Research Article

Stock Selection using Semi-variance and Beta to construct Portfolio and Effect Macro-variable on Portfolio Return

Adler Haymans Manurung[1*], Amran Manurung[2], Nera Marinda Machdar[1], Jadongan Sijabat[2]
[1]*Professor at University of Bhayangkara Jakarta Raya, Jakarta – Indonesia,*
[2]*Lecturer of University of HKBP Nommensen, Medan – Indonesia*

***Coresspondence Author**
adler.manurung@dsn.ubharajaya.ac.id

Abstract: This research has aims to construct portfolio by varying method and using semi-variance and Beta for selection stocks. This research found 28 stocks to become member portfolio. Equal Weighted, Market Capitalization Weighted, Markowitz Method and Elton Gruber is used to construct portfolio. This research found that the efficient frontier similar to Markowitz Method. Roy Criterion found the portfolio return varying from 2.2% to 9.65% but Kataoka Criterion found the portfolio return varying from 5.4% to 11.12%. This research found that Elton Gruber has the highest portfolio return compared to others portfolio. There is no difference of average return for four portfolios. Market returns significant affect to all portfolio return but the interest rate significant affect portfolio returns for equal weighted portfolio and Elton Gruber Method.

Keywords: Semi-variance, Portfolio Return, Quadratic Programming, Portfolio Risk, Markowitz Method, Safety-First, and Excess Return
JEL Classification: C13, C51, C61, G1, M21

1. Introduction

Many investors and Fund Manager should select stock to become a member portfolio that it will achieve target return. A portfolio containing a variety of various assets will offer the investor a variety of returns while lowering risk (Galankashi, *et al*., 2020). Markowitz (1952) used risk and return to select stock using quadratic programming. Elton and Gruber (1976, 1977 and 1978) use excess return to select stocks dan set up cut-off to become a member of portfolio.

The various characteristic stock was used to select stock to become member a portfolio which is Risk and return, excess return to beta, safety first and others. Numerous techniques have been created to investigate a portfolio that it could achieve their target. Academician did research to set up a good portfolio for investor needs. Markowitz (1952) introduce a good portfolio using risk and return and Quadratic Programming. Elton, et al. (1976, 1977 and 1978) introduced a portfolio that it selects from all stocks using excess return to beta. Then, safety first approach developed by some academician, which is Roy (1952), Kataoka (1963) and Telser (1955). This approach has a certain or special criteria to become member a portfolio. Jones (1992) used network analysis to set up a portfolio. Saaty (1980) developed a model hierarchy portfolio to set up a portfolio. Skewness as a tool to select stock to become a member portfolio discussed by Arditti (1967); Levy (1969), Kraus and Litzenberger (1976) and Manurung et.al (2023a). Black and Litterman (1991) suggested an asset allocation based on combining investor view with market equilibrium.

Research on the portfolio has been done mostly using Markowitz Model which is Hanif et.al (2021), Balqis (2021), Manurung and Berlian (2004), Manurung (1997a) and Manurung (1997b). Manurung et.al (2023a), Manullang et.al (2023) used Markowitz Model, Elton Grubel Model to construct a Portfollio for Indonesian stocks. Manurung et.al (2023a) used skewness methods to select stocks for member a portfolio. McNamara (1998), Alghalith (2011) and Dai et.al (2015) used stochastic dominance for construction portfolio. Bey and Howe (1984) used Gini's Mean Difference for stock Selection.

Based on above explanation, this research wants to construct a portfolio using Equal weighted, Market Capitalization, Markowitz Method, Elton Gruber Method, Safety-First Criterion which is Roy Criterion and Kataoka Criterion that is different from previous research. Safety-First criteria should have certain return to achieve. Then portfolio return seek factor that affected it that it used macroeconomic variable.

The remainder of this paper is structured as follows. Section 1 goes over the relevant Theoretical background. Section 2 then outlines the methodology. The results are then presented and discussed in Section 3. Finally, in section 4, the conclusions are presented.

2. Theoretical Review

The Theory of Portfolio introduced in the first time to scientific in Finance by Markowitz (1952). This theory focused on risk and return as factors to select instrument of investments such as stock, bond and other to construct in the optimal portfolio. Markowitz (1952) assumed that most investors are cautious and seek to incur the least amount of risk in order to earn the maximum potential return, optimizing the return to risk ratio. Theory of Portfolio develops a framework in which any expected return is composed of various future outcomes and is thus risky, and this risk-return relationship can be optimized through diversification (Kierkegaard, *et al*., 2007). The portfolio should meet these two conditions is referred to as an efficient portfolio. Markowitz (1959) stated that No other portfolio will produce a higher return at the same degree of risk. Markowitz (1991) mentioned that If it is possible to increase expected return without increasing risk or decrease risk while maintaining the same level of expected return, a portfolio is inefficient.

Markowitz (1952) stated that risk and return could be calculated using Quadratic Programming to estimate the efficient frontier. The efficient frontier is based on the straightforward line risk and return are connected from the smaller to the higher. Kierkegaard, *et al*., (2007) stated that there may be a technique to calculate the level of risk needed to achieve different levels of return. (Markowitz (1959) stated that the efficient frontier is a trade-off graph with expected return on one axis and risk on the other. All portfolios that optimize expected return for a specific amount of risk are represented by Figure 1. The efficient frontier is just a line drawn from bottom to top, with each point representing the junction of a prospective reward and its matching amount of risk. The portfolio that offers the Optimum return for a specific level of portfolio risk is considered to be the most efficient. Based on Efficient Frontier, it found asset allocation through every combination risk and return.

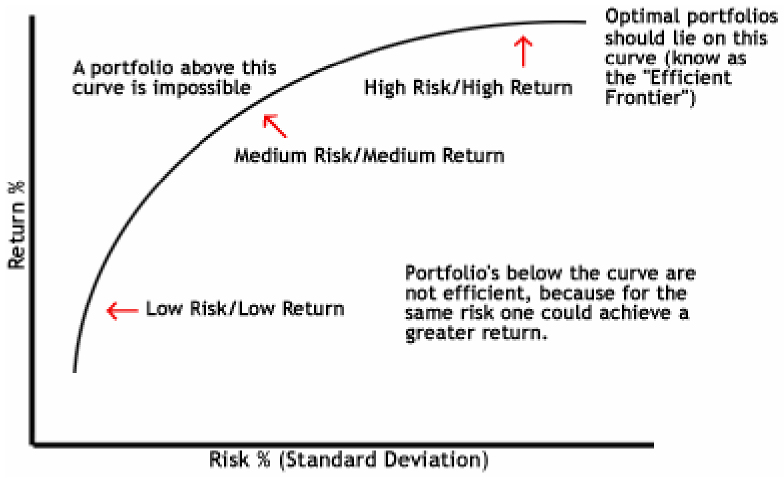


Figure 1. The Efficient Frontier ((Markowitz, 1959)

Figure 1 present that there are no portfolios above the efficient frontier, and all portfolios below the border are subpar compared to those on the frontier, as seen in the above graphic. A separate efficient portfolio is represented by each point on the frontier. The risk and return both rise as one moves from lower left to higher right. Each asset in the whole portfolio needs to be weighted in a specific way in order to produce a tangent portfolio on the efficient frontier. A portfolio with equally distributed fractions of each asset will not provide contact with the efficient frontier if only one asset is used. The weighting process is important for achieving a tangent portfolio on the efficient frontier. There is a portfolio that offers the lowest risk for every level of return and a portfolio that gives the highest return for every level of risk. Any portfolio in the line of the curve is efficient, meaning it provides the optimum expected return for a particular level of risk.

Elton, et al. (1976, 1977 and 1978) introduced a construction of portfolio that it selects from all stocks using excess return to beta. Stock that has excess return to beta is higher than a criterion (cut off value), it will become a group portfolio. The Elton, Gruber, and Padberg model is based on stock performance using a reward-to-volatility (RV) approach, which entails dividing excess return by systematic risk. Assets are ranked according to their performance ranking, beginning with the highest and working down to the lowest to determine the Optimal Portfolio. Assets with an RV value greater than the cut-off point are included in the optimal portfolio; assets with a lower RV value are not included in the optimal portfolio. The Elton, Gruber, and Padberg model process is broken down into the following steps: a) calculating individual stock performance, or RV = (R - Rf)/β) defining the ranking of individual stock performance based on RV ratings; c) deciding the cut-off point; select the highest cut-off point (C*); d) deciding the assets that go into the portfolio; and e) comparing the individual RV with the highest cut-off point. Sometimes this model called single index model to select portfolio.

Cut-off point for each stock is calculated using equation as follows:

$$C_i^* = \frac{\sigma_m^2 \sum_{j=1}^{i} \frac{(R_i - R_f) * \beta_j}{\sigma_{ej}^2}}{1 + \sigma_m^2 \sum_{j=1}^{i} \left\{\frac{\beta_j^2}{\sigma_{ej}^2}\right\}} \quad (1)$$

The asset allocation of each stocks is calculated as follows:

$$w_i = \frac{Z_i}{\sum_{i=1}^{n} Z_i} \quad (2)$$

where

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}\left(\frac{\bar{R}_i - R_f}{\beta_i} - C^*\right)$$

In Statistics, there is an indicator to measure normality of Bell curve that is called Skewness. Skewness is a measure of the asymmetry of a distribution. A distribution could be stated asymmetrical when its left and right side are not mirror images. A distribution can have right (or positive), left (or negative), or zero skewness. Skewness could be used to set up a portfolio by Fund Owner. Stocks will be selected to become a portfolio through return that has return in right skewness. When the portfolio return is negatively skewed, an extreme left-tail event is more likely than an extreme right-tail event (Kim, *et al.*, 2014). Therefore, the typical investor favors return distributions that are more positively biased. For instance, a portfolio that is more favorably skewed has a stronger Sortino ratio and less semi-deviation (Sortino & Van der Meer, 1991).

Then, there is a suggestion to select a portfolio using safety-first Criterion. This method is concerned only with risk of failing to achieve a certain minimum target return or secure prespecified safety margin. The risk is commonly expressed as

$$Prob(r_p \le r_L) \le \alpha \quad (3)$$

where r_p is the return of portfolio p, r_L is a certain desired level return below which the investor does not wish to fall, which is often referred to as the disaster level or the safety threshold, and α is an acceptable limit on the probability of failing to earn the minimally acceptable level of return, r_L. There is 3 criterion that overcome to discuss for portfolio construction which is Roy (1952), Kataoka (1963) and Telser (1955). It will explain following this explanation.

Roy (1952) introduced and developed a safety-first criterion that seeks to minimize the probability of earning a disaster level of return, α in equation (3) which is:

Minimize Prob $(r_p < r_L)$ (4)

Roy's safety-first criterion implies that investors choose their portfolios by minimizing the loss probability for a fixed safety threshold called the floor return. Roy's criterion tries to control risk for a fixed return whereas Markowitz's mean variance criterion offers a menu of positively related pairs of points having both the maximum local return and minimum local risk. Roy's Safety-first criterion is related to the Sharpe ratio (Francis and Kim, 2013, p 221). Minimizing Probability of equation (4) is equivalent to:

$$\text{Minimize } Prob\left(\frac{(r_p - E(r_p)}{\sigma_p} < \frac{r_L - E(r_p)}{\sigma_p}\right) = Prob\left(z < \frac{r_L - E(r_p)}{\sigma_p}\right) = Minimize\ \left(\frac{r_L - E(r_p)}{\sigma_p}\right)$$
$$= \text{Maximize}\left\{\frac{E(r_p) - r_L}{\sigma_p}\right\}$$

Sharpe Ratio is as follows: $S_p = \frac{E(r_p) - r_L}{\sigma_p}$ --- $E(r_p) = r_L + S_p\ \sigma_p$(5)

Equation (5) means that Expected return portfolio depend on r_L and risk tolerance. Roy criterion stated that risk tolerance is product of Sharpe ratio and portfolio risk. Based on equation (5), Roy criterion stated that risk portfolio is varying base on composition stock in the portfolio. The S_p depend on the performance portfolio adjusted to standard of deviation of portfolio. The Equation (5) could be plotted in a figure that it showed in Figure 2. The Figure 2 stated A>B>C>D regarding their slope. In this research, value of Sp is determined by researcher which is varying from 0.5 (D) to 2 (A). This value stated performance below, similar dan double to return portfolio that is adjusted to risk (standard of deviation).

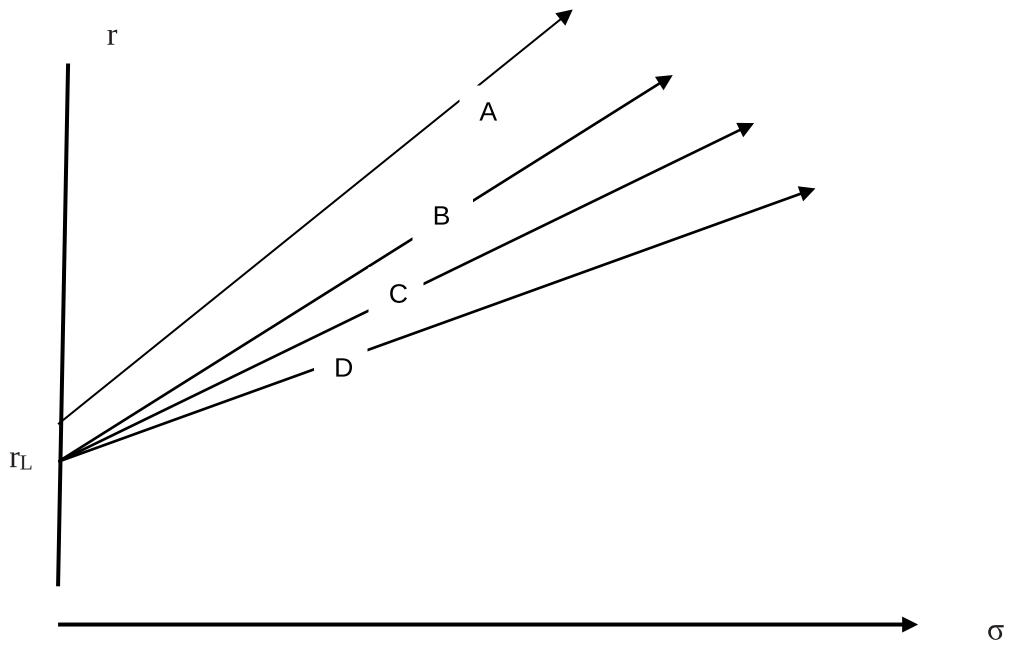


Figure 2: Portfolio Return in varying Risk and Slope

Besides Roy, there is other academician to suggest safety first. Kataoka (1963) also developed a safety-first criterion in which choose the portfolio with an insured return R_L, as high as possible subject to the constraint such as the probability that the portfolio return is no greater than insured return must not exceed a predetermined level, denoted α (alpha). Kataoka criterion stated in figure at below for $\alpha = 5\%$.

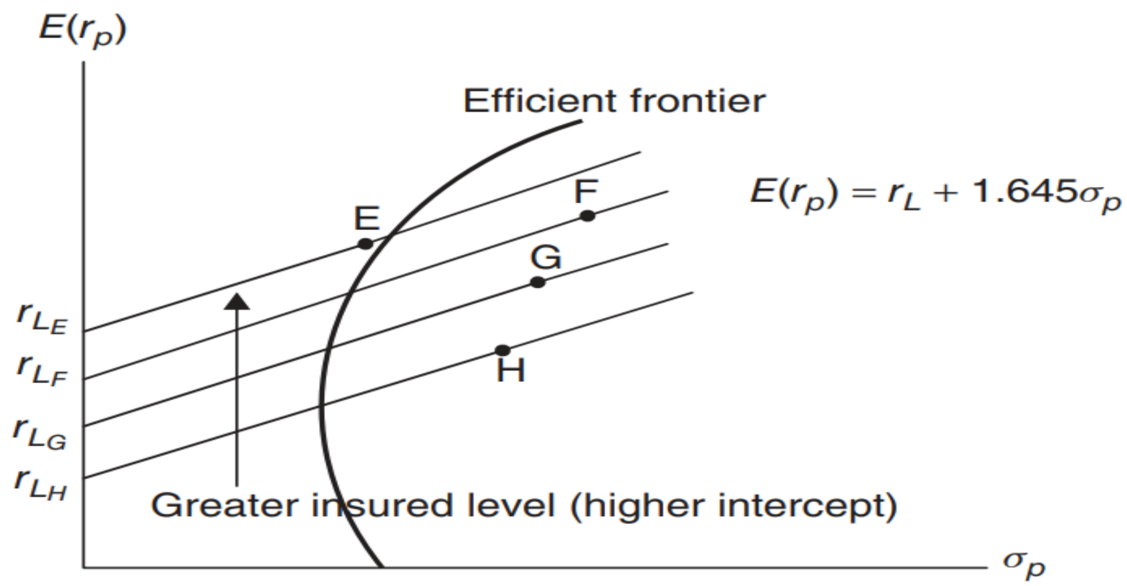


Figure 3: Kataoka's Safety-First Crietrion

Kataoka stated as follows:

Maximize R_L

$$Prob\ (R_p < R_L) \leq \alpha \quad (6)$$

$$E(R_p) = R_L + Z_\alpha * \sigma_p \quad (7)$$

Equation (7) stated that Expected Return Portfolio $E(R_p)$ depend on insured return R_L and portfolio risk (σ_p) and level of tolerance error (α, alpha). If tolerance error is 5%, so the value of Z_α equal to 1.645 which is tolerance level always used by researcher and academician.

3. Methodology

This study uses monthly stock price information obtained from www.finance.yahoo.com. Data is available *January 2015 to June 2023*. This study employed an adjusted price that included dividends, rights issues, and all business activity to stock price into account.

Stock Return calculated as follows:

$$R_{i,t} = \frac{Adjusted\ Clossing\ Price_{i,t}}{Adjusted\ Clossing_{i,t-1}} x100\% \tag{8}$$

Then, next step is to calculate of semi-variance as follows:

$$\sigma_t = SQRT(k) * \sqrt{\frac{\sum_{i=1}^{k}\left(R_{i,t}-\bar{R}\right)^2}{k-1}} \tag{9}$$

k = number of negative returns.

This semi-variance will use to select stock that will be a member portfolio.

Risk calculated by standard of Deviation as follows:

$$\sigma_t = SQRT(250) * \sqrt{\frac{\sum_{i=1}^{252}\left(R_{i,t}-\bar{R}\right)^2}{n-1}} \tag{10}$$

The return and risk will be used to choose stocks and calculate asset allocation using quadratic programming. In an operational research investigation, the weight of a group for reaching the target function can be solved using quadratic programming which is Risk minimization is the goal of portfolio management. Following is the quadratic programming equation:

$$\left.\begin{array}{ll} \text{Objective Function:} & \text{Min } \sigma = \sqrt{\sum_i^n \sum_j^m \left[w_i^2 \sigma_i^2 + 2 w_i w_j Cov(i,j)\right]} \\ \text{Subject to} & w_1 + w_2 + \cdots + w_n = 1 \\ & w_1 * R_1 + w_2 * R_2 + \cdots + w_n * R_n = R_p \\ & w_1, w_2, \ldots, w_n > 0 \end{array}\right\} \tag{11}$$

This research uses the quadratic programming method to find weight of every stock in a portfolio (Markowitz, 1952; Manurung, 1997).

Weighted Stock could be calculated as follows as:

$$w_i = \frac{nilai\ stock\ i_{th}}{total\ Portfolio} \tag{12}$$

Weighted stock i_{th} will be calculated for portfolio using Markowitz Model, Elton Gruber Method, market capitalization and Equal Weighted in Portfolio.

The cumulative return is calculated as follows:

$$CR_t = (1 + r_t) * CR_{t-1} \tag{13}$$

Equation (13) will use based year on December 2014 that value of 100.

4. Results and Discussion

As mentioned previously, this paper aims to construct a portfolio using risk and return from Kompas 100 Index. The 81 stocks out of 100 stocks of Kompas 100 index was eligible to become member a portfolio. Then, this research selects a stock that has positive return for period 2015 to June 2023. It means that this research dropped a negative stock return. This research found 60 stocks that it has positive return. Furthermore, this research dropped that stock return has semi-variance more than 10%. After that, this research dropped the stocks that it has negative skewness and also beta stock has more than 1.5. Based on these criteria, this research found 28 stocks to become a member of portfolio. Then this research constructs a portfolio using equal weighted, market capitalisation weighted, Markowitz method and Elton Gruber method that it will be explained in the following section.

a. Descriptive statistics

Based on the criteria was explained previously, this research found 28 stocks. The Average return, standard of deviation, Semi-Variance, Beta and Skewness for 28 stocks could be seen at Table 1 next pages. The Highet stock return is monthly return of 3.11% for stock of HRUM and the lowest stock return is monthly return of,143% for stock of DSNG. Besides that, there is 31.24% out of 28 stocks that it has stock return more than monthly return of 1%. These results could achieve target return by investor. The standard of deviation is varying from 6,11% to 20.35%. the Semi-variance is varying from 3,52% to 8.19%. These results showed that value of standard of deviation is double of value of semi-variance. Beta stocks is minimum of 0.16 and the maximum of 1.5. The highest of beta is caused the research choose the values of beta stocks of portfolio less than 1.5. The stock has the minimum of skewness of 0.00154 and the maximum of skewness of 3.514.

This research also calculated statistics Descriptive for Stock Return of 81 stocks and 28 stocks and Portfolio return for Equal Weighted, Market Capitalization Weighted, Markowitz and Elton Gruber Methods that it shows in Table 2 at below. The maximum monthly returns of 81 stocks are 174.29% for stocks of RAJA at September 2022. The average monthly return is 1.02%, that it is better than rate deposits in bank. The standard of deviation of return of 81 stocks is 14.34%. This stock return of 81 stocks has normality distribution that it showed by value of Jarque Berra. The maximum monthly return of 21 Stocks is 111.49% for BABP Stocks. The average monthly return is 1.13% that is also higher than average monthly return of 81 stocks. It is caused by the 21 stocks return has negative return in 81 stocks. The average monthly return is1.13% for equal weighted; 0.91% for Market Capitalization weighted; 1.002% for Markowitz method dan 1,52% for Elton Gruber Methods. The maximum monthly return is 1.02% for Equal Weighted; 12.08% for Market Capitalization weighted; 6.2% for Markowitz method and 11.52% for Elton Gruber Method. These results stated that Elton Gruber Method is better than 3 others portfolio. The Standard of deviation of portfolio return is 4.44% for Equal Weighted; 3.62% for Market Capitalization weighted; 2.65% for Markowitz method and 4.17% for Elton Gruber Method. This results support Markowitz theory that it stated high risk high return. These finding also show the Markowitz theory (1952) is in Indonesia. Besides that, the monthly of portfolio return have normal distribution.

Table 1.: Average Return, Standard of Deviation, Semi-Variance, Beta and Skewness of 28 Stocks

No.	TIK NAME	Return	STD	SEMI VAR	Beta	Skewness
1	SRTG	0.010052	0.111212	0.05084	0.165454	2.519033
2	APIC	0.020268	0.101933	0.050625	0.18099	2.62095
3	MYOR	0.01409	0.078007	0.039294	0.213126	0.927863
4	ABMM	0.007019	0.125265	0.062759	0.231345	1.876034
5	ICBP	0.00723	0.061199	0.0376	0.292542	0.046475
6	BABP	0.009679	0.161645	0.080282	0.340279	3.514439
7	SIDO	0.011426	0.076009	0.038797	0.360532	0.730121
8	TOBA	0.01397	0.141667	0.06983	0.379437	2.042842
9	AMRT	0.020771	0.099462	0.044033	0.380956	1.112297
10	BSSR	0.014714	0.124691	0.078139	0.412022	0.724682
11	TOWR	0.006309	0.092236	0.044711	0.612655	1.216391
12	DSNG	0.001463	0.101156	0.056969	0.634197	0.30344
13	KLBF	0.002974	0.061186	0.042304	0.750222	0.00154
14	EMTK	0.008286	0.140549	0.079761	0.769772	1.1168
15	TLKM	0.005122	0.0612	0.035188	0.831711	0.140499
16	ACES	0.003084	0.098347	0.046784	0.851186	0.978528
17	CPIN	0.008332	0.102015	0.059411	0.861505	0.3808
18	TBIG	0.006365	0.115264	0.051891	0.887646	1.434984
19	UNTR	0.006983	0.091974	0.050126	0.909115	0.46974
20	PNLF	0.008216	0.137547	0.062905	0.960361	1.076053
21	MPMX	0.012401	0.140541	0.080446	1.075722	0.636731
22	LSIP	0.009322	0.124675	0.057278	1.195895	1.948062
23	BFIN	0.02432	0.120797	0.072655	1.212239	0.564544
24	PTBA	0.008201	0.124576	0.066673	1.349194	0.420706
25	HRUM	0.031121	0.203535	0.077924	1.385412	2.043166
26	ERAA	0.02139	0.172144	0.081883	1.485691	0.83013
27	ADRO	0.014998	0.12439	0.073247	1.493736	0.417892
28	PNBN	0.00728	0.127955	0.067637	1.496596	0.40257

Sources: Process by researcher

Table 2: Return Stock for 81 stocks and 28 stocks and Portfolio Return for Equal Weighted, Market Capitalization Weighted, Markowitz and Elton Gruber Methods.

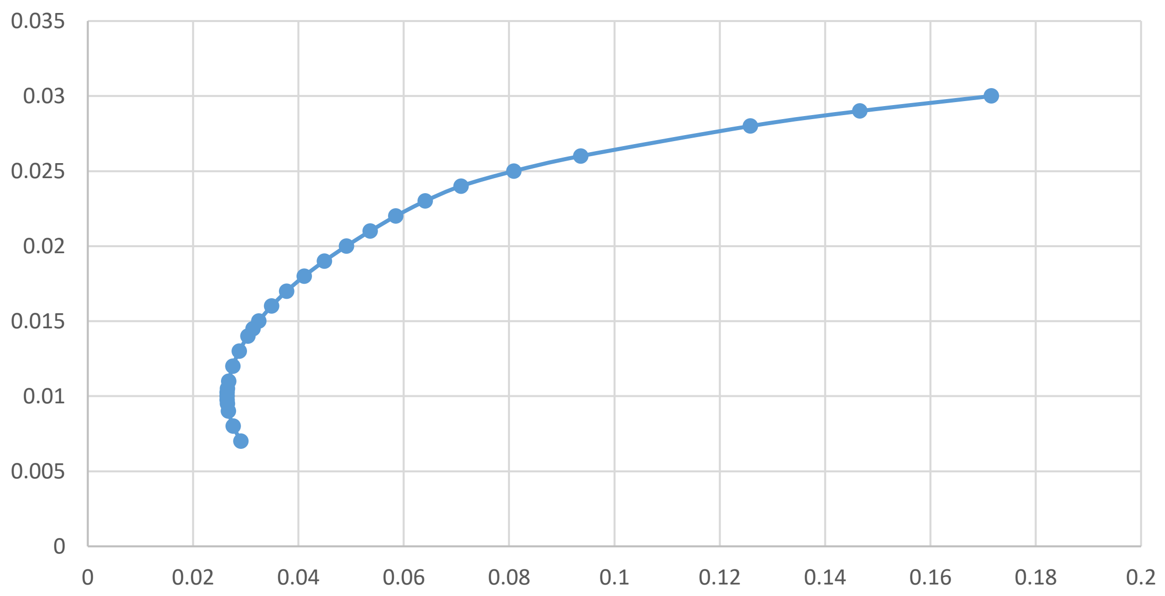
Description	Return 81 Stocks	Return 28 Stocks	Equal Weighted	MarCap Weighted	Markowitz Weighted	EG Weighted
Minimum	-0.99899	-0.46903	-0.11046	-0.08524	-0.07699	-0.09752
Maximum	1.742857	1.114943	0.12018	0.120804	0.062001	0.115224
Average	0.010217	0.011269	0.011254	0.009067	0.010023	0.015219
Standard of Deviation	0.143365	0.120822	0.044383	0.036241	0.026535	0.041706
Skewness	1.943875	1.528357	-0.1621	0.12726	-0.37799	-0.15078
Kurtosis	13.88509	8.177605	0.355495	0.663505	0.432172	0.251168
Jarque Bera	45991.71	4301.979	30.16871	23.47697	30.45226	32.49983

Suurces: Researcher Process

b. Markowitz Method.

As mentioned previously, this research will construct a portfolio using Markowitz method which used quadratic programming to get efficient frontier dan asset allocation each stock in the portfolio. The Efficient frontier is showed by Figure 4 at below.

Figure 4: Efficient Frontier Markowitz Method



The optimal portfolio is lying at efficient frontier that has return of 1% and risk of 2.64%. The asset allocation for 28 stocks showed at Table 3 at. Below

Table 3: Asset allocation of 28 stocks as member of a portfolio using Markowitz.

APIC	SRTG	MYOR	AMRT	TOBA	BSSR	SIDO	HRUM	BFIN	BABP	ERAA	ABMM	ICBP	MPMX	ADRO	EMTK	CPIN	PNLF	TOWR	UNTR	PTBA	LSIP	TBIG	PNBN	TLKM	ACES	KLBF	DSNG	Port	Ret-Port
0	0	0	0	0	0	0	0.835158	0.164842	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.17154694	0.03
0	0	0	0	0	0	0	0.688125	0.311875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14659743	0.029
0	0	0	0	0	0	0	0.541091	0.458909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1257097	0.028
0	0	0	0.2246	0	0	0	0.364235	0.411165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09356225	0.026
0.078006	0	0	0.264165	0	0	0	0.284323	0.373507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08088497	0.025
0.165079	0	0	0.2951	0	0	0	0.205162	0.334659	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07082877	0.023999
0.204315	0	0.049253	0.293933	0	0	0	0.155127	0.297372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06403437	0.023
0.207529	0	0.122946	0.26499	0	0.015106	0	0.127084	0.262344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05847542	0.022
0.202245	0	0.142608	0.239261	0	0.036028	0.039785	0.104863	0.232431	0	0	0	0.002777	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05360005	0.020999
0.193893	0	0.137276	0.219782	0	0.043595	0.057036	0.091147	0.209489	0	0	0	0.047782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04908209	0.019999
0.185505	0	0.131934	0.200341	0	0.051139	0.07418	0.077464	0.186598	0	0	0	0.09284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04488048	0.019
0.17688	0	0.126416	0.180948	0	0.058379	0.088955	0.06404	0.16378	0	0	0	0.1339	0	0	0	0.006702	0	0	0	0	0	0	0	0	0	0	0	0.04107666	0.018
0.165087	0	0.123338	0.162772	0.009165	0.061858	0.096679	0.05026	0.141324	0	0	0.003664	0.166848	0	0	0	0.019006	0	0	0	0	0	0	0	0	0	0	0	0.03773514	0.016999
0.151408	0	0.122705	0.143899	0.01828	0.062185	0.096421	0.038928	0.119593	0.005448	0	0.017736	0.191066	0	0	0	0.030303	0	0	0	0	0	0	0	0.002028	0	0	0	0.03487193	0.016
0.140431	0	0.120867	0.125452	0.022055	0.058834	0.093927	0.030459	0.100467	0.009613	0	0.024712	0.199709	0	0	0	0.03611	0	0.003495	0	0	0	0	0	0.033869	0	0	0	0.03242664	0.015
0.134838	0	0.119612	0.116046	0.023797	0.057638	0.093227	0.026539	0.090198	0.010815	0	0.027518	0.203121	0	0	0.002549	0.039003	0	0.009699	0	0	0	0	0	0.045401	0	0	0	0.03135209	0.0145
0.129917	0	0.117771	0.10661	0.025511	0.056579	0.092813	0.022671	0.079156	0.011676	0	0.030103	0.206176	0	0	0.007658	0.041804	0	0.016379	0	0	0	0.000401	0	0.054775	0	0	0	0.03037435	0.014
0.120385	0	0.114782	0.088214	0.029406	0.055144	0.090976	0.014367	0.056878	0.013451	0	0.035017	0.209989	0	0	0.016646	0.047461	0	0.027075	0	0	0	0.008235	0	0.071972	0	0	0	0.02872892	0.013001
0.109153	0	0.110635	0.073024	0.03329	0.052806	0.088601	0.006334	0.035636	0.015081	0	0.03977	0.212153	0	0	0.023834	0.049728	0	0.037685	0.006532	0	0	0.015477	0	0.082092	0.008168	0	0	0.0275285	0.012
0.097457	0	0.104833	0.061406	0.03441	0.049042	0.084653	0	0.016409	0.016702	0	0.043133	0.211563	0	0	0.027896	0.048083	0	0.045849	0.021323	0	0	0.022728	0	0.08548	0.018547	0	0.010484348	0.02674108	0.011001
0.089958	0	0.101574	0.055571	0.033631	0.045854	0.08178	0	0.006129	0.017498	0	0.045302	0.211877	0	0	0.029832	0.04674	0	0.050564	0.027331	0	0	0.025432	0	0.08828	0.025075	0	0.017571947	0.02650978	0.010501
0.086202	0	0.09985	0.052676	0.03328	0.044318	0.080185	0	0.000936	0.017923	0	0.046334	0.212374	0	0	0.030772	0.046158	0	0.052872	0.030091	0	0	0.026792	0	0.089821	0.02832	0	0.02109597	0.02643898	0.01025
0.081095	0	0.097054	0.048821	0.032219	0.041703	0.078001	0	0	0.017802	0	0.047983	0.212774	0	0	0.030367	0.044546	0	0.055151	0.03378	0	0	0.027799	0	0.092379	0.032627	0	0.025899101	0.0264045	0.01000
0.075741	0	0.093462	0.044761	0.031002	0.038846	0.075687	0	0	0.017683	0	0.049658	0.214046	0	0	0.029746	0.043046	0	0.056967	0.037118	0	0	0.02866	0	0.095775	0.036818	0	0.030983218	0.02641707	0.00975
0.071026	0	0.089936	0.041111	0.030238	0.036691	0.072831	0	0	0.017682	0	0.051087	0.212398	0	0	0.029364	0.041876	0	0.058108	0.038777	0	0	0.028467	0	0.096647	0.040282	0.007971	0.035509497	0.02647335	0.00950
0.061617	0	0.082831	0.033782	0.02875	0.032481	0.067224	0	0	0.017642	0	0.053915	0.208743	0	0	0.02867	0.039556	0	0.060592	0.041984	0	0	0.027857	0	0.097859	0.047059	0.025023	0.044416197	0.02670257	0.009001
0.04277	-1E-06	0.068852	0.019074	0.02579	0.024069	0.055667	0	0	0.017642	0	0.059595	0.201353	0	0	0.027189	0.034899	0	0.065267	0.048093	0	0	0.026698	0	0.100594	0.060634	0.059496	0.062319997	0.02761318	0.008
0.024123	0	0.054904	0.004222	0.022845	0.015737	0.044131	0	0	0.017577	0	0.065248	0.193551	0	0	0.025849	0.030334	0	0.070028	0.05415	0	0	0.025494	0	0.103187	0.0742	0.094106	0.080313485	0.02907294	0.007

This research support previous research such as Manurung (1997a, 1997b), Manurung Berlian (2004), Manullang et al (2023), Manurung et al (2023a, 2023b, 2023c, 2023d) and Markowitz (1952) and Cohen and Pogue (1967).

c. Portfolio Construction Using Safety-First Criterion

As mentioned previously, this paper wants to use Safety-First for construction portfolio. Three academicians introduced safety-first which is Roy (1952), Kataoka (1963) and Telser (1955). Roy Criterion will applied in the first explanation which is using equation (5), the paper will firstly determine value of slope equation (5) then it got portfolio return. Value of S_p is determined 0.5 for portfolio D, 1 for Portfolio C, 1.5 for portfolio B and 2 for portfolio A. Then we determine value of RL at least government bond of 10 years which is rate[1] of 6.878% pa at November 3rd, 2023, then rate of government bond yield is rate of 0.5732% per month. Risk premium is rate of 0.2% per month. So, R_L become sum of rate of Government Bond yield and risk premium (0.5732% + 0.2%) that is equal to 0.7732%. Rate of 0.2% per month is risk premium. Result portfolio return using Equation (5) appear in Table 4 and 5 at below. This portfolio return is calculated for equal weighted allocation for portfolio.

Tabel 4. Roy Model for Equal Weighted Portfolio

Description	S_p			
	0.5	1	1.5	2
R_L	0.007732	0.007732	0.007732	0.007732
Risk	0.0444	0.0444	0.0444	0.0444
R_p	0.029932	0.052132	0.074332	0.096532

[1] https://www.cnbcindonesia.com/market-data/bonds/ID10YT=RR, download November 3rd.2023.

Sources: Researcher Process

Based on Table 4, the monthly portfolio return using equation (5) is vary from 2.99% to 9.65% that Sp is also vary from 0.5 to 2. Then, this research also calculated the monthly portfolio return using Roy Criterion (equation 5) for market capitalization weighted portfolio. The result is showed in Table 5 at below.

Table 5: Roy Model for Market Cap Weighted Portfolio

Description	**S_p**			
	0.5	1	1.5	2
R_L	0.007732	0.007732	0.007732	0.007732
Risk	0.036241	0.036241	0.036241	0.036241
R_p	0.0258525	0.043973	0.0620932	0.80214

Sources: Researcher Process

Based on Table 5, the monthly portfolio return using Roy Criterion is vary from 2.85% to 8.214% that Sp is also vary from 0.5 to 2 that it is a fact from discussion to some fund manager in the stock market.

Based on table 4 and table 5, it means that the monthly return portfolio for Equal Weighted is higher than the monthly return portfolio of market capitalization weighted portfolio. The difference Return is caused by risk market capitalization below than equal weighted portfolio.

Tabel 6. Kataoka Model for Equal Weighted Portfolio

Description	Risk Tollerance		
	α=10% ($Z_{1\%}$=1.28)	α=5% ($z_{5\%}$=1.645)	α=1% ($z_{10\%}$=2.33)
R_L	0.007732	0.007732	0.007732
Risk	0.0444	0.0444	0.0444
R_P	0.064564	0.08077	0.111184

Sources: Researcher Process

Based on Table 6, the portfolio return using equation (7) is vary from 6.456% to 11.12% that risk tolerance is also vary from level of significant of 1% to 10%. If the risk tolerance become smaller, return become higher. It supported portfolio theory which is proposed by Markowitz (1952).

Tabel 7. Kataoka Model for Market Capitalization Weighted Portfolio

Description	Risk Tollerance		
	α=10% ($Z_{1\%}$=1.28)	α=5% ($z_{5\%}$=1.645)	α=1% ($z_{10\%}$=2.33)
R_L	0.007732	0.007732	0.007732
Risk	0.036241	0.036241	0.036241
R_P	0.05412	0.067348	0.0921735

Sources: Researcher Process

Based on Table 7, the monthly portfolio return using equation (7) is vary from 5.412% to 9.217% that risk tolerance vary from level of significant of 1% to 10%. These results also support Markowitz Theory (1952) and Kataoka (1963). This research do not calculate Telser Criterion (1955) in safety-first.

4.4. Cumulative Return.

Fund Manager always do compare portfolio that it managed them using cumulative return. Academician also compare portfolio using statistical analysis. Cumulative return use to see portfolio that has growing along research period. Fund Manager also set the based year for calculating cumulative return. This research used base year on 2015. The next cumulative return is calculating by Equation (12). The figure of cumulative return will show in Figure 5 at below.

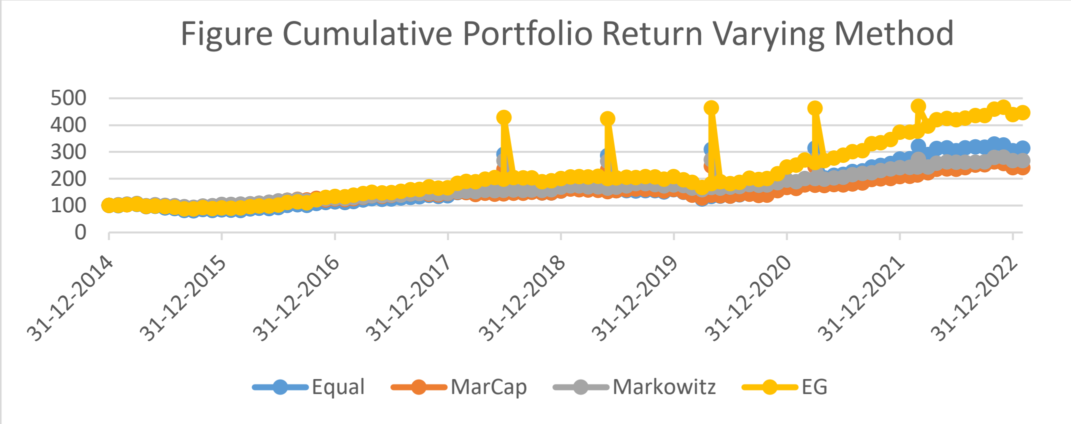


Figure 5 showed cumulative return for 4 portfolios the starting portfolio from December 2014 to June 2023. that portfolio return of Elton Gruber is the highest return compared to others portfolio. But, this research tests the four portfolio and result did not found differences of portfolio return. Based on the result, investor could use fund manager to manage their money.

d. Shock Macroeconomic Variable

This research also tests impact macroeconomics on Portfolio Return that it showed in the Table 8. Market return and interest rate are significant to affect portfolio return at level of significant at 1% for equal weighted portfolio. The 5 variables have coefficient of determination of 64.15%. Market return and interest rate has sign as expected to theory.

The market shock has impact to portfolio return at level of significant of 1% for Market Capitalization. The 4 others variables did not affect portfolio return at level of significant of 10%. This equation has coefficient of Determination of 65.66% for all variables and this coefficient has good impact for the models.

Based on the Table 8, Market Return and interest rate has impact to portfolio return of Elton Gruber Method. Markowitz portfolio return has good return compared to 3 other variables even the coefficient of determination impact of only 49.84%.

Table 8: Multifactor Model for portfolio

No.	Portfolio Description	Constant	Market	Exchange Rate	Oil Price	Interest Rate	Pandemic	R^2
1.	Equal Weighted	0.92284	0.778012 (10.73)	-0.09067 (-1.48)	-0.0907 (-0.35)	-0.08136 (-2.43)	0.010541 (1.184)	64.15%
2.	Market Capitalization	-0.09981	1.202654 (12.593)	0.013525 (0.2605)	-0.00452 (-0.496)	-0.0123 (-0.433)	0.003531 (0.467)	65.66%
3.	Elton Gruber Method	1.097983	0.65906 (7.697)	-0.1074 (-1.487)	0.65906 (0.435)	-0.08949 (-2.26)	0.008014 (0.762)	44.195%
4.	Markowitz Method	-0.16528	0.466191 (8.11)	0.021561 (0.445)	-0.00697 (-0.414)	-0.01045 (-0.394)	0.002285 (0.324)	49.84%
sources: compiled by the authors								

Exchange rate and oil price did not affect portfolio return at level significant less 10%. This research also tests impact of pandemic era for period March 2020 to end of 2022. The result is the pandemic era does not affect portfolio return. In the Pandemic era, investor become higher compared to previous before pandemic. All employee asked to work from home and the capital market become an activity to get money for supporting household expenditure.

This research support research in portfolio by Manurung (1997a, 1997b), Manurung Berlian (2004), Manullang et al (2023), Manurung et al (2023a, 2023b, 2023c, 2023d) and Markowitz (1952) and Cohen and Pogue (1967).

5. Conclusion

This research has conclusion as follows:

1. This research found the efficient frontier similar to Markowitz Method.
2. Roy Criterion found the portfolio return varying from 2.2% to 9.65% but Kataoka Criterion found the portfolio return varying from 5.4% to 11.12%.
3. This research found that Elton Gruber has the highest portfolio return compared to other portfolio. There is no difference of average return for four portfolios.
4. Market return significant affect to all portfolio return but the interest rate significant affect portfolio returns for equal weighted portfolio and Elton Gruber Method.

6. References

[1]. Alghalith, M. (2011), An Alternative Method of Stochastic Optimization: The Portfolio Model, Applied Mathematics, Vol. 2, pp. 912-913

[2]. Arditti, F.D. (1967), Risk and the Required Return on Equity, *Journal of Finance*, 22(1), pp. 19-36.

[3]. Artzner, P., Delbaen, F., Eber, J. M., & Heath, D. (1999). Coherent Measures of risk. *Mathematical Finance.* 9(3): 203-228. https://doi.org/10.1111/1467-9965.00068.

[4]. Balqis, V. P., Subiyanto, and S. Supian (2021), Optimizing Stock Portfolio with Markowitz Method as a Reference for Investment Community Decisions; International Journal of Research in Community Service, Vol. 2, No. 2, pp. 71-76.

[5]. Bey, R. P., and K. M. Howe (1984). Gini's Mean Difference and Portfolio Selection: An Empirical Evaluation, Journal of Financial and Quantitative Analysis , Vol. 19 , No. 3 , pp. 329 – 338

[6]. Black, F. and Litterman (1991), Assset Allocation: combining investor views with market equilibrium; JOURNAL OF FIXED INCOME, Sept., Vol. 1, No.2, pp. 7 – 19

[7]. Brinson, G. P., Hood, L. R. and G. L. Beebower (1986), Determinants of Portfolio Performance, Financial Analysts Journal, Vol. 42, No. 4, pp. 39-44

[8]. Brinson, G. P., Hood, L. R. and G. L. Beebower (1991), Determinants of Portfolio Performance II: An Update, Financial Analysts Journal, Vol. 47, No. 3, pp. 40-48

[9]. Cohen, R. J., & Pogue, J. A. (1967). An Empirical Evaluation of Alternative Portfolio Selection Models. Journal of Business, 40, 169-193. https://doi.org/10.1086/294954

[10]. Dai, H., Zhang, N., and W. Su (2015), A Literature Review of Stochastic Programming and Unit Commitment, Journal of Power and Energy Engineering, Vol. 3, pp. 206-214.

[11]. Elton, E. J. & Martin J. G. (1997), Modern Portfolio Theory, 1950 to Date, *Journal of Banking & Finance*. 21. 1743-1759. DOI: 10.1016/s0378-4266(97)00048-4

[12]. Elton, E. J., Martin J. Gruber, M. J., Brown, S. J. & Goetzmann, W. N. (2014). *Modern Portfolio Theory and Investment Analysis*, 9th eds., John Wiley & Sons.

[13]. Fahmy, H. (2014). *Financial Analysis, Asset Allocation, and Portfolio Construction: Theory & Practice*. HF Consulting, ON, Canada.

[14]. Galankashi, M. R., Rafiei, F. M. & Ghezelbash, M. (2020). Portfolio Selection: A Fuzzy-ANP Approach. *Financial Innovation*. 6(17). 1-34. https://doi.org/10.1186/s40854-020-00175-4.

[15]. Hanif, A., Hanun, N. R. & Febriansah, R. E. (2021). Optimization of the stock portfolio using the Markowitz model in the era of the covid-19 pandemic. *TIJAB (The International Journal of Applied Business), 5*(1), 37-50.

[16]. Hunjra, A. I., Alawi, S. M., Colombage, S., Sahito, U., and Hanif, M. (2020). Portfolio Construction by Using Different Risk Models: A Comparison Among Diverse Economic Scenarios. *Risks*, 8, 126; 1-23. doi:10.3390/risks8040126.

[17]. Kataoka, S. (1963), A Stochastic Programming Model,'' *Econometrica, Vol.* 31, pp. 181–196.

[18]. Kierkegaard, K., Lejon, C. & Persson, J. (2007). *Practical Application of Modern Portfolio Theory*. Jönköping University. (Dissertation). Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-657</div>

[19]. Kim, W. C., Fabozzi, F. J., Cheridito, P., & Fox, C. (2014). Controlling portfolio skewness and kurtosis without directly optimizing third and fourth moments. *Economics Letters,122*(2), 154-158. https://oar.princeton.edu/bitstream/88435/pr1bw01/1/PortfolioSkewnessKurtosisMoments.pdf

[20]. Kraus, A., and Litzenberger, R.H. (1976), Skewness Preference and the Valuation of Risk Assets, *Journal of Finance*, 31(4), pp. 1085-1100.

[21]. Levy, H. (1969), A Utility Function Depending on the First Three Moments, *Journal of Finance*, 24(4), pp. 715-719.

[22]. Manullang, M. D. R., Manurung, A. H., Sinaga, J., and P. Simorangkir (2023), Portfolio Construction using Elton Gruber and Macroeconomics Factor; Jurnal Akuntansi dan Manajemen (JAM), Vol. 20 No. 01, pp. 12-21.
[23]. Manurung, A. H. Machdar, N. M., Sijabat, J. and A. Manurung (2023d), The Construction of a Portfolio Using Varying Methods and the Effects of Variable on Portfolio Return,
[24]. MANURUNG, A. H., HIBATULLAH, F. F. and J. SIJABAT (2023c) Stock Selection Using Roy Criteria to Construct a Portfolio and the Effects of Variables on Portfolio Return, *Journal of Finance and Investment Analysis, Vol. 12, No. 3, 2023, 27-42*
[25]. Manurung, A. H., Sinaga, N. Y. and A. Manurung (2023b), Construction Portfolio Using Elton Gruber Model: COVID-19, *Journal of Applied Finance & Banking, Vol. 13, No. 4, pp. 111-122*
[26]. Manurung, A. H., Machdar, N. M., FoEh, J. E. H. J., and J. Sinaga (2023a), Stock Selection Using Skewness to Construct a Portfolio and the effects of Variables on Portfolio Return, Open Journal of Business and Management, Vol 11, pp. 1000-1012.
[27]. Manurung, A. H. & Berlian, C. (2004), Portofolio Investasi: Studi Empiris 1996-2003; *Manajemen Usahawan*, Vol 33(8). 44-48.
[28]. Manurung, A. H. (1997b), Portofolio Bursa Efek Jakarta: Kapitalisasi Besar, Kecil dan Campuran (Portfolio on the JSX: Big, Small and Mixed Market Capitalization); *Majalah Usahawan Indonesia*. 12, Th. XXVI, 1-7.
[29]. Manurung, A. H. (1997a), Portofolio Analysis on the JSX 1992 – 1994; *Jurnal Manajemen Prasetya Mulya*. IV (7). 43-55.
[30]. Markowitz, H. M. (1952). Portfolio Selection. *Journal of Finance*, 7(1), 77-91. http://links.jstor.org/sici?sici=00221082%28195203%297%3A1%3C77%3APS%3E2.0.CO%3B2-1.
[31]. Markowitz, H. M. (1959). *Portfolio Selection: Efficient Diversification of Investments*. John Wiley & Sons, New York.
[32]. Markowitz H. M. (1991). Foundations of Portfolio Theory. *The Journal of Finance*. 46(2), 469-477.
[33]. McNamara, J. R. (1998), Portfolio Selection Using Stochastic Dominance Criteria, Decision Sciences, Vol. 29, No. 4; pp. 785 - 801
[34]. Roy, A. D. (1952), Safety First and the Holding of Assets, Econometrica Vol. 20, pp. 431–449.
[35]. Sartono, R. A., & Setiawan, A. A. (2009). VAR Portfolio Optimal: Perbandingan Antara Metode Markowitz dan Mean Absolute Deviation. *Jurnal Siasat Bisnis*, *11*(1).37-50. https://journal.uii.ac.id/JSB/article/view/410.
[36]. Sortino, F.A., van der Meer, R. (1991). Downside risk. *J. Portfolio Manage*. 17, 27–31. http://dx.doi.org/10.3905/jpm.1991.409343.