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Optimal Portfolio Formation with Combination of LQ45 Stocks and Corporate Bonds

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Abstract

The objective of investors to invest their money was to maximize return, although they were subject to constraints, primarily risk, so this study aims to provide an alternative to the formation of portfolios and corporate bonds to obtain optimal returns with acceptable risk. The alternative model is to combine Graham's stock selection model with the formation of an optimal portfolio model, namely the Markowitz model. The results of the selection using the Graham model of defensive investors and aggressive investors are 9 and 13 stocks, respectively, of the 45 stocks listed on the LQ45 index. From the selected stocks, the optimal portfolio is formed using the Markowitz model. The results show that the Markowitz model optimizing portfolio provides better performance (reward to variability ratio) than the LQ45 portfolio index with a yield difference of 13.68 – 20.24% per year. Furthermore, the selection of corporate bonds for the optimal portfolio resulted in 8 corporate bonds with a portion of each bond, and this portfolio can generate rates of 8.88% per annum.

Keywords: Markowitz; optimal portfolio; LQ45 Index; Graham; Corporate Bonds
JEL: G10, G11, G12

1. INTRODUCTION

PT TASPEN (Persero) is one of the state-owned enterprises (SOE) where the core business is in the management of pension funds program. PT TASPEN (Persero) strives continuously to improve performance related to responsibility in the social security aspect of the State Civil Apparatus (ASN). Therefore, the implementation of the company's performance is always related to the investment strategy. To achieve this goal, PT Taspen (Persero) positions itself in carrying out its investment activities by seeking a high rate of return and still considering the existing risk aspects. When managing stock and bond instruments investments, a selection of stocks and bonds is made in the investment portfolio. The method that has been used so far for stock instruments is the Markowitz method or what is known as the Modern Portfolio Selection, while for bonds, the duration matches between assets and liabilities. However, in the increasingly advanced development of the investment world, several methods can be applied to calculate stocks,

one of which is the fundamental method developed by Benjamin Graham. When viewed from the criteria of PT Taspen (Persero) in managing investment assets in a "prudent" way, the author tries to combine the two methods by first selecting using the Graham method and then calculating the Return and portfolio risk using the Markowitz method.

(Khajar, 2011) stated that the objective of investors to invest their money in the stock exchange was to maximize return, although they were subject to constraints, primarily risk. Return was the motivating force in the investment process. It was their ward for undertaking the investment. To overcome and lessen the risk, an investor needed to diversify through the formation of a portfolio. This research aimed to know the return and risk from the active and passive strategy in the stocks of LQ45 for six months periods, August 2009 until January 2010. The active strategy used the single-index model, and the passive used the LQ45 share itself. This research indicated that active strategy (single index model): return portfolio was 5.43% and risk was 4.03%. Passive strategy (following the index): return portfolio was 2% and risk was 3.5%, and there was a linear relationship between an asset's risk and its required rate of return; the bigger the amount of return, the bigger the risk taken by investors or the reverse. The finding showed that between the two strategies, the return and risk of active strategy as a whole were bigger than that of the passive strategy.

2. HYPOTHESES DEVELOPMENT

Benjamin Graham, known as the first inventor of the value of an investment, i.e., an investment approach, and later developed by David Dodd in the book Security Analysis (1934). The general approach of stock selection criteria developed by Graham (Graham, 2007:380) includes the general long-term prospects of the company, the behavior and quality of good management of the company's financial and capital structure, historical dividend payments, and current dividend payments. Harry Markowitz contributed a lot to the development of a modern investment asset portfolio theory in 1952. The variables used in Markowitz's theory include Dependent Variables or Bound Variables and Independent Variables or Free Variables.

3. METHOD, DATA, AND ANALYSIS

This study uses stocks with the LQ45 category because the index contains blue chips that PT Taspen (Persero) chose to carry out investment activities according to applicable regulations. The data used in the study are:

1) LQ45 most liquid large-cap stock index for the period August 2020 - January 2021.
2) The monthly closing price of LQ45 shares in the period January 2000 – December 2020.
3) The data collected above is also the basis for calculating beta.
4) The yield or yield of Government Securities (SBN) with a tenor of 1 (one) year will be used as a risk-free asset
5) Published financial statements of each issuer included in the LQ45 index category for January 2000 – December 2020, which can be obtained from various sources such as ideas, Bloomberg, and others.

For corporate bonds, this study uses data on corporate bonds that:

1) Data collection is based on Pefindo's single-A minimum rating.
2) The monthly closing price of bonds for the period January 2018 – December 2020.
3) The yield or yield of Government Securities (SBN) with a tenor of 1 (one) year will be used as a risk-free asset
4) Published financial reports for each issuer included in the single rating category at least A for January 2018 - December 2020; Which can be obtained from various sources such as Bloomberg, Infovesta, and others.

Methods of data collection carried out include:

1) In stock instruments, the data collection method is carried out by analyzing large amounts of secondary data. The data can be obtained from financial reports issued by issuers, closing prices of shares, and Bloomberg or the internet to obtain information about economic conditions both nationally and internationally.
2) Dynamic bond data is obtained by considering all factors of corporate bonds. The data collection is dynamic because it considers all bonds expired, live, and issued between January 2018 and December 2020. Monthly data available for each bond are rating, profitability (ROA), leverage (DER), and total bond assets. Publishing company.

Investments in Equity

a. Graham Model Stock Selection

Perform stock selection using the Graham model, creating a portfolio based on several criteria (Graham, 2007):

1) The Graham Defensive Portfolio
   Investors who have a defensive portfolio do not have time or do not want to take the time to analyze their investment instruments but still want to get maximum results. Investors with defensive portfolios look for portfolios that require very minimal effort, research, and monitoring.
2) The Graham Aggressive Portfolio
   Investors who have aggressive portfolios are investors who want to take the time to analyze their investment instruments, such as analyzing growth, profitability, issuer's resolvability. Therefore, when they buy these instruments, investors already understand what kind of stock they are going to buy, not just going along with it, hoping the dealer fries the stock until it rises 10-100% instantly.

b. Formation of a Stock Portfolio Using the Markowitz Model (Markowitz, 1952) :

1) Calculating return or capital gain (loss) and standard deviation
   The calculation of return and the standard deviation is carried out on the price of each share included in the LQ45 index category, which can be explained in equation 1.

$$R_T = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

R_T = return of shares obtained
P_t = Current share price
P_{t-1} = The share price of the previous period

The standard deviation formula is in equation 2.

$$SD = \sqrt{\frac{\sum(r_i - r_{avg})^2}{n-1}} \quad (2)$$

r_i = Returns in one period
r_{avg} = Average of stock returns
n = Average of stock returns

The covariance formula is is in equation 3.

$$\text{Cov}(R_A, R_B) = \sigma_{RA,RB} = \sum_{i=1}^{n} \frac{[R_{Ai} - E(R_A)] . [R_{Bi} - E(R_B)]}{n} \quad (3)$$

Note:
$\text{Cov}(R_A, R_B)$ = return of covariance of stocks A and B
R_{Ai}, R_{Bi} = The rate of return of shares A and B to it-i
$E(R_A), E(R_B)$ = Expected Return of shares A and B
n = Number of observations

c. Formation of the Efficient Frontier Curve
By using Microsoft Excel and solver, the efficient frontier curve can be formed through the optimization process. The resulting data is the amount of allocation, return, and portfolio risk, which has the smallest variance. Then the portfolio is plotted onto the graph according to the expected returns and standard deviation of returns.

d. Calculating Net Asset Value (NAV)
At this stage, a calculation simulation is carried out using historical data on the price of shares included in the LQ45 index category within a predetermined time period so that the calculation will produce a return.

e. Comparison of Return Index with Portfolio Return
At this stage, the calculation of the return of the LQ45 index stock is carried out in the same time period as the calculation of the portfolio return, and then the results of both calculations are compared.

Investments in Corporate Bonds

a. Selection of Corporate Bonds Using 4 (four) Factors
Selecting corporate bonds, namely creating a portfolio based on several factors:
1) Bond-rating
2) Profitability (ROA)
3) Leverage (DER)
4) Company Assets

b. Establishment of a Corporate Bond Portfolio Using the Markowitz Model
1) Calculating the corporate bond yield
The yield and standard deviation calculation are carried out on the price of each share included in the corporate bond category, which can be explained in equation 4.

$$\text{Yield} = \frac{\text{Annual Coupon Payment}}{\text{Bond Price}} \quad (4)$$

The standard deviation formula is in equation 5.

$$\text{SD} = \sqrt{\frac{\sum(r_i - r_{avg})^2}{n-1}} \quad (5)$$

r_i = Returns in one period
r_{avg} = Average of bond returns
n = Number of periods

The covariance formula is in equation 6.

$$\mathrm{Cov}(R_A, R_B) = \sigma_{RA,RB} = \sum_{i=1}^{n} \frac{[R_{Ai} - E(R_A)] \,.\, [R_{Bi} - E(R_B)]}{n} \quad (6)$$

$\mathrm{Cov}(R_A, R_B)$	=	The Return on the covariance of bonds A and B
R_{Ai}, R_{Bi}	=	Rate of Return of the i bonds A and B
$E(R_A), E(R_B)$	=	Expected Return of bonds A and B
n	=	Number of observations

c. Formation of the Efficient Frontier Curve
By using Microsoft Excel and solver, the efficient frontier curve can be formed through the optimization process. The resulting data is the amount of allocation, return, and portfolio risk, which has the smallest variance. Then the portfolio is plotted onto the graph according to the expected returns and standard deviation of returns.

d. Yield to Maturity (YTM)
The yield to maturity is the Rate of Return (IRR) of an investment in a bond if the investor holds the bond until maturity, with all payments being made on schedule and reinvested at least at the same rate (Fabozzi, Frank - 2012). The YTM formula is in equation 7.

$$\mathrm{YTM} = \frac{C + \frac{P_p - P}{t}}{\frac{P_p + P}{2}} \quad (7)$$

C	=	Bond Coupon Payment
P_p	=	Par value of the bond
P	=	Current bond price
t	=	time until maturity

4. RESULTS

The following are the data processing results for monthly returns, standard deviation from 2016 to 2020, as follows Table 1.

Table 1. Expected Return of Monthly Data and Standard Deviation

Description	**Investment Instrument**			
	Deposito	Bond	Stock	Mutual Fund
Expected Return	0,44%	0,68%	0,95%	0,77%
Standard Deviation	0,11%	3,12%	6,34%	3,16%

One of the methods used is the Markowitz portfolio. Thus, after compiling the composition based on the expected return and standard deviation, the following results are obtained in Table 2.

Table 2. Formation of Efficient Frontier (Allocation Limitation on Shares and Mutual Funds)

Description	Instrumen Investasi				Return	Risk	Sharpe Ratio
	Deposit	Bond	Stock	Mutual Fund			
Simulation 1	10,00%	75,00%	5,00%	10,00%	0,68%	2,79%	6,41%
Simulation 2	10,00%	70,00%	5,00%	15,00%	0,68%	2,76%	6,65%
Simulation 3	10,00%	65,00%	5,00%	20,00%	0,69%	2,74%	6,87%
Simulation 4	10,00%	70,00%	10,00%	10,00%	0,69%	2,87%	6,69%
Simulation 5	10,00%	65,00%	10,00%	15,00%	0,70%	2,86%	6,89%
Simulation 6	10,00%	60,00%	10,00%	20,00%	0,70%	2,85%	7,08%
Simulation 7	10,00%	65,00%	15,00%	10,00%	0,71%	2,98%	6,90%
Simulation 8	10,00%	60,00%	15,00%	15,00%	0,71%	2,97%	7,08%
Simulation 9	10,00%	55,00%	15,00%	20,00%	0,72%	2,97%	7,24%
Simulation 10	10,00%	60,00%	20,00%	10,00%	0,72%	3,11%	7,06%
Simulation 11	10,00%	55,00%	20,00%	15,00%	0,72%	3,11%	7,21%
Simulation 12	10,00%	50,00%	20,00%	20,00%	0,73%	3,11%	7,35%
Max Slope	10,00%	30,00%	0,00%	90,00%	0,74%	2,84%	8,42%

Several alternatives found that the highest rate of return was found in simulation 12 of 0.73% with a risk level of 3.11%. The portfolio consists of 10% deposits, 50% bonds, 20% shares, and 20% mutual funds. And the efficient frontier curve can be described as follows in Figure 1.

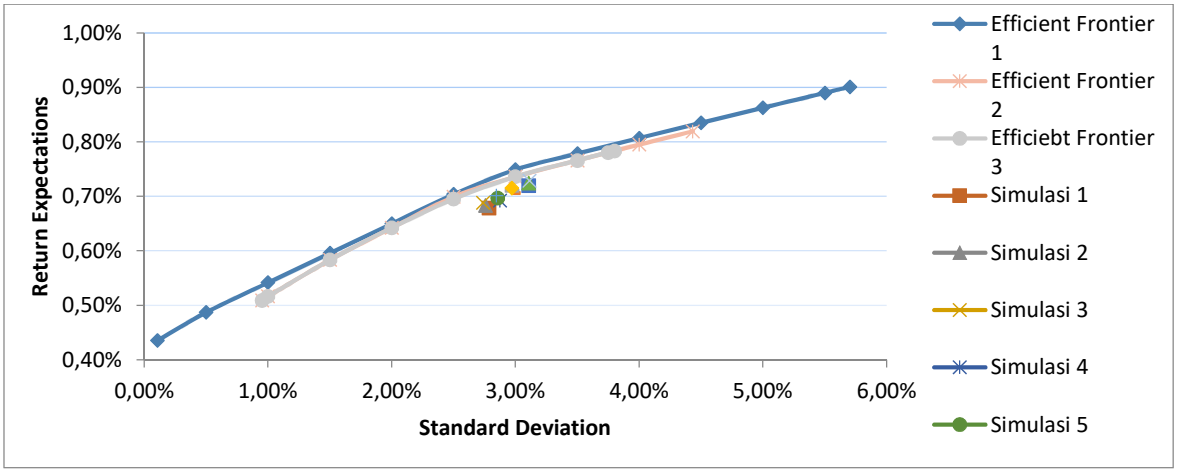

Figure 1. Efficient Frontier Curve (Defensive Investor)

Formation of Optimal Stock Portfolio Using Markowitz Model

From the results of stock selection using both Graham models, an optimal portfolio will be formed using the Markowitz model. The optimal portfolio to be chosen for a defensive portfolio is the point of intersection between the efficient frontier curve and the CAL line that forms the most significant angle.

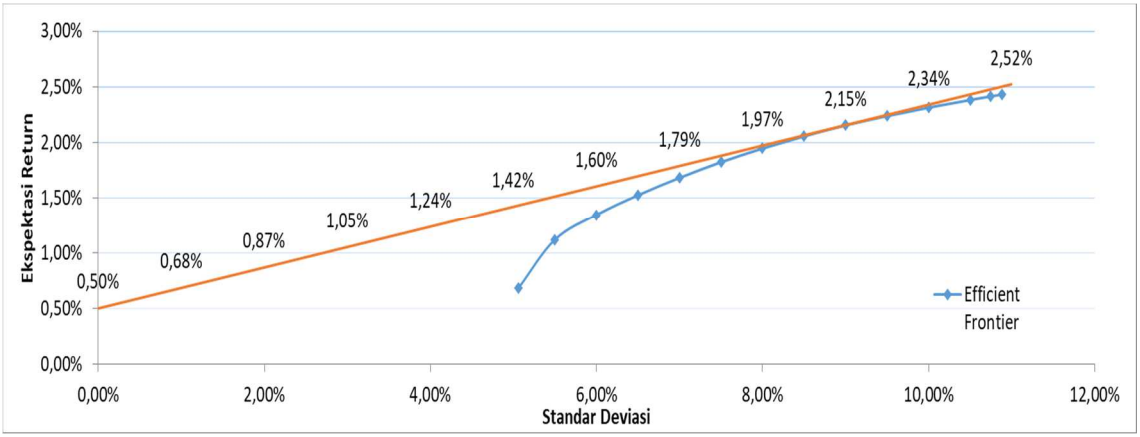

Figure 2. Efficient Frontier Curve (Defensive Investor)

From Figure 2, it can be seen that the optimal portfolio is at the point (8.71%; 2.10%) or a portfolio that provides an expected return of 2.14% per month or 25.71% annually with a standard deviation of 8.94%. The proportion of each share is as follows in table 3.

Table 3. Optimal Portfolio Composition for Defensive Investors

Stock	ACES	BSDE	GGRM	HMSP	INKP	MNCN	PTBA	PWON	UNTR
Proportion	50,00%	0,00%	0,00%	0,00%	32,72%	2,84%	0,00%	14,44%	0,00%

Furthermore, the optimal portfolio to be chosen for aggressive portfolios is the point of intersection between the efficient frontier curve and the CAL line that forms the largest angle. From Figure 3, it can be seen that the optimal portfolio point formed for aggressive investors is (7.24%; 1.76%). This means that the portfolio offers an expected return of 1.80% per month or 21.15% annually with a standard deviation of 7.24%. The composition of the portfolio is as follows in table 4.

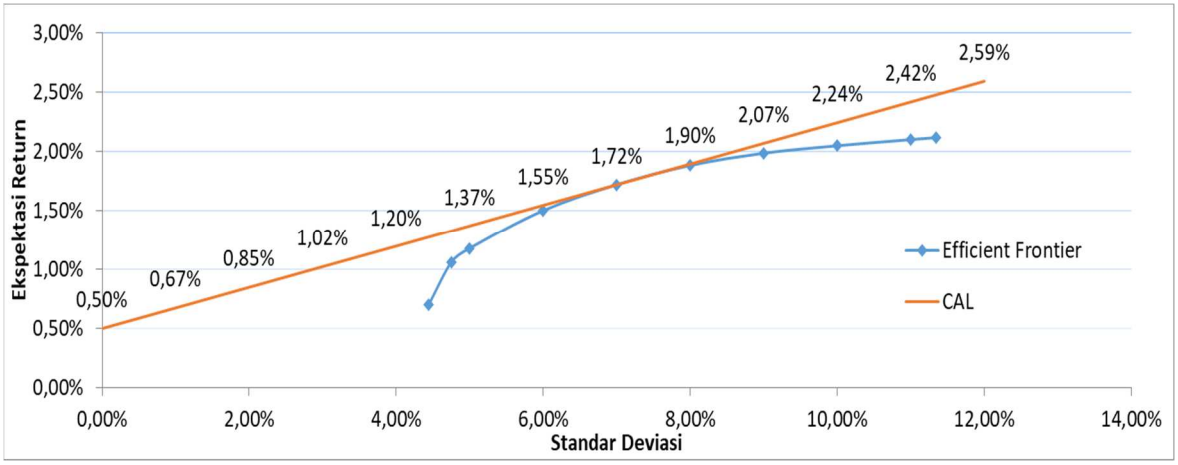

Figure 3. Efficient Frontier Curve for Aggressive Investors

Table 4 Optimal Portfolio Composition for Aggressive Investors

Stock	ACES	ASII	CPIN	CTRA	ERAA	GGRM	HMSP
Proportion	50%	0%	20,67%	9,22%	8,59%	0%	0%
Stock	INTP	MIKA	MNCN	PTBA	PWON	UNTR	
Proportion	0%	11,52%	0%	0%	0%	0%	

From the selection, eight corporate bonds have met the criteria. A result of all the selections have been made; Furthermore, eight bonds met all the criteria shown in table 5.

Table 5. Selection Results for Corporate Bonds

No	Series	Code	Coupon (%)	Due date	YTM (%)	Rating	Nominal (Billion Rp)
1	OBL BKLJT I TELKOM TAHAP I TAHUN 2015 SERI C	TLKM01CCN1	10,6	6/23/2030	7,63	idAAA	1.200
2	OBL BKL I CHANDRA ASRI PETROCHEM. THP II TH18 SR C	TPIA01CCN2	9	3/1/2025	7,41	idAA-	300
3	OBL BKLJ I SARANA MULTI INFRA. THP I TH2016 SR C	SMII01CCN1	8,65	11/18/2026	6,90	idAAA	700
4	OBL BKLJ I SARANA MULTI INFRA. THP I TH2016 SR D	SMII01DCN1	8,9	11/18/2031	7,46	idAAA	674
5	OBLIGASI BKLJT I HUTAMA KARYA TAHAP II TAHUN 2017	PTHK01CN2	8,07	6/6/2027	7,48	idAAA	1.968
6	OBLIGASI BKLJT I HUTAMA KARYA TAHAP I TAHUN 2016	PTHK01CN1	8,55	12/21/2026	7,62	idAAA	1.000

No	Series	Code	Coupon (%)	Due date	YTM (%)	Rating	Nominal (Billion Rp)
7	OBLIGASI BKLJT I HUTAMA KARYA TAHAP III TH 17 SR B	PTHK01BCN3	8,4	9/26/2027	7,72	idAAA	2.367
8	OBL SUB BKLJT III BANK PANIN TAHAP I TAHUN 2018	PNBN03SBCN1	9,5	7/3/2025	8,74	idA+	1.302

Formation of Optimal Corporate Bond Portfolio Using Markowitz Model

From the results of the selection of corporate bonds using several criteria, an optimal portfolio will be formed using the Markowitz model. The first stage informing the optimal portfolio is to determine the expected return and standard deviation of each corporate bond obtained from the Average and standard deviation of monthly returns from 2018 – 2020. If the expected return, standard deviation, and Sharpe ratio of each alternative portfolio are considered, it will be shown in table 6. And Efficient Portfolio Alternatives to Corporate Bonds can be seen in table 7.

Table 6. Calculation of expected Return, standard deviation, and Sharpe ratio in the optimal portfolio of corporate bonds

Alternative Portfolio	Expected Return	Standard Deviation	Sharpe Ratio
1	0,74%	0,04%	649,05%
2	0,75%	0,04%	645,37%
3	0,75%	0,04%	634,45%
4	0,75%	0,04%	623,65%
5	0,75%	0,04%	613,08%
6	0,75%	0,04%	602,60%
7	0,76%	0,04%	592,24%
8	0,76%	0,04%	583,88%
Max Slope	0,74%	0,04%	650,90%

The optimal portfolio to be chosen is the point of intersection between the efficient frontier curve and the CAL line that forms the most significant angle.

Table 7. Efficient Portfolio Alternatives to Corporate Bonds

Formation of Efficient Frontier	**Corporate Bond Ticker**								**Exp. Return**	**Risk**
	TLKM01CCN1	**TPIA01CCN2**	**SMII01CCN1**	**SMII01DCN1**	**PTHK01CN2**	**PTHK01CN1**	**PTHK01BCN3**	**PNBN03SBCN1**		
Alternatif 1	20,00%	0,00%	20,00%	20,00%	2,25%	0,00%	17,75%	20,00%	0,74%	0,04%
Alternatif 2	20,00%	0,03%	7,28%	20,00%	12,69%	0,00%	20,00%	20,00%	0,75%	0,04%
Alternatif 3	20,00%	3,43%	4,58%	20,00%	11,99%	0,00%	20,00%	20,00%	0,75%	0,04%
Alternatif 4	20,00%	6,56%	2,09%	20,00%	11,35%	0,00%	20,00%	20,00%	0,75%	0,04%
Alternatif 5	20,00%	9,65%	0,00%	20,00%	10,35%	0,00%	20,00%	20,00%	0,75%	0,04%
Alternatif 6	20,00%	13,62%	0,00%	20,00%	6,38%	0,00%	20,00%	20,00%	0,75%	0,04%
Alternatif 7	20,00%	17,23%	0,00%	20,00%	2,77%	0,00%	20,00%	20,00%	0,76%	0,04%
Alternatif 8	20,00%	20,00%	0,00%	20,00%	0,00%	0,00%	20,00%	20,00%	0,76%	0,04%
Max Slope	20,00%	0,00%	17,47%	20,00%	2,53%	0,00%	20,00%	20,00%	0,74%	0,04%

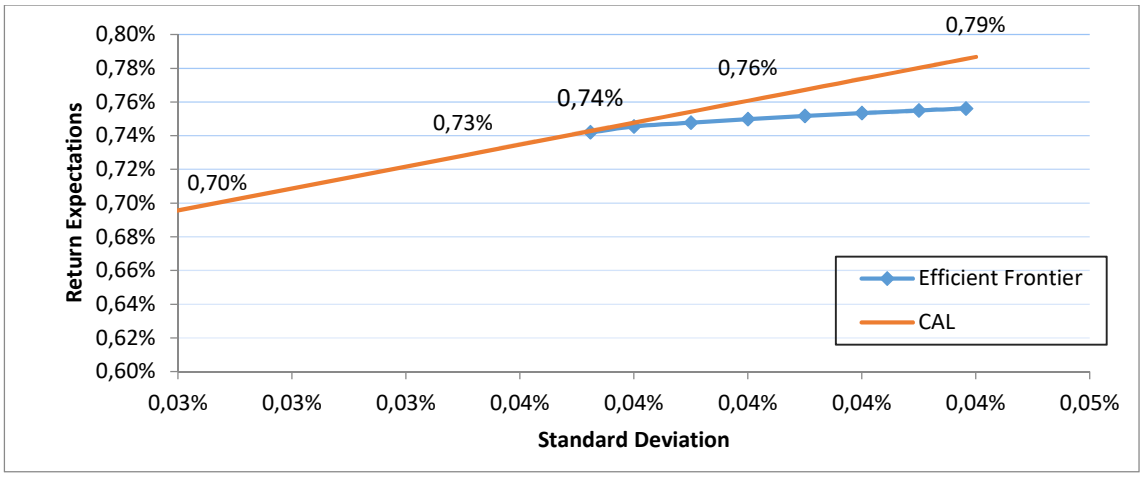

Figure 4. Efficient Frontier Curve on Corporate Bonds

From Figure 4, it can be seen that the portfolio formed is at the point (0.74%; 0.04%) or a portfolio that provides an expected return of 0.74% per month or 8.88% a year with a standard deviation of 0.04%. This point corresponds to the alternative on the maximum slope portfolio with a Sharpe ratio of 650,90%. The proportion of each corporate bond is as follows in table 8. From Table 8, the optimal portfolio is found in simulation 8, which produces the highest return but with a risk level that is still in the risk tolerance category. Therefore, it can be concluded that the optimal portfolio is in the max slope simulation.

Table 8. Portfolio Composition Based on Efficient Frontier Curve

	Corporate Bond Ticker							
Description	TLKM0	TPIA01C	SMII01	SMII01	PTHK01	PTHK	PTHK0	PNBN03
	1CCN1	CN2	CCN1	DCN1	CN2	01CN1	1BCN3	SBCN1
Proportion	20,00%	0,00%	17,47%	20,00%	2,53%	0,00%	20,00%	20,00%

5. DISCUSSION

The optimal portfolio chosen offers an adequate return potential compared to the risk-taking into account regulatory constraints and operational needs. In this regard, the ideal portfolio following the existing provisions (regulations) is carried out with a composition of 10% deposits, 50% bonds, 20% shares, and 20% mutual funds. This composition has an expected return of 0.73% and a risk of 3.11%.

6. CONCLUSION, LIMITATIONS, AND SUGGESTIONS

Conclusion

From the results of the selection of the Graham method, several conclusions can be drawn, including the following: The optimal portfolio for stocks with a formed defensive portfolio provides an expected return of 2.14% per month or 25.71% a year with a standard deviation of 8.94% and a Sharpe ratio of 18.37%. Meanwhile, the aggressive portfolio provides an expected return of 1.76% per month, or 21.15% a year, with a standard deviation of 7.24% and a Sharpe ratio of 17.44%. From the results of the comparison of the portfolio performance formed, it is found that the expected and actual performance of the stock portfolio using the Graham model for both defensive and aggressive investors is better than the performance of the LQ45 index.

From the results of the selection of corporate bonds and the formation of an optimal portfolio using the Markowitz method, the results of the selection of corporate bonds aim to form a portfolio of corporate bonds that have good performance and are both historically and currently sound. The Number of corporate bonds that are eligible for investors is eight corporate bonds out of a total of 187 corporate bonds. The optimal portfolio for corporate bonds formed provides an expected return of 0.74% per month or 8.88% a year with a standard deviation of 0.04% and a Sharpe ratio of 650.90%.

Limitations and Suggestions

By looking at some of the conclusions as above, some suggestions that can be used as input, especially for PT Taspen (Persero), are as follows: In an economic situation that tends to fluctuate, the authors recommend being more selective in investing activities, especially in the stock and bond markets. However, furthermore, the authors suggest that the rules/regulations that limit investment activities can be adjusted (flexible) to the existing economic conditions. For further research, it is necessary to consider using all JCI shares as stocks selected using the Graham model. Stock selection should also be adjusted to the global and domestic economic conditions that support it; current and future projections and stock return expectations can use future price projections, using valuation methods or other methods.

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