CREATING A SUPERIOR PORTFOLIO USING MARKOWITZ MODERN PORTFOLIO THEORY: INDEXING LQ45 COMPONENTS AS BENCHMARK

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Abstract. *Investing, one among the sources of financial gain is currently becoming crucial publicly eyes. The right decision of investment could possibly lead to a significantly higher income than keeping money aside. However, this type of income is uncertain and requires more volatility to gain good returns. As there are many risk-averse investors who tend to be more cautious and most of the time does not satisfy with the results, a modern portfolio theory has emerged and become the bridge between safer investment and good returns. The theory is called Optimal Modern Portfolio found by Harry Markowitz, which combines the assets with possible low correlations to reduce the similarity across the components which then also decrease the amount of standard deviations. Constructing a portfolio sometimes can be done by indexing an existing market to be used as the benchmark, but somehow the cost of investing in market index is incredibly expensive. In this study, a portfolio will be constructed by indexing the LQ45 market with less number of stocks and possibly smaller amount of costs. The result is expected to become the alternative for investors to make an investment in a portfolio consisting part of components in LQ45 with a lower cost than the market.*

Keywords: *Index, Portfolio, LQ45, Markowitz, Capital Market*

INTRODUCTION

For the past years, Investment market in Indonesia has become attractive for people to start planting their money on diversified assets. According to the data of Jakarta Stock Exchange Composite Index (JKSE), the number of investors has been scaling up from nearly year 2001 until present. The chart's movement of the prices determines the enthusiastic of people on coming to investment market in Indonesia. In addition, the economic condition and politic rearrangement has successfully engaged foreign investors to the market and gain positive insights which ranks up Indonesia to the second place in '*Best Country to Invest*' after Philippines (usnews.com, 2018)

Unfortunately, the indexes that are available in the market such as LQ45, IDX30, etc. cannot be traded and owned by investors, and that is one of the reasons why ETFs are created to index the market. However, in the primary market ETFs require high number of minimum investment in terms of creation unit and owned by mostly institutional investors, meanwhile in the secondary market the assets are less liquid. Based on that fact, ETFs still does not reach out some investors with limited funds. Therefore, this paper aims to give alternative for investors in the form of a newly made portfolio, indexing in existing market (LQ45) with lower possible cost of investing. The type of data on this study will be secondary since the lists of the components are taken from Indonesia Stock Exchange data stream, and prices of the five years period (2014-2019) risk-free rate, and Customer Price Index (CPI) are completely derived from investing.com official website.

LITERATURE REVIEW

Capital market is the source for supplying and capital market to develop financial institution to operations which will contribute to the ... market is index funds, the portfolio that is managed passively in order to imitate a particular benchmark with a wide diversification and low-cost management (Fuchs & Götschi, 2017) This type of investment was initiated to be exclusively available for institutional investors but now is being offered in the market for private investors as well. The rapid development of science in the world of capital market has led to a theory first put forward by (Markowitz, 1923) about the establishment of a modern portfolio theory which let investors to make their own diversified assets by doing numbers of calculation regarding the returns, risk, and relationship between broad class of assets.

According to Francis and Doengchol (2013) A modern portfolio theory (MPT) refers to the maximization of the expected returns and acceptable levels of portfolio risk with selected components using historical data and quantified models. The past historical returns, covariances and correlations are the basic terms for inputs in generating a portfolio. (p. 113) The trade-off between the risk and return which is mathematically computed by standard deviation, will be the main focus of MPT to be completely characterized using the linear constraints optimization structure (Maier-Paape & Zhu, 2018). However, this theory was actually

built for risk-averse investors who require the lowest possible risk for a desirable level of returns (Emanuelsson & Marling, 2012) since the bottom line of the theory was practically resulted from the assumptions that investors are risk-averse, rational and tend to access the same information (Senthilnathan, 2013)

The word risk-aversion was repeatedly mentioned in the theory of Modern Portfolio. Risk-aversion theory is commonly defined as something that is closely related to the existence of risk premium, how people require a "premium" as the means to compensate the difference between the expected value of the returns and its certainty equivalent (Montesanno,1988) or risk-aversion as a mean preserving spreads, how an increase in risk could lead to a reduction of individuals' preference (Chew, Karni, & Safra 1987). In terms of portfolio investment, there is one measurable function, which is utility value that unifies the index of risk aversion of investors, the expected return and variance of the portfolio (Bodie, Kane, & Marcus, 2014) and this calculation interprets the utility curve as a function of risk premium demanded by the investors (Pratt, 1964 and Arrow, 1965 as cited by Meyer & Meyer, 2006) and so, defines the proportion of assets within the portfolio. Sharpe Ratio, the measurement of returns of each unit level of risks, has been one that related with the risk aversion and portfolio management (Sharpe, 1966 as cited by Sharpe, 1994) In practical implementations, the input for Sharpe Ratio uses historic data (ex-ante) which assumed to be at least the basis of predictive ability (ex-post) (Sharpe, 1994)

Later on the execution of the portfolio management for this paper, a study of capital market theory will be taken off. Mean reversion, will be the basis for assessing the final class of assets chosen to be proposed to alternatives for investors. Mean-reversion, the theory that relies on the worst-performing stocks assumes that those stocks tend to reefer back to its normalcy (Roberts & Liew, 2013)

METHODOLOGY

As it was explained in introduction part, the data used is secondary data which is taken from the official website that keep the track records of all stocks listed in LQ45. *Figure 1-1* shows the flowchart of how the researcher examine the data until the final part. The first thing is to start collecting data in which the data will be analyzed in the next step to produce three general aspects: Standard deviaton, average return, and aveerage excess return. The sequencing will be done to divide the class of assets into four quadrants in each of the semester. Each class will be examined using Markowitz analysis with biggest Sharpe Ratio as the objective. The stocks then will be chosen regarding their performances, and ended with the output of proposal of list of stocks that is expected to perform good in the future.
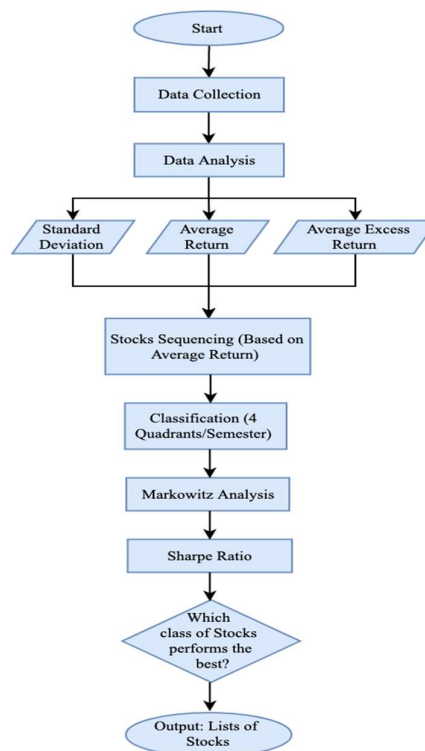

Figure 1. Flowchart of Methodology Framework

1. *Data Collection*

   Data collection includes all activities where the author discovers and collects relevant information. Starting from the name of all 45 stocks for each period of time that listed in LQ45. Since it is a two times per year data, and the time-scope of the observation is within 5 years, then there is a total of ten combination of different components. The prices should also cover the given periods in the form of monthly data. The inflation is substracted from the customer price index in Indonesia in the past 5 years and lastly the government bond's data is used to calculate the risk free rate.

2. *Data analysis*

   Since the previously collected data does now provide specific information about input parameters to create a modern portfolio theory, initial calculation of some of the information is required as the main part of data analysis step. Therefore researcher will realize these outputs from the calculation:

- Average return,
- Average excess return, and
- Standard deviation

3. *Stocks Sequencing*

   Average return is the critical input that will be used as a parameter to arrange the stocks in the order that lines from the largest to the smallest. This sequence is repeatedly made for every semester from year 2014 until the beginning of 2019.

4. *Classification*

   To create less numbers of stocks in the portfolio, the classification is needed. The list of stocks that has been put in order will then be classified into four quadrants. This division is based on the performance of listed stocks in terms of its average returns. For total of 45 stocks, the top 12 stocks are classified as high-performed stocks, the second quarter are the 11 stocks that belongs to medium-high class, continued with 11 medium-low stocks, and the last 11 names are defined as the worst-performed stocks in that semester.

5. *Markowitz Analysis*

   The theory of markowitz modern portfolio will finally be applied. The stocks in each quadrant in every semester will be assessed independently, in order to generate the weight and list stocks should be taken into account in the newly made portfolio. This theory used the solver add-ins feature in Microsoft Excel to produce the weight on stocks that is expected to give the portfolio optimal result (highest return in the lowest possible level of risk). In this case, the objective cell of the solver is the sharpe ratio.

6. *Sharpe Ratio*

   Sharpe Ratio, which indicates the amount of return the investor will get for each unit of risk, can be simply calculated with the solver as the objective cell. This ratio, which theoritically the slope of Capital Allocation Line (CAL), will later be used to see the comparison of the performance of stocks for all semesters and therefore the author can make assumptions about which class should be taken into consideration for further investment strategy.

7. *Output*

   After assessing the performance of group of stocks, the author will choose which investment strategy should be used to make a decision, looking at the pattern of historical records of LQ45's data. Also, for every quadrants, the pattern on which one of four quadrants should the investors rely on will be shown.

FINDINGS AND ARGUMENTS

The *Table 1-1* shows the main result from the Markowitz examination. The aspects emerged from the assessment are the returns, standard deviation and the Sharpe Ratio for given weight of stocks in a particular portfolio. Some weights using original technique of Markowitz most of the time give zero weight for some stocks, therefore the author uses different constraints which lmits any stocks to be included at least 1% of the total portfolio. What could be seen from the table is that most of the time, the class which gives the best sharpe ratio comes from the quadrant one or two. But however, the data below does not determine the final result since the sharpe ratio is only the objective cell of Markowitz assessment in the first place. There will be more data analysis after this step. Therefore, the task for the author is to be able to recognize which capital market strategy should be applied to create a good investment opportunity in the future.

Table 1-1. Table of Optimal Markowitz Portfolio with Highest Sharpe Ratio Objective. Author's data

Year	Smt	Q	Mean	SD	Sharpe	Year	Smt	Q	Mean	SD	Sharpe
Optimum Markowitz Result (Highest Sharpe Ratio)											
1	1	1	0.9055	0.0675	13.4182	3	6	1	1.1330	0.2698	4.2002
		2	0.3299	0.0076	43.5152			2	-0.0588	0.3015	-0.1950
		3	0.4133	0.0285	14.4902			3	-0.1614	0.3156	-0.5114
		4	-0.0709	0.3602	-0.1967			4	-0.2871	0.2475	-1.1604
	2	1	0.4636	0.0232	19.9973	4	7	1	0.4863	0.0004	1244.6991
		2	0.1781	0.0009	209.2925			2	0.1513	0.1933	0.7828
		3	0.0378	0.0566	0.6677			3	-0.0710	0.5007	-0.1418
		4	-0.4900	0.3522	-1.3915			4	-0.3187	0.4451	-0.7161
2	3	1	1.1737	0.0446	26.3064		8	1	0.9638	0.0791	12.1887
		2	-0.0400	0.3169	-0.1261			2	0.3087	0.0134	22.9617
		3	-0.2965	0.3629	-0.8170			3	0.0851	0.6290	0.1352
		4	-0.5068	0.3655	-1.3865			4	-0.1871	0.1784	-1.0487
	4	1	0.4636	0.0232	19.9973	5	9	1	0.7223	0.1703	4.2426
		2	0.1487	0.2416	0.6154			2	-0.2356	0.2481	-0.9499
		3	-0.0812	0.6507	-0.1248			3	-0.4919	0.3539	-1.3897
		4	-0.3439	0.4015	-0.8567			4	-0.5472	0.2687	-2.0363
3	5	1	1.0755	0.0631	17.0575		10	1	0.4299	0.0706	6.0909
		2	0.4206	0.0178	23.6845			2	-0.0258	0.2276	-0.1133
		3	0.1522	0.0612	2.4884			3	-0.3023	0.6485	-0.4661
		4	-0.1849	0.3168	-0.5836			4	-0.4518	0.8437	-0.5355

CONCLUSIONS

The theory of capital market has been continuously developing as the investors are increasing in numbers. The truth of investment theory never been really clear to be understood by investors, since the gambles and the useless efforts are still frightening them. And most of the time, they jump to a conclusion where a safer investment is better than the risky one, but somehow at the end the returns of riskier assets are bigger than the safer one. A portfolio, which combines several assets in order to reduce risk amongst the assets is used to help investors realize that sometimes investing in risky assets could be beneficial too. The Markowitz theory is the main idea of this paper and all the data are assessed by this theory. Actually, a further step of choosing the capital market strategy is used after the clear pattern of the investment opportunity in LQ45 has been seen. Before the author finally makes a decision on which strategy should be used, the data that is done using the markowitz theory should be compared with the actual performance for chosen stocks. Therefore, the researcher can construct a clear vision of the pattern and finally comes to a conclusion which class of stocks should be set as the best class to invest. This class then defines the lists of stock should be chosen and the best for future investment.

REFERENCES

Emanuelsson, Sara and Marling, Hannes (2012) 'The Markowitz Portfolio Theory'

Fabozzi, Frank J. And Grant, James L. (2001) 'Modern Portfolio Theory, Capital Market Theory, and Asset Pricing Models', *Equity Portfolio Management,* Vol. 1, pp. 11-47

Francis, Jack Clark and Kim, Doengchol (2013) 'Efficient Portfolios. *Modern Portfolio Theory: Foundation, Analysis, and New Developments,* Vol. 1, pp. 113-131

Francis, Jack Clark and Kim, Doengchol (2013) 'Mean-Variance Portfolio Analysis'. *Modern Portfolio Theory: Foundation, Analysis, and New Developments,* Vol. 1, pp. 85-110`

Francis, Jack Clark and Kim, Doengchol (2013) 'Risk and Diversification'. *Modern Portfolio Theory: Foundation, Analysis, and New Developments,* Vol. 1, pp. 28-41

Fuchs, Markus and Götschi, Marcus. (2017) 'Exchange Traded Funds and Index Funds', *Compact.*

Hanna, Sherman D. & Chen, Peng. (1998) 'Subjective and Objective Risk Tolerance: Implications for Optimal Portfolios'.

Jorgenson, Dale W and Ferber, Robert. (1967) 'The Theory of Investment Behavior', *Determinants of Investment Behavior,* Vol.1, p.129-175.

Maier-Paape, Stanislaus and Zhu, Qiji Jim. (2018) 'A General Framework for Portfolio Theory—Part I: Theory and Various Models'. *Risks.*

Meyer, Donald J. And Meyer, Jack. (2006)'The Framework', *Measuring Risk Aversion,* Vol. 2, pp.7-34

Montesano, Aldo. (1990) 'On the Definition of Risk Aversion', *Theory and Decision,* pp. 53-68

Roberts, Ryan & Liew, Jim. (2013) 'U.S. Equity Mean 9-Reversion Examine'

Senthilnathan, Samithamby. (2013)'Risk, Return and Portfolio Theory – A Contextual Note', *International Journal of Science and Research (IJSR).* Vol.6 no. 14

Sharpe, William F. (1996) 'The Sharpe Ratio', *The Journal of Portfolio Management,* Vol. 21, Issue 1, pp. 49

Spierdjik, Laura and Bikker, Jacob A. (2012) 'Mean Reversion in Stock Prices: Implications for Long-Term Investors'

Zhang, Qing. Tie, Jingzhi, & Luu, Phong. (2018) 'A Threshold Type Policy for Trading a Mean-Reverting Asset with Fixed Transaction Costs'

Zvi, Bodie. Kane, Alex & Marcus, Alan J. (2014)'Equilibrium in Capital Markets', *Investments,* Vol. 10, pp. 291-311

Zvi, Bodie. Kane, Alex & Marcus, Alan J. (2014)'Portfolio Theory and Practice', *Investments,* Vol. 10, pp. 117-284

Chew, Soo Hong, Karni, Edi & Safra Z. (1987) 'Risk Aversion in the Theory of Expected Utility with Rank Dependent Probabilities',*Journal of Economic Theory,* Vol. 2, pp. 304-318