solve efficient portfolio of securities and based on the investor's undifferentiated curve. It is assumed that the distribution of returns does not change into time and that the variation on the actual returns comes from different performances of the same distribution. Therefore, the expected return and variance did not change over time. In the above introduction, one knows that many scholars have considered the return and risk of return to more detail and have made their own improvements on the Markowitz mean-variance model to obtain better performances with the market and make it more acceptable to investors.

Regarding to the investigation motivation, plenty of reasons are attributed for this study. First of all, it will bring state-of-art knowledges related to finance and bigdata. Moreover, trying to give investors a best analyze will be helpful for decision of investment decisions, e.g., what type of invest are most suitable for them, or which plan can help them minimize their risk. With this in mind, this paper will offer some new insights for the portfolio design and pave an example path for investors to hedge the risks.

The rest part of the paper is organized as follows. The Sec. II will be the methodology part which contains all of the data used during simulation. Moreover, all functions and tools in excel with vivid graph. Afterwards, the Sec. III will demonstrate the results and offer the explanations as well as the research limitations. During this section, all the obtained results will be stated and discussed. Eventually, a brief summary will be given in Sec. IV.

2 METHODOLOGY

All data come from Yahoo finance, there are totally 10 giants' company's 3000 days daily return, which are Amazon.com, Inc. Apple Inc. Citrix Systems, Inc. JPMorgan Chase & Co. Berkshire Hathaway Inc. The Progressive Corporation United Parcel Service, Inc. FedEx Corporation J.B. Hunt Transport Services, Inc., Landstar System, Inc.

Then, one needs to calculate average annual return, annual volatility, beta, alpha and residual standard deviation as summarized in Table. 1. Specifically, the beta and alpha are obtained according to CAPM model with the baseline of S-P 500.

Table 1 Standard deviation of the underlying assets

	AMZN	AAPL	CTXS	JPM	BRK/A	PGR	UPS	FDX	JBHT	LSTR	SPX
AAR	0.338	0.340	0.156	0.119	0.090	0.154	0.098	0.130	0.225	0.174	0.075
ASD	0.414	0.345	0.415	0.290	0.162	0.211	0.214	0.267	0.307	0.239	0.149
beta	1.351	1.257	1.221	1.361	0.572	0.712	0.830	1.104	1.076	0.798	1.000
alpha	0.236	0.245	0.064	0.016	0.047	0.100	0.036	0.046	0.144	0.121	0.114
residual Std	0.362	0.290	0.373	0.208	0.138	0.182	0.175	0.211	0.262	0.208	0.208

In generally, the final goal of portfolio is bringing investors highest returns to lowest risk, through several ways just similar to diversify holdings to maintain a stable state. On this basis, the correlation coefficients of the underlying assets are given in Table. 2.

Table2 The correlation coefficients among the underlying assets

	AMZN	AAPL	CTXS	JPM	BRK/A	PGR	UPS	FDX	JBHT	LSTR	SPX
AMZN	1.000	0.629	0.493	0.576	0.464	0.510	0.581	0.580	0.581	0.540	0.715
AAPL	0.629	1.000	0.577	0.593	0.516	0.552	0.562	0.625	0.575	0.575	0.762
CTXS	0.493	0.577	1.000	0.598	0.483	0.534	0.546	0.592	0.550	0.520	0.670
JPM	0.576	0.593	0.598	1.000	0.701	0.660	0.671	0.721	0.692	0.649	0.867
BRK/A	0.464	0.516	0.483	0.701	1.000	0.558	0.658	0.655	0.549	0.537	0.749
PGR	0.510	0.552	0.534	0.660	0.558	1.000	0.644	0.635	0.569	0.565	0.731
UPS	0.581	0.562	0.546	0.671	0.658	0.644	1.000	0.825	0.688	0.670	0.789
FDX	0.580	0.625	0.592	0.721	0.655	0.635	0.825	1.000	0.737	0.700	0.817
JBHT	0.581	0.575	0.550	0.692	0.549	0.569	0.688	0.737	1.000	0.752	0.748
LSTR	0.540	0.575	0.520	0.649	0.537	0.565	0.670	0.700	0.752	1.000	0.724
SPX	0.715	0.762	0.670	0.867	0.749	0.731	0.789	0.817	0.748	0.724	1.000

According to this model, the return of any stock can be decomposed into the expected excess return of individual stocks due to firm-specific factors, usually expressed by its alpha coefficient (α equivalent to returns) due to the impact of macroeconomic events on the market and the effect of unexpected microeconomic events on the firms selected and listed in the portfolio. In a portfolio, the unsystematic risk due to company-specific factors can be reduced to zero by diversification. Stochastic frontier analysis (SFA) is an approach to economic modelling. Its starting point is the stochastic production frontier model proposed simultaneously by Aigner, Lovell and Schmidt and Meeusen and Van den Broeck.

The cost frontier approach attempts to measure how far firms are from full cost minimization (i.e., cost efficiency). From the model, non-negative cost-efficiency components are added rather than subtracted in the stochastic specification. The profit frontier analysis examines the situation, where the producer is seen as a profit maximiser (both output and inputs should be determined by the firm) rather than a cost minimizer (the level of output is considered to be exogenous). The specification here is similar to that of the production frontier.

3 RESULTS & DISCUSSION

The optimal parameters (the weights of the underlying assets) are given in Table. 3 for the two cases. Table. 4 summaries the performances of the two portfolios. Based on all the Table. 3 and Table. 4, one can enter the results part to throw drawing the maximum variance, minimum variance as well as efficient frontier figures, as illustrated in Fig. 1, Fig. 2 and Fig. 3, respectively.

Table 3 Summary of the sharpe for underlying assets

	AMZN	AAPL	CTXS	JPM	BRK/A	PGR	UPS	FDX	JBHT	LSTR	SPX
MM	122%	-53%	20%	-79%	125%	-23%	127%	46%	-65%	55%	-1002%
IM	101%	49%	-14%	164%	107%	145%	-36%	190%	38%	83%	-727%

Table 4 Weights of MM and IM

MM			IM		
return	StDev	Sharpe	return	StDev	Sharpe
-37%	113%	-0.33	-37%	283%	-0.13
89%	90%	0.99	89%	84%	1.07

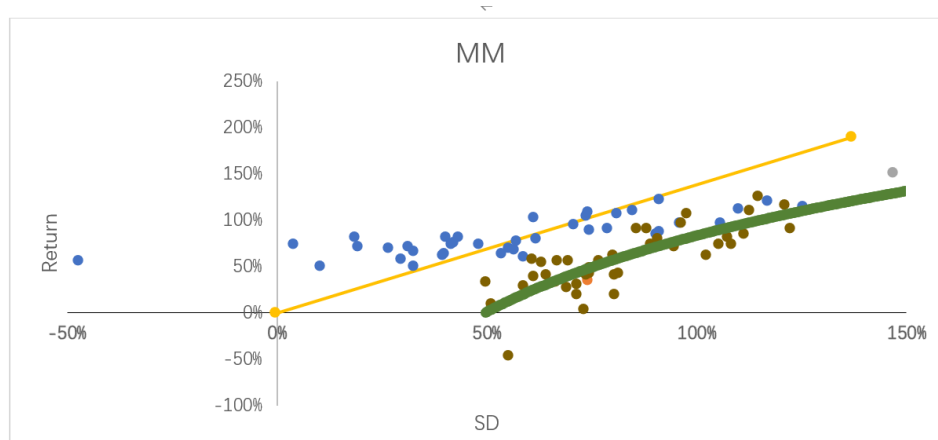


Figure 1. Maximum variance

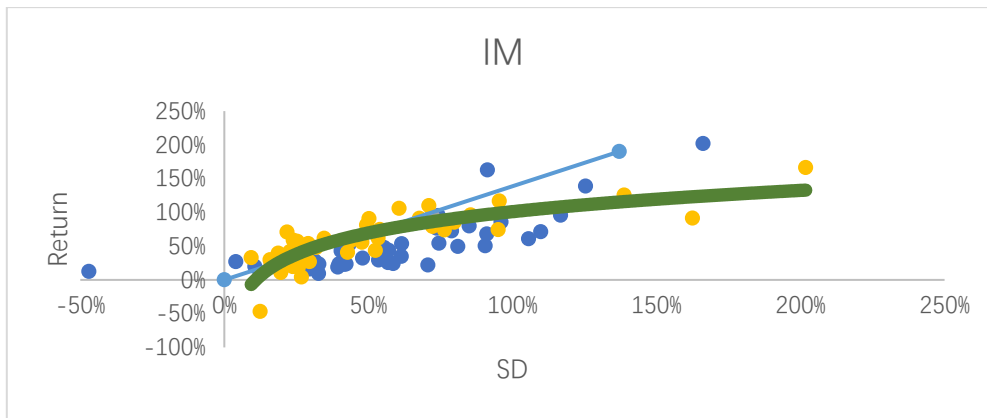


Figure 2. Minimum variance

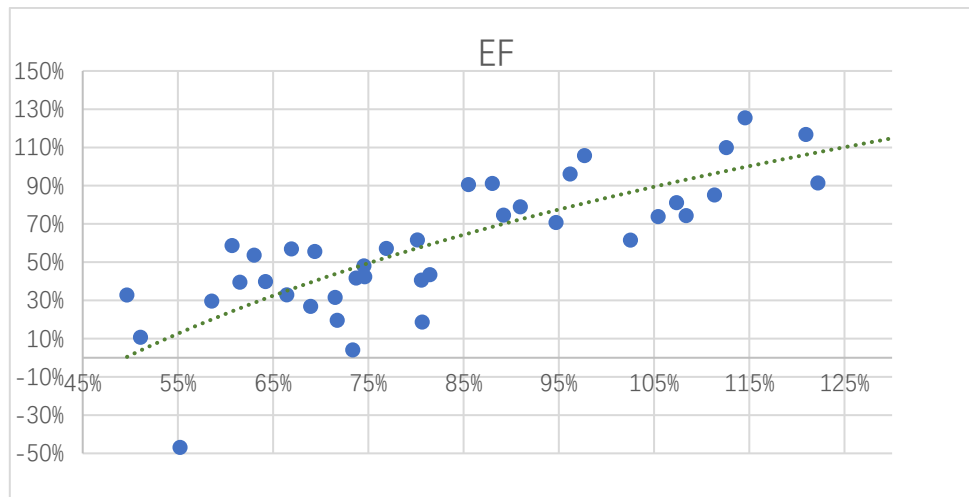


Figure 3. Efficient frontier

Technology enterprises, innovation is the first productivity. As for technology enterprises that are constantly innovating, they will continue to grow absolutely. Naturally, the risk level will also be reduced compared to other industries and underlying assets [11, 12]. Generally, one can rarely choose a single stock, fund or other kind of underlying assets perfectly and accurately. In most of cases, entrepreneurs will spread out the risks by making portfolio investments in order to hedge the risk.

Regarding to companies with service types, consumers' needs should be the main consideration. Service-oriented companies from the perspective of consumers will eventually be accepted by the market and continue to grow. Seen from Figs. 1-3, one can successfully analyze the importance of investment diversification. The result is that a quality asset portfolio is ideally one with high liquidity, stable and high yield, and low investment risk.

However, during this process, there are a lot of problem that cannot be solved, as a result, one would constantly study, continuously improving to make every image and every piece of data more accurate. In addition, more underlying assets and underlying assets ought to take into considerations for the robustness of the constructed portfolio, which can be used in further studies.

4 CONCLUSION

In summary, this paper investigates several models including index models and frontier models based on real calculation with 3000 days original giant company data. According to the analysis, from switching daily data to monthly data, then using various function in excel to build several vivid graphs, one realizes that minimize risk as well as highest return. However, there also are exist few limitations, for example, some graph is not totally accurate. Indeed, it is necessary to improve in the future. In this case, investors can combine it with advanced finance data to build more brilliant graph with more precisely data. In the future, there will be more scholars wandering in the sea of finance, which will bring more advanced technology to take finance to new heights. Overall, these results offer a guideline for intriguing basic finance knowledge combing with opportunity to deal with the app Microsoft Excel. Moreover, it will be a guidance for those investors who want to minimize the risk and pave a path for future researches in the field of portfolio construction.

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