ANALYSIS OF COMPANY STOCK PORTFOLIO PSEI INDEX USING MARKOWITZ METHOD

Hermiyetti, Dito TriUtomo, Usmar

ABSTRACT

The purpose of this research is to analyze company stock portfolio PSEi (Philippine)Index to reach optimal return and mitigate risk using the Markowitz method. This research is for measuring portfolio performance with four main portfolio measurements such as Treynor, Sharpe, and Jensen measurement, and Information Ratio. Population sample used for research PSEi company from 2014 to 2018. The purposive sampling method is used to pick the sample.The portfolio results are merged with risk and free-risk assets. Stock Portfolio Result on PSEicompany using Markowitz methods as follows Expected Return 16,46%, Standard Deviation 11,48%, Sharpe Ratio 1,12, Result for Treynor 2,03, Jensen 0,12 and 1,05, Information for Free Risk Level 3,57% and Beta 0,06. Risk and Free asset allocation of 98% and 2%.

Keywords: Markowitz Methods, PSEi, Philippine Stock Exchange (PSE).

INTRODUCTION

The investor can invest stock for different company according to risk and profit. Either on a financial asset like a stock, obligation, and deposit or real asset. Investment activity not only being done by the individual investor but also corporate investors that willing to add value from their assets compare with idle money.

Based on the background above, the research is a development of research conducted by Paramitha and Anggoro (2013) which produces an optimum portfolio diversification of fourteen stock of LQ-45 index period 2007 – 2012 using Markowitz modern portfolio theory which produces an expected return of 79.34% and standard deviation of 48.95%. The Treynor portfolio performance measure has a value of 60.31% and Sharpe of 147.79%. Changes made in the object of research from the LQ-45 index to the PSEi index contained in the Philippine Stock Exchange market because economic growth in Indonesia and the Philippines have the same growth.

Based on this background, the title of this study is "Analysis of Company Stock Portfolio in the PSEi Index Using Markowitz Method". The purpose of this study is to get the analysis in the optimum of the stock portfolio included the composition and share of shares using the Markowitz method and the measurement of the performance stock portfolio in the PSEi index.

MATERIALS AND METHOD

PSEi Stock

PSEiIndex is one among index in Philippine Stock Exchange which consists of 30 stock most liquid option. Criteria, where Stock is identified as PSEi index, are as follows:

1. The stock total minority that is distributed in society is less than 12% from available stock and easy to buy sell in the market;
2. The company ought to have 25% upper range of liquidity level between listed company average value daily change per month 9 to 12 months; and
3. Full Market capitalization highest to lowest according to weighted average volume price.

Generally, stocks that are in the PSEi index can be categories by liquidity level, company performance, and market capitalization. The Philippine Stock Exchange will do emitted performance periodically.

Asset Portfolio

Asset Portfolio is the result of managing asset investment. Financial Asset which will be researching is stock. Financial Asset consists of Risk and Free risk asset. A Complete optimum portfolio consists of risk and free risk that is leveled by aversion risk investor. The risky asset has an uncertain level of return where there's a level of differences between expected returnandthe actual return for each product. Contrary to the risky asset, the return of free risk asset is certain for a while and known to the investor. the higher the risk the higher the return. Examples of risk-free assets such as Deposito, savings, Country Obligation and Certificate of Central Bank.

Return and Risk Portfolio

The formation of a stock portfolio is an attempt to mitigate the risks that will occur and increase returns. A low level of risk is not necessarily an absolute consideration for investors in making decisions to invest due to it allows investors to get a low return and vice versa. However, investors will choose the investment with the best level of return and return in a portfolio.

Return Portfolio

Return portfolio can be calculated with the equationby using the following steps (Bodie, Kane, Marcus 2013, 244):

$$E(r_p) = \sum_{i=1}^{n} w_i E(r_i)$$

Information:

$E(r_p)$ = expected return portfolio

w_i = portion of portfolio assets to-i

$E(r_i)$ =expected return on portfolio assetsto-i

n = amount of investment in the portfolio

Return Portfolio is the expected return value that multiplied by each investment asset.

Risk of Portfolio

Portfolio Risk is a condition when uncertainty occurs in a portfolio. A maximum Returnlow riskcommonly called Optimumis the most sought condition by the investor.The calculation of portfolio return or portfolio risk has a different calculation. The sum of each level of risk (standard deviation) of investment assets multiplied by each portion is not the same as portfolio risk.

$$\sigma_p = \sum_{i=1}^{n} w_i \sigma_i$$

Information:

σ_p = standard deviation of the portfolio

w_i = portion of portfolio assets to-i orto-j

σ_i = standard deviation of assetsto-i

n = amount of investment assets in the portfolio

Portfolio risk is a standard deviation of the portfolio by using the following equation: (Bodie, Kane, Marcus 2013, 227):

$$\sigma_p = \sqrt{\sum_{i=1}^{R} w_i^2 \sigma_i^2 + \sum_{i=1}^{R} \sum_{j=i}^{R} w_i w_j \sigma_i \sigma_j \rho_{i,j}}$$

i≠j

Information:

σ_p = standard deviation of the portfolio

$w_i w_j$ = portion asset to - i or to - j in the portfolio

$\sigma_i \sigma_j$ = the asset standard deviation to - i or to - j in the portfolio

$\rho_{i,j}$ = correlation coefficientbetween asset to - i and to - j

n =amount of investment assets in the portfolio

in addition to using the equation above, a portfolio can also be calculated with the following equation (Bodie, Kane, Marcus 2005, 244):

$$\sigma_p = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j Cov(r_i, r_j)}$$

Information:

σ_p = standard deviation of the portfolio

$w_i w_j$ = portion asset to - i or to - j in the portfolio

$Cov(r_i, r_j)$ = covarianbetween asset to-i or to-j

n = amount of investment assets in the portfolio

Allocation to risk assets and risk-free assets

The portion of investment allocated to risk assets depends on the level of investor aversion. The equation in calculating the portion to be allocated to the portfolio of risk assets is as follows (Bodie, Kane, Marcus 2005, 206):

$$y^* = \frac{E(r_p) - r_f}{0{,}01A\sigma_p^2}$$

Information:

y^* = optimum portion of the portfolio of risk assets

$E(r_p)$ = expected return portfolio

r_f = risk-free return of assets

A = investor aversion rate (1,2,3,4)

σ_p^2 = variant/standard deviation of portfolio squared

Complete Portfolio

Complete Portfoliois a portfolio composition consisting of portfolio risk assets and risk-free assets. This portfolio's expected return is calculated by the following equation(Bodie, Kane, Marcus 2005, 201):

$$E(r_c) = {}_yE(r_p) + (l - y)r_f$$

Information:

$E(r_c)$ = expected return complete optimum portfolio

$E(r_p)$ = expected return portfolio risk assets

r_f = risk-free return of assets

y = portion of risk assets

$(l-y)$ = portion of risk-free assets

Capital Allocation Line (CAL)

Capital Allocation Line (CAL) is a straight line that connects the point of risk-free assets on the ordinate *y* axis with the point of line intersection on the efficient frontier curve. CAL illustrates the combination of portfolio return and risk that can be formed by investors based on the size of different *y* portions. To simplify the understanding of CAL, the lines are presented in the form of images as follows(Bodie, Kane, Marcus 2005, 202):

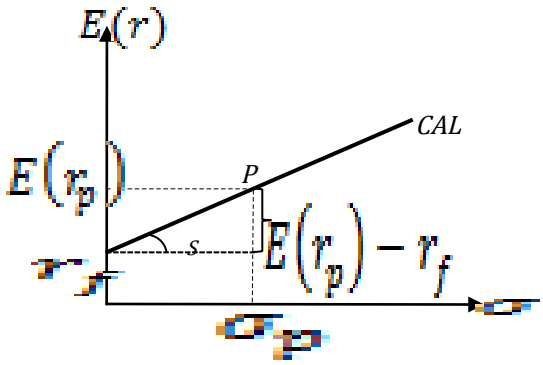

Figure 4.1. Capital Allocation Line (CAL)

Reward-to-variability ratio

The reward-to-variabilityratio (S) is the ratio of risk premium return $[^{E(r_p)-r_f}]$ portfolio with its risk portfolio (standard deviation). S illustrates the enhancementreturn of ratiodue to increasing risks. The value is the slope of the CAL line. To calculate S, using the following equation (Bodie, Kane, Marcus 2005, 203):

$$S = \frac{E(r_p) - r_f}{\sigma_p}$$

Information:

S = reward-to-variability ratio

$E(r_p)$ = expected return on risky asset portfolios

r_f = risk free return

σ_p = standard deviation of the portfolio

Leverage

Most investors are risk-averse however some investors are interested in risk (risk-lover), that investors who dare to take an additional risk by borrowing funds from third parties to be allocated to the investor's investment. This condition is denoted byy >1 or (1-y) < 0.

Portfolio Performance Measurement

Key portfolio performance measurements that combine risk and return in a value that is, Treynor's measure, Sharper's measure, Jensen's measure, and Information Ratio / Appraisal Ratio.

Treynor's Measure of Portfolio Performance

Treynor (1965) was the first person to develop a portfolio performance measurement involving the value of risk. Treynor divides risk components into 2 (two) parts, i.e:

1. Risks stemming from market fluctuations generally (systematic risk); and
2. Risks arising from fluctuations in the portfolio (unsystematic risk).

To calculate using the Treynor's measure slope is as follows:

$$T = \frac{(r_p - r_f)}{\beta_p}$$

Information:

T = Treynor's measure

r_p = the average portfolio return in a period

r_f = the average risk-free return in a period

β_p = beta portfolio

Sharpe's Measure of Portfolio Performance

Sharpe's *measure* (1966) Sharpe measures the portfolio risk in total (*systematic* dan *unsystematic risk*) standard deviation of portfolio returns from market risk (beta). To calculate using Sharpe's measure is as follows:

$$S = \frac{(\bar{r}_p - \bar{r}_f)}{\sigma_p}$$

Information:

S = *Sharpe's measure*

$\bar{r}_p$ = the average portfolio return in a period

$\bar{r}_f$ = the average portfolio return in a period

σ_p *the average portfolio return in a period*

Jensen's Measure of Portfolio Performance

Jensen (1968) states that the performance of a portfolio can be seen from the value of α (alpha) or the intercept results of the expected portfolio return regression with the expected return generated from the CAPM equation. The α value describes how much the expected portfolio return is related to the ability of investors to produce portfolio risk-adjusted returns related to the ability of investors to produce above-average risk-adjusted returns. To calculate using the CAPM equation is as follows:

$$E(r) = r_f + \beta_p(r_M - r_f)$$

Information:

E(r) = *expected return*

r_f = risk free return

r_M = *market return*

β_p = *beta* portfolio

Portfolio Performance Measures based on Information Ratio

To see the ability of investors to utilize the capabilities and information needed to produce portfolio returns that are different from their approaches, they can use a measure commonly referred to as Information Ratio (IR) or also known as Valuation Ratios.

The equation used in calculating IR is as follows:

$$IR = \frac{\alpha_p}{\sigma_e}$$

Information:

IR = Information Ratio

α_p = alpha Portfolio

σ_e = standard error of regression / tracking error

Portfolio Mathematics

The guidelines for calculating the context of forming a portfolio are namely the mathematical and statistical aspects.

PORTFOLIO MODEL WITH THE MARKOWITZ METHOD

Markowitz calculates portfolio risk by looking at the relationship between portfolio asset returns (covariance) to reduce portfolio risk to a minimum. So it can be concluded that the risk that exists in the combination of two assets will be different from the risk of two assets separately.

Assumption

In this Markowitz, the Model has several assumptions. The assumptions contained in the

Markowitz portfolio formation model are as follows:

1. Investors are rational;
2. Investors are risk-averse;
3. Investors have the free and correct access to risk and return information; and
4. The market is efficient and absorbs information perfectly and quickly.

Diversification according to Markowitz

Markowitz is sure that diversification is an election process aimed at not only reducing risk by reducing the standard of deviation but also by reducing covariance arising from the risk relationship between investment assets. In theory, to get the level of portfolio risk from zero up to the maximum value can be done by combining different portfolio assets.

To diversify, there are several main parameters used in applying the Markowitz portfolio theory as follows

1. Expected Return;
2. Measurement of return effectiveness using standard deviations; and
3. Covariance.

Efficient Frontier

Figure 4.2. represents the placement of risk points and returns of individual white shares and portfolio risk points of black returns resulting from calculations with the Markowitz Method.

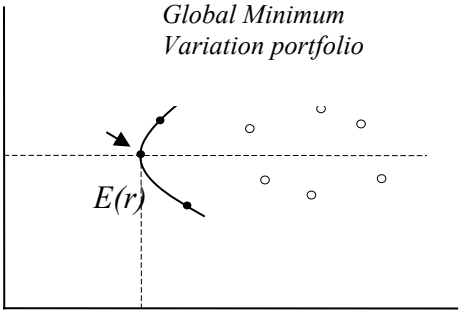

Figure 4.2. Efficient Frontier

Source: Bodie, Zvi; Alex, Kane; J. Marcus, Alan, *Investment,* Tenth Ed., Irwin/McGraw-Hill,

Singapore, 2013, page. 241

The frontier minimum-variance curve is a curve that describes the return points and portfolio risks in forming a curve that shows the smallest portfolio variance (standard deviation) at a particular return condition. The global minimum variance portfolio is a condition that is indicated by the point on the curve with the lowest standard deviation portfolio value. Portfolios can provide higher returns compared to investing in individual assets separately as indicated by Efficient Frontier.

Portfolio Optimum

In the efficient frontier curve, there is the most optimum portfolio among the formed portfolios. The optimum portfolio is formed at the point where the CAL line (the line where assets are at risk-free level) intersects the efficient frontier on the efficient frontier curve.

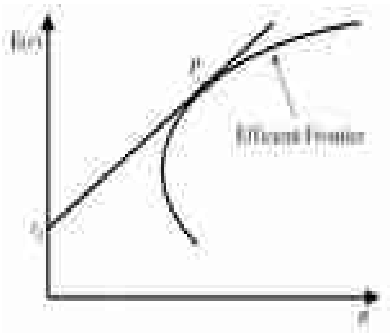

Figure 4.3. Capital Allocation Line (CAL) dan Efficient Frontier

Source: Bodie, Zvi; Alex, Kane; J. Marcus, Alan, Investment Tenth Ed., Irwin/McGraw-Hill, Singapore, 2013, page 241.

Complete Optimum Portfolio

The combination of risk-free assets with an optimal portfolio where the portion (y) depends on the level of investor aversion can form the optimum portfolio (Optimal Complete Portfolio).

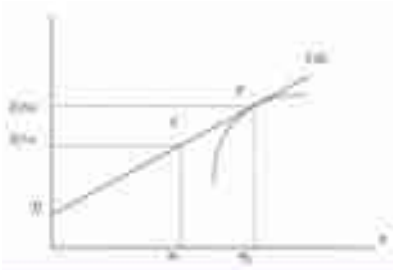

Figure 4.4. Portfolio Optimum

Source: Bodie, Zvi; Alex, Kane; J. Marcus, Alan, Investment, Tenth Ed., Irwin/McGraw-Hill, Singapore, 2013, page 239

The Equation for return and standard deviation of the complete Optimum Portfolio are as follows (Bodie, Zvi; Alex, Kane; J. Marcus, Alan, 2013, 201-202):

$$E(r_c) = yE(r_p) + (l - y)r_f$$

$$\sigma_c = y\sigma_p$$

Information:

$E(r_c)$ = expected return Complete Optimum Portfolio

σ_c = Standard Optimum Portfolio Complete deviation

σ_p = Portfolio standard deviation

$E(r_p)$ = expected return Portfolio Optimum

y = Portfolio Optimum

r_f = risk free assets

Data Collection

The data used in this study are secondary. Secondary data is data obtained indirectly through intermediary media (Indriantoro dan Supomo 2014, 147). The data used are data from 2013 to

2018. Financial statement data are also taken from the factbook and PSE website.

Data Processing Method

The data processing will use the Solver feature. The solver is an add-in that has the purpose of providing value solutions to a linear programming formula based on value criteria with some constraints or formulation formulations in a Microsoft Excel spreadsheet. Besides, this can help all parties who do the portfolio calculation using the portfolio calculation procedure using the Markowitz method.

RESULT AND DISCUSSION

Object of Research

In this study, the sample that became the object of research is 22 consistent shares that are always listed in the PSEi Index from January 2014 to December 2018, there are 24 shares, namely Ayala Corporation (AC), Aboitiz Equity Ventures, Inc. (AEV), Alliance Global Group, Inc. (AGI), Ayala Land, Inc. (ALI), Aboitiz Power Corporation (AP), BDO Unibank, Inc. (BDO), Bank of the Philippines Islands (BPI), DMCI Holdings, Inc. (DMC), First Gen Corporation (FGEN), Globe Telecom, Inc. (GLO), International Container Terminal Services, Inc. (ICT), Jollibe Foods Corporation (JFC), JG Summit Holdings, Inc. (JGS), Metropolitan Bank & Trust Company (MBT), Megaworld Corporation (MEG), Metro Pacific Investments Corporation (MPI), Petron Corporation (PCOR), Robinsons Land Corporation (RLC), Semirara Mining Corporation (SCC), SM Investments Corporation (SM), San Miguel Corporation (SMC), SM Prime Holdings, Inc. (SMPH), Philippine Long Distance Telephone Company (TEL) , Universal Robina Corporation (URC).

Stock Return, Variance, Beta, Standard Deviation, Sharpe, Treynor, Jensen & Information Ratio

The following table that presents the results of the calculation of returns and standard deviations of each stock for the PSEi index:

Tabel 4.1.
Return Saham, Variance, Beta, Standard Deviation, Sharpe, Treynor, Jensen and Information Ratio

No.	Code	Company Name	Average Monthly Return	Monthly Variance	Average Annual Return	Beta	Standar Deviasi	Annual Standar Deviasi	Sharpe	Treynor	Jensen	Information Ratio
1	AC	Ayala Corporation	0,93%	0,32%	9,79%	-1,52%	5,62%	19,47%	0,47	-6,01	0,09	0,48
2	AEV	Aboitiz Equity Ventures, Inc	-0,15%	0,59%	-5,53%	-8,42%	7,71%	26,71%	-0,23	0,74	-0,07	-0,25
3	AGI	Alliance Global Group, Inc	-0,79%	0,72%	-13,67%	15,97%	8,50%	29,43%	-0,49	-0,90	-0,12	-0,41
4	ALI	Ayala Land, Inc	0,84%	0,68%	6,86%	2,97%	8,24%	28,54%	0,22	2,09	0,06	0,21
5	AP	Aboitiz Power Corporation	0,07%	0,19%	-0,25%	15,24%	4,33%	14,98%	-0,06	-0,06	-0,01	-0,05
6	BDO	BDO Unibank, Inc	0,99%	0,55%	9,33%	54,20%	7,43%	25,73%	0,34	0,16	0,04	0,15
7	BPI	Bank of Phillipines Islands	1,89%	4,10%	0,00%	-91,19%	20,24%	70,11%	-0,01	0,01	-0,01	-0,02
8	DMC	DMCI Holdings, Inc	0,39%	0,51%	1,69%	39,37%	7,15%	24,78%	0,04	0,03	0,01	0,03
9	FGEN	First Gen Corporation	0,77%	0,72%	5,16%	37,21%	8,49%	29,41%	0,15	0,12	0,03	0,10
10	GLO	Globe Telecom, Inc	0,50%	0,68%	2,17%	3,01%	8,22%	28,47%	0,05	0,50	0,01	0,05
11	ICT	International Container Terminal Services, Inc	0,37%	0,71%	0,33%	1,06%	8,44%	29,25%	-0,01	-0,32	0,00	-0,01
12	JFC	Jollibe Foods Corporation	1,25%	0,28%	14,18%	-0,49%	5,33%	18,47%	0,73	-27,69	0,14	0,74
13	JGS	JG Summit Holdings, Inc	0,85%	0,54%	7,30%	9,76%	7,34%	25,44%	0,26	0,68	0,06	0,24
14	MBT	Metropolitan Bank & Trust Company	0,42%	0,37%	2,86%	29,87%	6,12%	21,20%	0,10	0,07	0,02	0,07
15	MEG	Megaworld Corporation	0,83%	0,67%	6,24%	16,72%	8,19%	28,38%	0,20	0,33	0,05	0,16
16	MPI	Metro Pacific Investments Corporation	0,34%	0,42%	1,56%	11,40%	6,50%	22,51%	0,04	0,08	0,01	0,04
17	PCOR	Petron Corporation	-0,60%	0,87%	-11,40%	29,11%	9,33%	32,31%	-0,37	-0,41	-0,09	-0,26
18	RLC	Robinsons Land Corporation	0,32%	0,47%	1,05%	-22,89%	6,85%	23,71%	0,02	-0,02	0,00	0,02
19	SCC	Semirara Mining Corporation	0,10%	0,58%	-2,33%	35,35%	7,63%	26,42%	-0,11	-0,08	-0,02	-0,07
20	SM	SM Investments Corporation	1,25%	0,22%	14,59%	15,16%	4,71%	16,30%	0,85	0,92	0,12	0,72
21	SMC	San Miguel Corporation	2,16%	1,17%	21,78%	-22,05%	10,82%	37,50%	0,56	-0,96	0,26	0,69
22	SMPH	SM Prime Holdings, Inc	1,56%	0,28%	18,53%	6,46%	5,32%	18,45%	0,97	2,77	0,17	0,91
23	TEL	Philippine Long Distance Telephone Company	-1,15%	0,61%	-16,15%	23,19%	7,81%	27,06%	-0,62	-0,73	-0,13	-0,48
24	URC	Universal Robina Corporation	0,36%	0,41%	2,02%	-3,83%	6,38%	22,10%	0,06	-0,35	0,01	0,06

Stock Correlation for the PSEi Index

The 24 stocks selected for the PSEi index will produce 576 correlations. The results of the correlation are presented in the matrix as follows:

Tabel 4.2.
Correlation of PSEi Index

	AC	AEV	AGI	ALI	AP	BDO	BPI	DMC	FGEN	GLO	ICT	JFC	JGS	MBT	MEG	MPI	PCOR	RLC	SCC	SM	SMC	SMPH	TEL	URC
AC	1	0.144308	0.133604	0.257432	0.191051	0.087912	0.223152	0.232781	0.303014	0.276701	0.185097	0.101814	0.206164	0.251172	0.347865	0.147576	0.071847	0.244258	0.061095	0.323807	-0.014795	0.253974	0.157106	0.244352
AEV	0.144308	1	0.077688	0.102561	0.010314	0.058580	0.291029	-0.157234	0.203664	-0.048000	-0.048899	0.021584	0.185983	0.198033	0.027673	0.103751	0.120611	-0.032818	-0.211547	0.014155	-0.108672	0.175373	0.012918	0.149754
AGI	0.133604	0.077688	1	0.017085	-0.024594	0.020291	0.001145	0.273688	0.057263	0.160012	-0.337592	0.172874	-0.004188	0.240898	0.129753	0.294940	-0.054266	0.065427	0.020524	0.153964	-0.008921	0.077180	0.104663	0.034297
ALI	0.257432	0.102561	0.017085	1	0.246801	0.568110	0.062395	0.069103	-0.021459	0.227753	0.096036	-0.000181	0.219777	0.066980	0.109590	0.172723	0.156140	0.129065	-0.035706	-0.056418	-0.022162	0.146973	0.216328	0.239790
AP	0.191051	0.010314	-0.024594	0.246801	1	0.163607	0.073769	0.250768	0.391460	0.208142	0.055612	0.462482	0.570841	0.286365	0.352985	0.298481	-0.019797	0.491758	0.117010	0.242468	-0.163324	0.164594	0.082152	0.450472
BDO	0.087912	0.058580	0.020291	0.568110	0.163607	1	0.172968	0.156363	0.068564	0.084556	0.024391	0.019212	0.196658	0.237870	0.253185	0.047897	0.107146	0.023106	0.249559	-0.057861	-0.051223	0.091534	0.035778	0.226738
BPI	0.223152	0.291029	0.001145	0.062395	0.073769	0.172968	1	-0.120625	0.074988	0.344323	0.079818	-0.000344	0.327919	0.068268	0.130274	0.017794	-0.082371	-0.057308	-0.002831	0.340279	0.188938	0.091488	0.324616	0.227717
DMC	0.232781	-0.157234	0.273688	0.069103	0.250768	0.156363	-0.120625	1	0.183473	-0.039536	-0.013264	0.402908	0.261896	0.319763	0.497673	0.338443	0.085727	0.292333	0.493908	0.132607	-0.088586	0.107987	-0.041255	0.168378
FGEN	0.303014	0.203664	0.057263	-0.021459	0.391460	0.068564	0.074988	0.183473	1	0.141953	0.228963	0.400971	0.375442	0.545876	0.488836	0.313420	0.159352	0.488864	-0.012217	0.400430	-0.079206	0.220530	0.154254	0.453362
GLO	0.276701	-0.048000	0.160012	0.227753	0.208142	0.084556	0.344323	-0.039536	0.141953	1	0.221308	0.062255	0.380840	0.175606	0.257035	0.230975	0.189791	0.299975	0.098443	0.306180	0.075167	0.200093	0.510189	0.229182
ICT	0.185097	-0.048899	-0.337592	0.096036	0.055612	0.024391	0.079818	-0.013264	0.228963	0.221308	1	0.126815	0.275324	0.114666	0.185638	-0.005496	0.199586	0.223632	-0.027089	0.283859	0.009260	0.241310	0.154102	0.142794
JFC	0.101814	0.021584	0.172874	-0.000181	0.462482	0.019212	-0.000344	0.402908	0.400971	0.062255	0.126815	1	0.393420	0.487113	0.456080	0.322820	0.054277	0.362344	0.197661	0.327267	-0.012663	0.124260	0.102086	0.338338
JGS	0.206164	0.185983	-0.004188	0.219777	0.570841	0.196658	0.327919	0.261896	0.375442	0.380840	0.275324	0.393420	1	0.453622	0.343031	0.296968	0.090815	0.300652	0.200043	0.424705	-0.061516	0.234312	0.243782	0.612722
MBT	0.251172	0.198033	0.240898	0.066980	0.286365	0.237870	0.068268	0.318763	0.545876	0.175606	0.114666	0.487113	0.453622	1	0.577463	0.337992	0.187310	0.213312	0.148626	0.501982	-0.109004	0.336555	0.110793	0.253784
MEG	0.347865	0.027673	0.129753	0.109590	0.352985	0.253185	0.130274	0.497673	0.488836	0.257035	0.185638	0.456080	0.343031	0.577463	1	0.319721	0.279224	0.543303	0.155591	0.366486	-0.017382	0.549116	0.180516	0.278677
MPI	0.147576	0.103751	0.294940	0.172723	0.298481	0.047897	0.017794	0.338443	0.313420	0.230975	-0.005496	0.322820	0.296968	0.337992	0.319721	1	0.086763	0.295614	0.062730	0.339370	0.208161	0.392526	0.189776	0.351724
PCOR	0.071847	0.120611	-0.054266	0.156140	-0.019797	0.107146	-0.082371	0.085727	0.159352	0.189791	0.199586	0.054277	0.090815	0.187310	0.279224	0.086763	1	0.151683	-0.023526	0.088865	0.001796	0.189776	0.049245	0.086208
RLC	0.244258	-0.032818	0.065427	0.129065	0.491758	0.023106	-0.057308	0.292333	0.488864	0.299975	0.223632	0.362344	0.300652	0.213312	0.543303	0.295614	0.151683	1	0.054685	0.230884	0.016542	0.308926	0.022957	0.344219
SCC	0.061095	-0.211547	0.020524	-0.035706	0.117010	0.249559	-0.002831	0.493908	-0.012217	0.098443	-0.027089	0.197661	0.200043	0.148626	0.155591	0.062730	-0.023526	0.054685	1	0.122596	-0.003626	-0.110553	0.067071	0.171199
SM	0.323807	0.014155	0.153964	-0.056418	0.242468	-0.057861	0.340279	0.132607	0.400430	0.306180	0.283859	0.327267	0.424705	0.501982	0.366486	0.339370	0.088865	0.230884	0.122596	1	0.004221	0.398704	0.290519	0.257592
SMC	-0.014795	-0.108672	-0.008921	-0.021162	-0.163324	-0.051223	0.188938	-0.088586	-0.079206	0.075167	0.009260	-0.012663	-0.061516	-0.109004	-0.017382	0.208161	0.001796	0.016542	-0.003626	0.004221	1	-0.017039	0.308459	0.074577
SMPH	0.253974	0.175373	0.077180	0.146973	0.164594	0.091534	0.091488	0.107987	0.220530	0.200093	0.241310	0.124260	0.234312	0.336555	0.549116	0.392526	0.189776	0.308926	-0.110553	0.398704	-0.017039	1	0.210481	0.053853
TEL	0.157106	0.012918	0.104663	0.216328	0.082152	0.035778	0.324616	-0.041255	0.154254	0.510189	0.154102	0.102086	0.243782	0.110793	0.180516	0.358303	0.049245	0.022957	0.067071	0.290519	0.308459	0.210481	1	0.188020
URC	0.244352	0.149754	0.034297	0.239790	0.450472	0.226738	0.227717	0.168376	0.453362	0.229182	0.142794	0.338338	0.612722	0.253784	0.278677	0.351724	0.086206	0.344219	0.171199	0.257592	0.074577	0.053853	0.188020	1

The lowest value of -0.333759, namely between ICT and AGI means the relationship between

the two stocks has the opposite direction.

Stock Covarian for the PSEi Index

Tabel 4.3.
The covariance of PSEi Index

	Variance-Covariance Matrix																						
	AC	AEV	AGI	ALI	AP	BDO	BPI	DMC	FGEN	GLO	ICT	JFC	JGS	MBT	MEG	MPI	PCOR	RLC	SCC	SM	SMC	SMPH	TEL	URC
AC	0,037283	0,00738	0,007529	0,014066	0,005481	0,00433	0,029953	0,011041	0,017058	0,015191	0,010366	0,003599	0,010042	0,010194	0,0189	0,006361	0,004445	0,011089	0,00309	0,010107	-0,00106	0,008969	0,00814	0,01034
AEV	0,00738	0,070143	0,006005	0,007686	0,000406	0,003957	0,053581	-0,01023	0,015726	-0,00359	-0,00376	0,001047	0,012426	0,011024	0,002062	0,006134	0,010234	-0,00204	-0,01467	0,000606	-0,0107	0,008494	0,000918	0,008692
AGI	0,007529	0,006005	0,085167	0,001411	-0,00107	0,00151	0,000232	0,01962	0,004872	0,013182	-0,02858	0,009237	-0,00031	0,014777	0,010655	0,019214	-0,00507	0,004489	0,001569	0,007263	-0,00097	0,004119	0,008196	0,002193
ALI	0,014066	0,007686	0,001411	0,080075	0,010376	0,041004	0,012274	0,004803	-0,00177	0,018193	0,007882	-9,4E-06	0,015688	0,003984	0,008726	0,01091	0,014156	0,008588	-0,00265	-0,00258	-0,00223	0,007606	0,016426	0,01487
AP	0,005481	0,000406	-0,00107	0,010376	0,022073	0,0062	0,007619	0,009152	0,016956	0,008729	0,002396	0,01258	0,021394	0,008942	0,014757	0,009899	-0,00094	0,017178	0,004553	0,005823	-0,00902	0,004472	0,003275	0,014667
BDO	0,00433	0,003957	0,00151	0,041004	0,0062	0,065056	0,030668	0,009797	0,005099	0,006088	0,001804	0,000897	0,012653	0,012752	0,018171	0,002727	0,008756	0,001386	0,016671	-0,00239	-0,00486	0,00427	0,002449	0,012674
BPI	0,029953	0,053581	0,000232	0,012274	0,007619	0,030668	0,483234	-0,0206	0,015198	0,067566	0,016093	-4,4E-05	0,057503	0,009975	0,025482	0,002761	-0,01834	-0,00937	-0,00052	0,038237	0,048831	0,011631	0,06055	0,03469
DMC	0,011041	-0,01023	0,01962	0,004803	0,009152	0,009797	-0,0206	0,060342	0,01314	-0,00274	-0,00095	0,01812	0,016229	0,016458	0,0344	0,018558	0,006747	0,016883	0,031776	0,005266	-0,00809	0,004851	-0,00272	0,009064
FGEN	0,017058	0,015726	0,004872	-0,00177	0,016956	0,005099	0,015198	0,01314	0,085	0,011683	0,019361	0,021403	0,027612	0,033451	0,040102	0,020398	0,014884	0,030082	-0,00093	0,018871	-0,00859	0,011759	0,012067	0,028966
GLO	0,015191	-0,00359	0,013182	0,018193	0,008729	0,006088	0,067566	-0,00274	0,011683	0,079683	0,018119	0,003217	0,027119	0,010419	0,020416	0,014554	0,017164	0,019909	0,007278	0,013971	0,007889	0,01033	0,038644	0,014177
ICT	0,010366	-0,00376	-0,02858	0,007882	0,002396	0,001804	0,016093	-0,00095	0,019361	0,018119	0,084123	0,006734	0,020144	0,00699	0,01515	-0,00036	0,018546	0,01525	-0,00206	0,013309	0,000999	0,0128	0,011993	0,009076
JFC	0,003599	0,001047	0,009237	-9,4E-06	0,01258	0,000897	-4,4E-05	0,01812	0,021403	0,003217	0,006734	0,033519	0,01817	0,018745	0,023496	0,013193	0,003184	0,015597	0,009478	0,009685	-0,00086	0,004161	0,005015	0,013575
JGS	0,010042	0,012426	-0,00031	0,015688	0,021394	0,012653	0,057503	0,016229	0,027612	0,027119	0,020144	0,01817	0,063635	0,024052	0,024349	0,016723	0,00734	0,017831	0,013216	0,017318	-0,00577	0,01081	0,016501	0,033872
MBT	0,010194	0,011024	0,014777	0,003984	0,008942	0,012752	0,009975	0,016458	0,033451	0,010419	0,00699	0,018745	0,024052	0,044178	0,034153	0,015858	0,012613	0,010541	0,008182	0,017055	-0,00852	0,012937	0,006248	0,01169
MEG	0,0189	0,002062	0,010655	0,008726	0,014757	0,018171	0,025482	0,0344	0,040102	0,020416	0,01515	0,023496	0,024349	0,034153	0,079177	0,020082	0,025172	0,035943	0,011466	0,01667	-0,00182	0,028258	0,013629	0,017184
MPI	0,006361	0,006134	0,019214	0,01091	0,009899	0,002727	0,002761	0,018558	0,020398	0,014554	-0,00036	0,013193	0,016723	0,015858	0,020082	0,049829	0,006205	0,015515	0,003667	0,012246	0,017276	0,016025	0,021461	0,017206
PCOR	0,004445	0,010234	-0,00507	0,014156	-0,00094	0,008756	-0,01834	0,006747	0,014884	0,017164	0,018546	0,003184	0,00734	0,012613	0,025172	0,006205	0,102643	0,011426	-0,00197	0,004602	0,000214	0,011119	0,004233	0,006053
RLC	0,011089	-0,00204	0,004489	0,008588	0,017178	0,001386	-0,00937	0,016883	0,030082	0,019909	0,01525	0,015597	0,017831	0,010541	0,035943	0,015515	0,011426	0,055277	0,003367	0,008775	0,001446	0,013283	0,001448	0,017735
SCC	0,00309	-0,01467	0,001569	-0,00265	0,004553	0,016671	-0,00052	0,031776	-0,00093	0,007278	-0,00206	0,009478	0,013216	0,008182	0,011466	0,003667	-0,00197	0,003367	0,068593	0,00519	-0,00035	-0,0053	0,004713	0,009826
SM	0,010107	0,000606	0,007263	-0,00258	0,005823	-0,00239	0,038237	0,005266	0,018871	0,013971	0,013309	0,009685	0,017318	0,017055	0,01667	0,012246	0,004602	0,008775	0,00519	0,02613	0,000254	0,011787	0,012601	0,009125
SMC	-0,00106	-0,0107	-0,00097	-0,00223	-0,00902	-0,00486	0,048831	-0,00809	-0,00859	0,007889	0,000999	-0,00086	-0,00577	-0,00852	-0,00182	0,017276	0,000214	0,001446	-0,00035	0,000254	0,13823	-0,00116	0,030772	0,006076
SMPH	0,008969	0,008494	0,004119	0,007606	0,004472	0,00427	0,011631	0,004851	0,011759	0,01033	0,0128	0,004161	0,01081	0,012937	0,028258	0,016025	0,011119	0,013283	-0,0053	0,011787	-0,00116	0,033447	0,010329	0,002158
TEL	0,00814	0,000918	0,008196	0,016426	0,003275	0,002449	0,06055	-0,00272	0,012067	0,038644	0,011993	0,005015	0,016501	0,006248	0,013629	0,021461	0,004233	0,001448	0,004713	0,012601	0,030772	0,010329	0,071999	0,011056
URC	0,01034	0,008692	0,002193	0,01487	0,014667	0,012674	0,03469	0,009064	0,028966	0,014177	0,009076	0,013575	0,033872	0,01169	0,017184	0,017206	0,006053	0,017735	0,009826	0,009125	0,006076	0,002158	0,011056	0,048025

The highest covariance value is 0.483234, namely BPI shares and BPI shares, while the smallest is -0.05634 shares, namely ICT and AGI shares.

Portfolio Simulation Before Using Solver for PSEi

The results of the stock portfolio with the same portion of shares produce an expected return of 3.17% and a standard deviation of 11.68% and a Sharpe value of -0.03. This shows that for 1% of the risk borne, the portfolio gives an excess return of 0.03%.

Stock Portfolio Simulation After Using Solver for PSEi

The results of the stock portfolio using solver produce a weight of 35.45% for SMPH, 22.51% for JFC, 19.13% for SM, 14.15% for SMC, 8.13% for BDO and 0.62% for AC. From the results of the stock portfolio with an average risk-free rate of 3.57%, it will produce an expected return of 16.46%, Standard Deviation of 11.48%, Sharpe Ratio 1.12, Beta 0.06, Treynor 2.03, Jensen 0.12 and Information Ratio 1.05. This shows that for 1% of the risk borne, the portfolio gives an excess return of 1.12%, 1% of systematic risk borne, the portfolio gives an excess return of 2.03% with Jensen alpha of 0.12 and management performance of 1.05. Based on the stock

portfolio above, the results of the stock allocation based on the stock aversion level are as follows:

Tabel 4.4.
The Allocation of Risky Asset and Risk-free Asset

A	*Y**	*1-Y*	*U*	*E(rc)*
1	98%	2%	16.40%	16.53%
2	49%	51%	16.34%	18.28%
3	33%	67%	16.28%	18.85%
4	24%	76%	16.23%	19.17%

Sharpe, Treynor, Jensen and Information Ratio for the PSEi index measurements

The measurement results of the performance of the stock portfolio based on measurements using Sharpe, Treynor, Jensen and Information Ratio are as follows:

Tabel 4.5.
The Measurement of Performance Stock Portfolio PSEi Index

Measurement	Stock Portfolio	PCOMP	Result
Sharpe	1.12	0.31	Good
Treynor	2.03	0.04	Good
Jensen	0.12	0.00	Good
Information Ratio	1.05	0.00	Good

Stock Portfolio for Index PSEi by using Markowitz

An optimal form of a stock portfolio based on the Markowitz method is as follows:

Tabel 4.6.
The Composition and Portion of Stock **Portfolio PSEi Index**

Stock Composition	Portion
AC	0.62%
BDO	8.13%
JFC	22.51%
SM	19.13%
SMC	14.15%
SMPH	35.45%
Total	100.00%

In the diagram, the optimal portfolio formed on the PSEi Index shares is as follows:

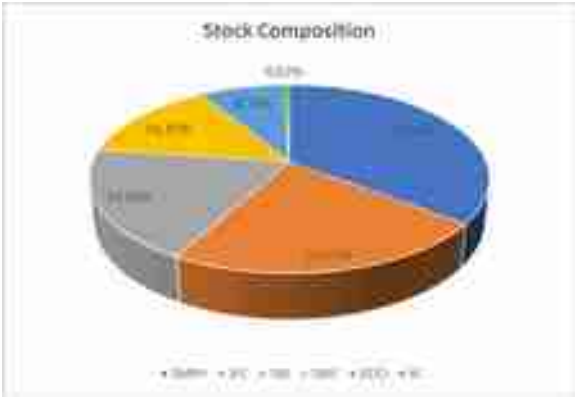

Figure 4.5. Stock Composition in PSEi Index

Based on the diagram above it is known that to get the optimum portfolio form on the PSEi index using the Markowitz method, the composition and portion of its shares is 35.45% of the shares of SM Prime Holdings, Inc. (SMPH), 22.51% shares of Jollibee Foods Corporation (JFC), 19.13% shares of SM Investments Corporation (SM), 14.15% shares of San Miguel Corporation (SMC), 8.13% shares of BDO Unibank, Inc (BDO), and 0.62% stake in Ayala Corporation (AC).

SMPH shares received the largest allocation of funds compared to other shares. SMPH shares are attractive to investors because they have the largest expected return compared to other PSEi stock samples in the period from January 2014 to December 2018. The optimum portfolio calculation above is expected to produce an expected return of 16.46% with a standard deviation of 11.48%. If we assume Rp. 1,000,000,000,- equal to 3,700,000 PHP, then the calculation of optimum portfolio investment in PSEi index shares is as follows:

Tabel 4.7.
The Simulation of Stock Portfolio in the PSEi Index

	Wi	Proporsi Dana (Dalam Peso)	Return	Return Investasi (Dalam Peso)
SMPH	35,45%	1.311.791	6,57%	86.180
JFC	22,51%	833.033	3,19%	26.604
SM	19,13%	707.708	2,79%	19.750
SMC	14,15%	523.650	3,08%	16.139
BDO	8,13%	300.836	0,76%	2.283
AC	0,62%	22.983	0,06%	14
	100,00%	3.700.000	16,46%	150.969

From the above table it can be seen that by investing PHP 3,700,000 in the PSEi index portfolio, investors are expected to get a return of 16.46% percent or PHP 150,969. The level of risk faced in PSEi's optimal portfolio investment is 11.48%. The portfolio table above produces performance measurements with a Sharpe value of 1.12, Treynor value of 2.03, Jensen value of 0.12 and Information Ration of 1.05. This shows that for 1% of the risk borne, the portfolio gives an excess return of 1.12%, 1% of systematic risk borne, the portfolio gives an excess return of 2.03% with Jensen alpha of 0.12 and management performance of 1.05.

If we simulate with an assumption of 100% in SMPH shares, investors are expected to get a return of 18.53% percent or PHP 685,610. The level of risk faced in SMPH stock investment increased compared to portfolio risk to 18.29%. The portfolio table above produces performance measurements with Sharpe value of 0.82, Treynor value of 2.32, Jensen value of 0.14 and Information Ration of 0.77. This shows that for 1% of the risk borne, SMPH shares only provide an excess return of 0.82% or 0.3% less than portfolio excess return, 1% of systematic risk borne, SMPH provides an excess return of 2.32% with Jensen alpha of 0.14 and management performance of 0.77. Thus, it can be said that investments made only in SMPH shares cannot be said to be more optimum than stock portfolios because SMPH stock performance has a higher risk than optimum stock portfolio risk or a difference of 0.24% of the expected return generated.

If we simulate with the assumption that 100% of selected stock portfolios are evenly distributed to 6 shares, investors are expected to get a return of 14.70% percent or PHP 90,654 so that this value is lower than the optimum stock portfolio. The level of risk faced in portfolio

investments in 6 selected shares with the same portion is 10.92%. The portfolio table above produces performance measurements with a Sharpe value of 1.02, Treynor value of 1.29, Jensen value of 0.10 and Information Ration of 0.92. This shows that for 1% of the risk borne, the portfolio of 6 selected shares with the same portion gives excess return of 1.02%, 1% of systematic risk borne, the portfolio of 6 selected shares with the same portion gives an excess return of 1.29% with Jensen alpha of 0.10 and management performance of 0.92. So, it can be said that the investment made in the portfolio of 6 selected shares with the same portion is not more optimum to the optimum stock portfolio because the expected return is lower than the expected return and the resulting performance measurement results are lower than the optimum portfolio performance measurement results.

The economic growth of the Philippines is higher than the Indonesian economy than the GDP value in the Philippines reached an all-time high of 330.91 billion US dollars in 2018. Economic results in the Philippines increased by 5.6 percent because it is still the fastest growth rate since the March quarter 2015, and continued the 6.3 percent expansion which was revised up in the last quarter of 2018.

CONCLUSSION

Based on the results of an analysis of stock portfolios on the PSEi index using the Markowitz method for the period January 2014 to December 2018 it can be concluded as follows:

1. Based on the calculation of average risk (standard deviation) and return of 24 selected shares, a portfolio of risk assets can be formed with a composition consisting of six shares, namely Ayala Corporation (0.62%), BDO Unibank, Inc. (8.13%), Jollibee Foods Corporation (22.51%), SM Investments Corporation (19.13%), San Miguel Corporation (14.15%) and SM Prime Holdings, Inc. (35.45%). Based on the calculation of average risk (standard deviation) and return of 24 selected shares, a portfolio of risk assets can be formed with a composition consisting of six shares, namely Ayala Corporation (0.62%), BDO Unibank, Inc. (8.13%), Jollibee Foods Corporation (22.51%), SM Investments Corporation (19.13%), San Miguel Corporation (14.15%) and SM Prime Holdings, Inc. (35.45%).

2. The portfolio of risk assets for the PSEi index, it will produce an expected return of 16.46% and a risk level of 11.48%.
3. The level of investor risk aversion will affect the composition of the complete optimum portfolio. For the PSEi index, investors with aversion 4 (risk-averse) have a composition of risk-free assets of 76% and risk assets of 24% while investors with aversion 1 (risk-lovers) have a composition of risk-free assets of 2% and risk assets of 98%.
4. Based on the results of performance measurements, the portfolio on the PSEi index showed good results with the following detailed values: Sharpe's Measure which has a value of 1.12 compared to the market (PCOMP) which has a value of 0.31; Treynor's measure which has a value of 2.03 compared to the market (PCOMP) which has a value of 0.04; Jensen's measure which has a value of 0.12 compared to the market (PCOMP) which has a value of 0.00; Information Ratio which has a value of 1.05 compared to the market (PCOMP) which has a value of 0.00.
5. Based on the research conducted, the optimum portfolio for the PSEi index will produce an expected return of 16.46% with a risk level of 11.48%. The results of the performance measurements of the PSEi Index are as follows:

Tabel 4.8.
The Measurement of Stock Portfolio Performance in the PSEi Index

Measurement	Stock Portfolio	PCOMP	Result
Sharpe	1.12	0.31	Good
Treynor	2.03	0.04	Good
Jensen	0.12	0.00	Good
Information Ratio	1.05	0.00	Good

BIBLIOGRAPHY

Bodie, Kane, & Marcus. (2013). *Investment.* New York: McGraw-Hill.

Bringham, Eugene F, C. Ehrhadt& Michael. (2010). *Financial Management Theory and Practice,* 13th Edition. United States of America: The Harcourt College Publishers.

Clarke, Silva, & Thorley. (2013). Risk Parity, Maximum Diversification, and MinimumVariance: An Analytic Perspective. Los Angeles: *The Journal of Portfolio Management2013.39.3*, 39-53.

Dominguez, Herraiz. (2015). A Sharpe-Ratio-based measure for currencies. Spanyol: *European Journal of Government and Economics*, 71.

Dong, Leung& Cai. (2015). What Drives Fixed Asset Holding and Risk-Adjusted Performance of Corporates in China? An Empirical Analysis. China: *International Real Estate Review-Journal*, 1.

Drakopoulou, Vellota. (2015). A Review of Fundamental and Technical Stock Analysis Techniques. California: Journal of Stock & Forex Trading, 1.

Fabozzi, Frank J. (1991). *Manajemen Investasi*, *Edisi Pertama*. Jakarta : Salemba Empat.

Francis, Jack Clark. (1993). *Management of Investment.* New York: McGraw-Hill.

Grinold, R. C. & Kahn, R.N. (2000). *Active Portfolio Management: A Quantitative Approach for Producing Superior Return and Controlling Risk.* New York: McGraw-Hill.

Hartono, Jogiyanto. (2015). *Teori Portofolio dan Analisis Investasi*. Yogyakarta : BPFE.

Hubner, Georges. (2003). The Generalised Treynor Ratio. Lille, Prancis: *EDHEC Business School Journal*, 4.

Husnan, Suad. (2015). *Teori Portofolio dan Analisis Sekuritas*. Yogyakarta: UPP STIM YKPN.

Indriantoro, Nurdan Supomo, Bambang (1999). *Metodologi Penelitian Bisnis Untuk Akuntansi & Manajemen*. Yogyakarta : Penerbit BPFE.

Jack Clark, Francis. (1993). *Management of Investment.* New York: McGraw-Hill.

Jones, Charles P. (2012). *Investments: Analysis and Management 12th Edition*. New York: Wiley.

Jones, Charles P & Jensen, Gerald R. (2016). *Investment: Analysis and Management, 13th Edition*. New York: Wiley.

Kamarudin, Ahmad. (2004). *Dasar-Dasar Manajemen Investasi dan Portofolio*. Jakarta : PT. Rineka Cipta.

Kang & Lee. (2013). A Bias in Jensen's Alpha When Returns Are Serially Correlated. Seoul, Korea Selatan: *Theoretical Economic Letters Journals*, 189.

Levisauskaite, Kristina. (2010). Development and Approbation of Applied Courses Based on the Transfer of Teaching Innovations in Finance and Management for Further Education of Entrepreneurs and Specialists in Latvia, Lithuania, and Bulgaria. Lithuania: *Journal of Education and Culture DG,* 12.

Markowitz, H.M. (1952). Portfolio Selection. United States of America: *America Finance Association Journal*, 12.

Paramitha, Fadila & Anggono, Achmad H. (2013). Performance Analysis and Optimum Portfolio Diversification of fourteen stocks of LQ-45 Index period 2007-2012 using Markowitz Modern Portfolio Theory. Bandung: *Journal of Business and Management*, Volume 2, No 1, 29-38.

Reily, Frank K & Brown, Keith C. (2005). *Investment Analysis and Portfolio Management.* New York: McGraw-Hill.

Sehgal, Sanjay & Garg, Vidisha. (2016). Cross-sectional Volatility and Stock Returns: Evidence for Emerging Markets. Ahmedabad: *SAGE Journals*, 22-29.

Sengupta, Chandan. (2009). *Financial Modelling Using Excel and VBA*. New Jersey, USA: John Wiley & Son, Inc.

Sharpe, William F. (1994). *Investment.* New York: McGrawHill Inc.

Sirucek & Kren. (2015). Application of Markowitz Portfolio Theory by Building Optimum Portfolio on the US Stock Market. Ceko: *ACTA Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis Journal*, 1376.

Stankovic, Markovic, & Stojanovic. (2015). Investment Strategy Optimization Using Technical Analysis and Predictive Modelling in Emerging Markets. Serbia: *Procedia Economics and Finance*, Volume 19, 51-62