Available online at https://journal.rescollacomm.com/index.php/ijqrm/index

International Journal of Quantitative Research and Modeling

e-ISSN 2721-477X
p-ISSN 2722-5046

Vol. 5, No. 3, pp. 228-240, 2024

Mean-Variance Portfolio Optimisation Model for Comparison of Stock Portfolio Composition on the American Stock Exchange before and after the Boycott of Companies Supporting Israel (Case Study: AAPL, SBUX, AMZN, GOOGL, MCD)

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Abstract

The background of this research is related to the boycott of companies that support Israel, which affects the composition of stock portfolios on the American Stock Exchange. The focus of this research is on key companies such as Apple (AAPL), Starbucks (SBUX), Amazon (AMZN), Google (GOOGL), and McDonald's (MCD). The problem to be solved is the identification of changes in optimal asset allocation in investment portfolios before and after the boycott. Using a mean-variance portfolio optimization model, historical stock price data is analyzed to model the transformation of portfolio composition as well as the associated risk level. The purpose of this study is to provide an in-depth understanding of the impact of the boycott on the investment portfolio structure of related companies on the American Stock Exchange. The result of this research is that there is a change in the allocation of assets held against stocks before the boycott and after the boycott. This research is expected to provide useful insights for investors, financial analysts, and other stakeholders in managing their investment portfolios, especially in anticipating and adjusting investment strategies amid dynamic changes in the stock market.
Keywords: Boycott, Stock market, Portfolios, Mean-Variance, Investment.

1. Introduction

Boycotts or refusal to buy goods from a country have become a common way of protesting against its policies. It aims to influence the country's policies by dampening its economy through reduced exports and investment. For example, the boycott of Israeli products spread globally as a form of support for Palestine and reject Israeli policies that are considered detrimental to the Palestinian people. (Santosa et al., 2023).

Political and social issues related to conflicts in the Middle East, especially those involving Israel, have triggered reactions in society that encourage boycotts of products or companies that are perceived to support controversial parties in the conflict. Such boycotts often attract widespread attention and have the potential to affect a company's performance in the stock market.

This research focuses on applying the mean-variance portfolio optimization model to analyze and compare the stock portfolio composition of some leading companies listed on the American Stock Exchange before and after the boycott of companies supporting Israel. The case study involves companies such as Apple (APPL), McDonald's (MCD), Starbucks (SBUX), Amazon (AMZN), and Google (GOOGL). The purpose of this study is to identify and understand the changes in the stock portfolio composition structure of these companies before and after the boycott. Through the application of the mean-variance portfolio optimization model, this study aims to evaluate the difference in optimal asset allocation in the periods before and after the boycott.

The method used involves a mathematical mean-variance portfolio optimization model to compare the optimal allocation of assets in an investment portfolio before and after the boycott. Using historical stock price data and risk-return parameters, the research will model changes in portfolio composition and associated risks.

The results of this study are expected to provide a deeper understanding of how the boycott of Israel-supporting companies affects the composition of their stock portfolios. This information can be useful for investors and financial analysts in adapting their investment strategies and anticipating the impact of political issues on their portfolios in the future. This research is expected to provide a more detailed view of investment portfolio management in the context of dynamic changes in the political environment, specifically related to the boycott of companies supporting Israel on the American Stock Exchange.

2. Literature Review

The seminal article by Markowitz, H. M. (1952) introduced the mean-variance portfolio theory, laying the foundation for the mathematical approach used in optimizing stock portfolios. Subsequently, Derwall et al. (2005) examined the impact of socially responsible investing on portfolio performance, providing insight into the influence of non-financial factors on portfolios. Meanwhile, research by Oikonomou et al. (2012) explored the relationship between CSR practices and portfolio performance, which may be relevant in the context of boycotts against companies that support Israel. In addition, studies by Morck et al. (2010) and Cutler et al. (2006) respectively examine the impact of political events on financial markets and investor behaviors, which may provide a perspective on how politically sensitive events affect stock markets. Research by Kutan et al. (2006) presents a review of the literature on the effect of political events on stock market behaviors, contributing relevant information to the understanding of the relationship between political events and stock market behaviors.

While a number of studies have examined the impact of political events on financial markets and investor behaviors, no specific research has explicitly explored the impact of boycotts on the stock portfolio composition of companies associated with support for Israel on the American Stock Exchange. Therefore, this study aims to fill this literature gap by analyzing the composition of stock portfolios before and after the boycott, which may provide new insights into how such non-financial factors may affect the structure of investment portfolios.

3. Materials and Methods

3.1. Materials

The stock data used in portfolio formation is as many as five stock data included in the list of shares of companies boycotted for supporting Israel on the American Stock Exchange. The data includes closing price data for Apple (AAPL), McDonald's (MCD), Starbucks (SBUX), Amazon (AMZN), and Google (GOOGL). Historical daily stock data was accessed through the website www.finance.yahoo.com for one year before the boycott (October 1, 2022-September 30. 2023) and after the boycott (October 1, 2023-December 15, 2023).

3.2. Methods

Suppose given a portfolio p with weight vector **w**. The efficient portfolio selection is done by finding the maximum value of $2\tau\mu_p - \sigma_p^2$, provided that $\sum_{i=1}^{N} w_i = 1$ and $\tau \geq 0$. The parameter τ is called risk tolerance. In Mean-Variance investment portfolio optimisation without risk-free assets, suppose there are N risk-free assets with returns $r_1, \ldots, r_N$. Assuming that the first and second moments of $r_1, \ldots, r_N$ exist, the transpose vector of expected return values is expressed by:

$$\mu^T = (\mu_1, \ldots, \mu_N), \text{ dengan } \mu_i = E[r_i], i = 1, \ldots, N$$

and the covariance matrix is expressed by

$$\Sigma = (\sigma_{ij}) \text{ dengan } \sigma_{ij} = Cov(r_i, r_j), i, j = 1, \ldots, N.$$

If the portfolio return r_p with transpose weight vector $\mathrm{w}^T = (w_i, \ldots, w_N)$ and the condition $\sum_{i=1}^{N} w_i = 1$, then the expected portfolio return using vector notation, can be expressed as:

$$\mu_p = E[r_p] = \mu^T \mathrm{w} = \mathrm{w}^T \mu$$

and the portfolio variance can be expressed as:

$$\sigma_p^2 = Var(⟦(r⟧_p) = \mathrm{w}^T \Sigma \mathrm{w}$$

In Mean-Variance optimization, an efficient portfolio is defined as follows.

Definition: A portfolio p^* is called (Mean-Variance) efficient if there exists a portfolio p with $\mu_p \geq \mu_{p^*}$ and $\sigma_p^2 < \sigma_{p^*}^2$.

To get an efficient portfolio, it means to solve the portfolio optimization problem as follows.

$$\text{maximum } \{2\tau\mu^T \mathrm{w} - \mathrm{w}^T \Sigma \mathrm{w}\}$$
$$\text{condition } \mathrm{e}^T \mathrm{w} = 1$$

with$\mathrm{e}^T = (1, \ldots, N)$, $\mu^T \mathrm{w} = \mathrm{w}^T \mu$, and $\mathrm{w}^T \mathrm{e} = \mathrm{e}^T \mathrm{w}$. The Lagrange function of the optimisation problem, where λ is the multiplier, is expressed as follows.

$$L(\mathrm{w}, \lambda) = (2\tau\mu^T \mathrm{w} - \mathrm{w}^T \Sigma \mathrm{w}) + \lambda(\mathrm{w}^T \mathrm{e} - 1)$$

Using the necessary conditions of Kuhn-Tucker theorem $\frac{\partial L}{\partial \mathrm{w}} = 0$ and $\frac{\partial L}{\partial \lambda} = 0$. we get:

$$\frac{\partial L}{\partial \mathrm{w}} = 2\tau\mu - 2\Sigma\mathrm{w} + \lambda\mathrm{e} = 0$$
$$\frac{\partial L}{\partial \lambda} = \mathrm{w}^T\mathrm{e} - 1 = 0$$

The equation $\frac{\partial L}{\partial \mathrm{w}}$ is multiplied by Σ^{-1} and expressed in w, then the result is multiplied by e^T, so the following solution is obtained.

$$\mathrm{w} = \frac{1}{\mathrm{e}^T\Sigma^{-1}\mathrm{e}}\Sigma^{-1}\mathrm{e} + \tau\left\{\Sigma^{-1}\mu - \frac{\mathrm{e}^T\Sigma^{-1}\mu}{\mathrm{e}^T\Sigma^{-1}\mathrm{e}}\Sigma^{-1}\mathrm{e}\right\} \; ; \tau \geq 0$$

When $\tau = 0$ produces a minimum variance portfolio with weights:

$$\mathrm{w}^{Min} = \frac{1}{\mathrm{e}^T\Sigma^{-1}\mathrm{e}}\Sigma^{-1}\mathrm{e}$$

4. Results and Discussion

4.1. Analysis of Stock Data Before Boycott (Period October 1, 2022 - September 30, 2023)

4.1.1. Stock Return

The return graphs of the five stocks, namely AAPL, SBUX, AMZN, GOOGL, and MCD are as follows.

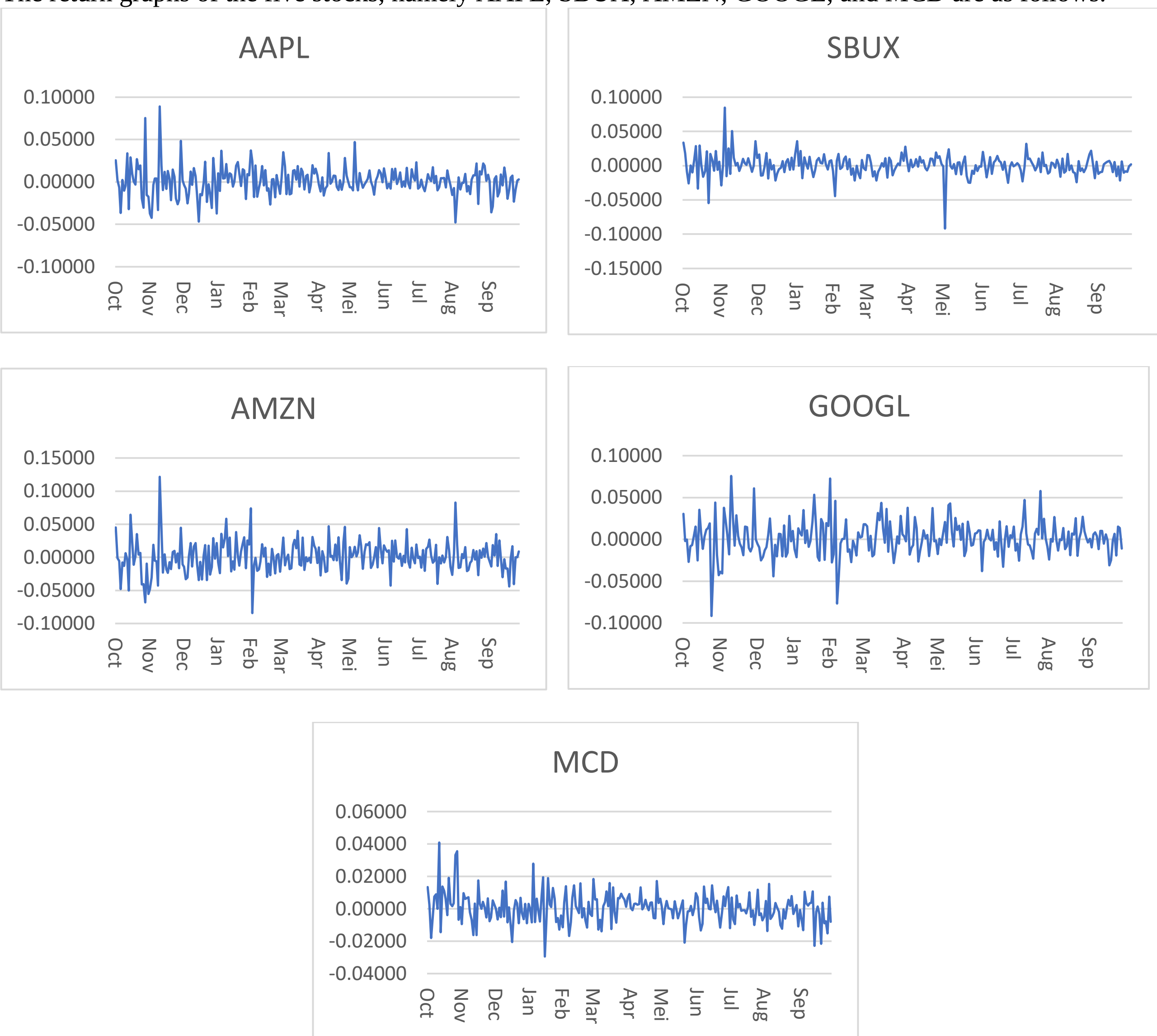
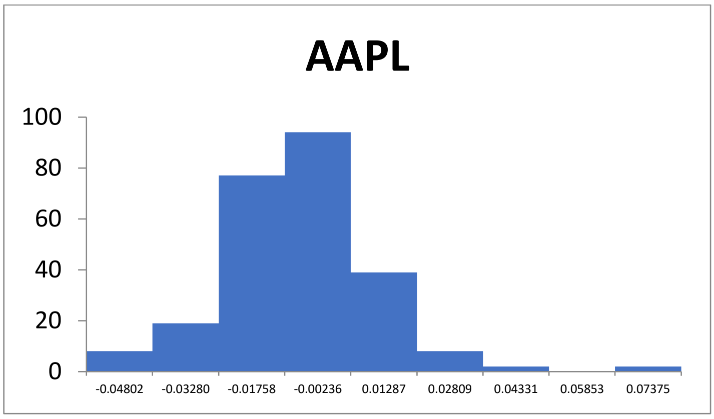


Figure 1. Graph of stock returns before the boycott

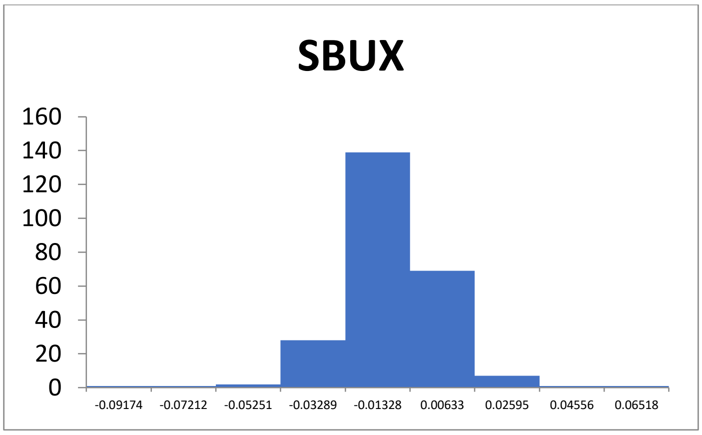
In the stock return chart above, it can be seen that stocks with the code AAPL, SBUX, AMZN, GOOGL and MCD experience constant increases and decreases so that stock prices tend to stabilize.

4.1.2. Descriptive Statistics

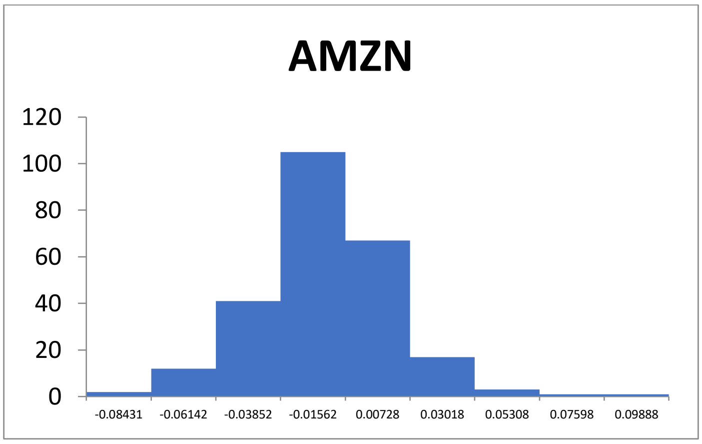
In this section, the identification of the distribution model is carried out by making histograms of stock returns before the boycott using excel software. The histograms of the five stocks are as follows.



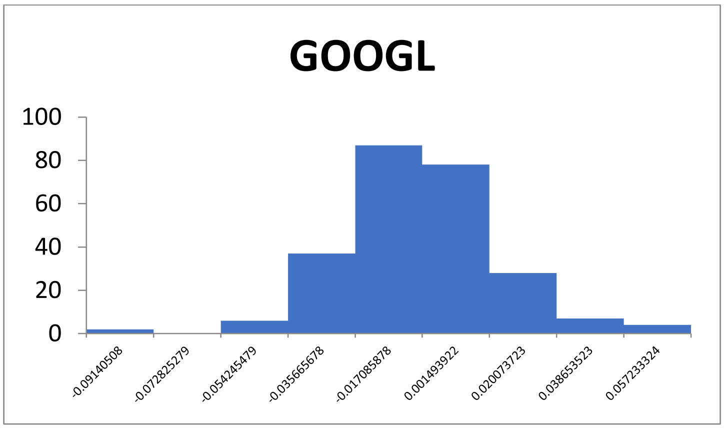
AAPL	
Mean	0.000887
Standard Error	0.001097
Median	0.001095
Standard Deviation	0.017308
Sample Variance	0.0003
Kurtosis	3.787691
Skewness	0.655046
Range	0.136995
Minimum	-0.04802
Maximum	0.088975



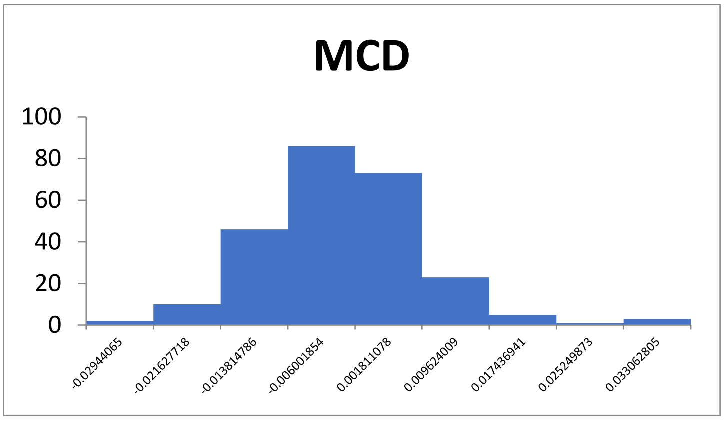
SBUX	
Mean	0.000377
Standard Error	0.000982
Median	0.000457
Standard Deviation	0.015503
Sample Variance	0.00024
Kurtosis	8.419693
Skewness	-0.23757
Range	0.176525
Minimum	-0.09174
Maximum	0.08479



AMZN	
Mean	0.000667
Standard Error	0.001549
Median	0
Standard Deviation	0.024446
Sample Variance	0.000598
Kurtosis	2.89977
Skewness	0.493922
Range	0.206093
Minimum	-0.08431
Maximum	0.121778



GOOGL	
Mean	0.001363
Standard Error	0.001353
Median	0.000737
Standard Deviation	0.021349
Sample Variance	0.000456
Kurtosis	2.394851
Skewness	0.028865
Range	0.167218
Minimum	-0.09141
Maximum	0.075813



MCD	
Mean	0.000497
Standard Error	0.000598
Median	0.000663
Standard Deviation	0.009442
Sample Variance	0.000089
Kurtosis	2.177417
Skewness	0.492022
Range	0.070316
Minimum	-0.02944
Maximum	0.040876

Figure 2. Histogram of Stock Return

Based on the stock return histogram in Figure 2. it can be seen that in general the histogram is shaped like a bell. So it can be assumed that the distribution of returns follows a normal distribution. Then, the results of estimating the distribution, expectation and variance of the return of the five stocks, along with the ratio between the expectation and variance of the return, can be seen in Table 1.

Table 1. Estimation of Distribution, Expectation and Variance of Stock Returns

Stock Name	**Distribution Estimator**	**Expectation/ Average μ**	**Variance σ^2**	**Ratio $\frac{\mu}{\sigma^2}$**
AAPL	Normal	0.000886897	0.000299578	2.96048887
SBUX	Normal	0.000376761	0.000240338	1.56762772
AMZN	Normal	0.000667354	0.000597623	1.11668075
GOOGL	Normal	0.001362613	0.000455776	2.98965416
MCD	Normal	0.000497343	0.000089159	5.57815814

From these five stocks, the estimated covariance value between stocks is then determined. With the help of excel software, the results are shown in Table 2.

Tabel 2. Estimation of Stock Covariance

	AAPL	SBUX	AMZN	GOOGL	MCD
AAPL	0.000300	0.000113	0.000216	0.000240	0.000057
SBUX	0.000113	0.000240	0.000143	0.000102	0.000062
AMZN	0.000216	0.000143	0.000598	0.000339	0.000025
GOOGL	0.000240	0.000102	0.000339	0.000456	0.000034
MCD	0.000057	0.000062	0.000025	0.000034	0.000089

4.2. Analysis of Stock Data After Boycott (Period October 1, 2023 - December 15, 2023)

4.2.1. Stock Return

The return graphs of the five stocks, namely AAPL, SBUX, AMZN, GOOGL, and MCD are as follows.

Figure 2. Stocks return chart.

In the stock return chart in Figure 2, it can be seen that stocks with the code AAPL, AMZN, and MCD experience increases and decreases, while the SBUX stock code tends not to rise and fall (constant) but there is a high increase at one time, the GOOGL stock code also does not experience an increase and decrease, but there is a sharp decline at one time.

4.2.2. Descriptive Statistics

In this section, the identification of the distribution model is carried out by making histograms of stock returns before the boycott using excel software. The histograms of the five stocks are as follows.

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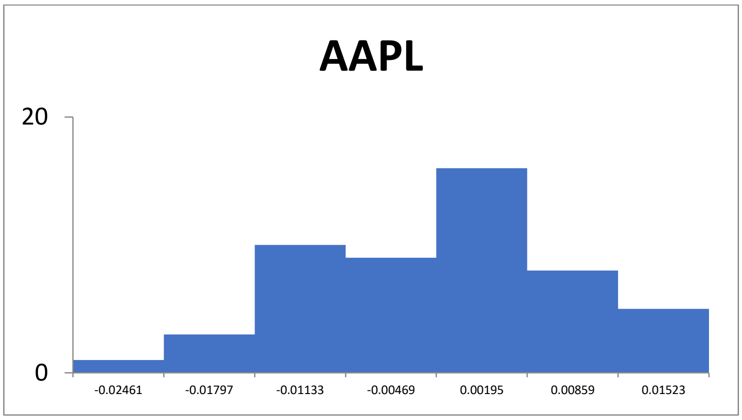
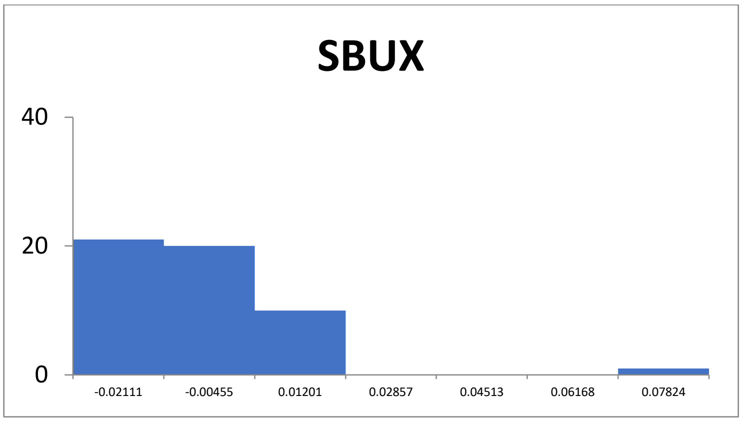
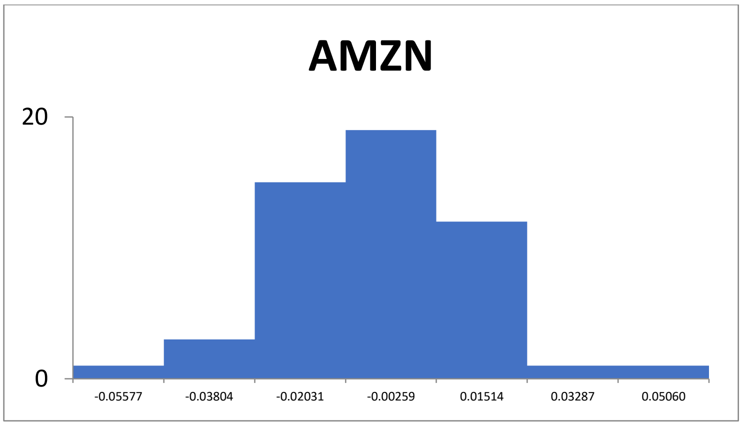


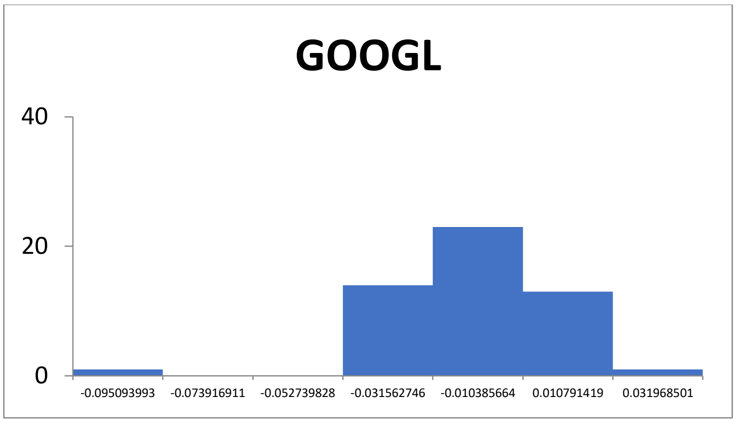
AAPL	
Mean	0.0025772
Standard Error	0.0014131
Median	0.0030519
Standard Deviation	0.0101902
Sample Variance	0.0001038
Kurtosis	-0.19512
Skewness	-0.171977
Range	0.0464793
Minimum	-0.024606
Maximum	0.0218737



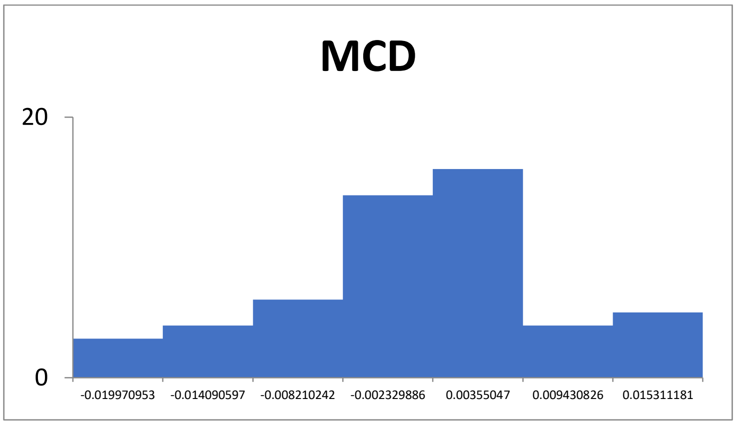
SBUX	
Mean	0.0015133
Standard Error	0.0024343
Median	-0.002121
Standard Deviation	0.0175538
Sample Variance	0.0003081
Kurtosis	14.916259
Skewness	3.040829
Range	0.1159068
Minimum	-0.021107
Maximum	0.0948003



AMZN	
Mean	0.0026879
Standard Error	0.0027087
Median	0.0037346
Standard Deviation	0.0195324
Sample Variance	0.0003815
Kurtosis	2.558639
Skewness	0.1202957
Range	0.1240998
Minimum	-0.055772
Maximum	0.0683282



GOOGL	
Mean	-0.000131
Standard Error	0.0027015
Median	-0.000261
Standard Deviation	0.0194811
Sample Variance	0.0003795
Kurtosis	10.841283
Skewness	-1.922743
Range	0.1482396
Minimum	-0.095094
Maximum	0.0531456



MCD	
Mean	0.0023139
Standard Error	0.0012972
Median	0.0031256
Standard Deviation	0.0093545
Sample Variance	0.0000875
Kurtosis	0.2072602
Skewness	-0.3389683
Range	0.0411625
Minimum	-0.019971
Maximum	0.0211915

Figure 4. Histogram of Stocks Return

Based on the stock return histogram in Figure 4. it can be seen that in general the histogram is shaped like a bell. So it can be assumed that the distribution of returns follows a normal distribution. In Figure 4. it can also be seen that GOOGL shares have negative return expectations so that the shares are not included in further calculations. Then, the results of estimating the distribution, expectation, and variance of the return of the four stocks, along with the ratio between the expectation and variance of the return, can be seen in Table 3.

Table 3. Estimation of Distribution, Expectation and Variance of Stock Returns

Stock Name	Distribution Estimator	Expectation/ Average μ	Variance σ^2	Ratio $\frac{\mu}{\sigma^2}$
AAPL	Normal	0.002577212	0.00010384	24.81894846
SBUX	Normal	0.00151327	0.000308136	4.91105046
AMZN	Normal	0.002687932	0.000381516	7.045398346
MCD	Normal	0.002313936	0.00008751	26.44273318

From these four stocks, the estimated covariance value between stocks is then determined. With the help of excel software, the results are shown in Table 4.

Table 4. Estimation of Stock Covariance

	AAPL	SBUX	AMZN	MCD
AAPL	0.000104	0.000053	0.000129	0.000012
SBUX	0.000053	0.000308	0.000053	0.000057
AMZN	0.000129	0.000053	0.000382	0.000021
MCD	0.000012	0.000057	0.000021	0.000088

4.3. Formation of Mean-Variance Investment Portfolio Optimization before Boycott

From the mean value estimator in Table 1. $\mu_i, (i = 1, \ldots, 5)$ a mean transpose vector $\mu^T = (0.000886897 \quad 0.000376761 \quad 0.000667354 \quad 0.001362613 \quad 0.000497343)$ is formed. Then a unit transpose vector $e^T = (1 \quad 1 \quad 1 \quad 1 \quad 1)$ is formed. Furthermore, estimating the value of the variance $\sigma_i^2, (i = 1, \ldots, 5)$

as well as the results of the calculation of the covariance estimator between stock returns in Table 2, a covariance matrix Σ is formed as follows.

$$\Sigma = \begin{bmatrix} 0.000300 & 0.000113 & 0.000216 & 0.000240 & 0.000057 \\ 0.000113 & 0.000240 & 0.000143 & 0.000102 & 0.000062 \\ 0.000216 & 0.000143 & 0.000598 & 0.000339 & 0.000025 \\ 0.000240 & 0.000102 & 0.000339 & 0.000456 & 0.000034 \\ 0.000057 & 0.000062 & 0.000025 & 0.000034 & 0.000089 \end{bmatrix}$$

With excel software, we can determine the inverse matrix $\boldsymbol{\Sigma^{-1}}$, which is as follows

$$\Sigma^{-1} = \begin{bmatrix} 6765.68 & -1080.44 & -546.27 & -2731.4 & -2340.76 \\ -1080.44 & 6047.55 & -1057.13 & 248.44 & -3319.82 \\ -546.27 & -1057.13 & 3155.82 & -1889.72 & 923.17 \\ -2731.4 & 248.44 & -1889.72 & 4963.96 & 180.56 \\ -2340.76 & -3319.82 & 923.17 & 180.56 & 14684.15 \end{bmatrix}$$

Furthermore, the inverse matrix $\boldsymbol{\Sigma^{-1}}$ is used for the calculation process of efficient portfolio weight composition based on the Mean-Variance portfolio optimization model.

4.4. Formation of Mean-Variance Investment Portfolio Optimization after Boycott

From the mean value estimator in Table 3 $\boldsymbol{\mu}_i, (i = 1, \dots, 4)$ a mean transpose vector $\boldsymbol{\mu}^T = (0.002577212 \quad 0.00151327 \quad 0.002687932 \quad 0.002313936)$ is formed. Then a unit transpose vector $e^T = (1 \quad 1 \quad 1 \quad 1)$ is formed. Furthermore, estimating the value of the variance $\sigma_i^2, (i = 1, \dots, 4)$ as well as the results of the calculation of the covariance estimator between stock returns in Table 4 a covariance matrix $\boldsymbol{\Sigma}$ is formed as follows.

$$\Sigma = \begin{bmatrix} 0.000104 & 0.000053 & 0.000129 & 0.000012 \\ 0.000053 & 0.000308 & 0.000053 & 0.000057 \\ 0.000129 & 0.000053 & 0.000382 & 0.000021 \\ 0.000012 & 0.000057 & 0.000021 & 0.000088 \end{bmatrix}$$

With excel software, we can determine the inverse matrix $\boldsymbol{\Sigma^{-1}}$, which is as follows

$$\Sigma^{-1} = \begin{bmatrix} 17901.31 & -2141.62 & -5789.81 & 299.40 \\ -2141.62 & 4009.30 & 301.86 & -2403.27 \\ -5789.81 & 301.86 & 4568.81 & -481.34 \\ 299.40 & -2403.27 & -481.34 & 13075.94 \end{bmatrix}$$

Furthermore, the inverse matrix $\boldsymbol{\Sigma^{-1}}$ is used for the calculation process of efficient portfolio weight composition based on the Mean-Variance portfolio optimization model.

4.5. Mean-Variance Investment Portfolio Optimization Process before Boycott

In the Mean-Variance portfolio optimization problem without risk-free assets, using the vectors μ^T and e^T and matrix Σ^{-1}, the weight vector w is calculated. Risk tolerance τ with the condition $\tau \geq 0$ in investment portfolio optimization is simulated by taking several values that satisfy the condition $e^T w = 1$. Taking the risk tolerance value is stopped when a value if for a risk tolerance value produces a weight $w_i, (i = 1, \dots, 5)$ which is not a positive real number and meets $e^T w = 1$. To simplify the calculation, excel software is used. The results of taking risk tolerance values and calculating efficient portfolio weights are shown in Table 5.

Table 5. Mean-Variance Investment Portfolio Optimization Process before boycotts

τ	AAPL	SBUX	AMZN	GOOGL	MCD	$e^T w$	μ_p	σ_p^2	$\frac{\mu_p}{\sigma_p^2}$
0	0.00539	0.06768	0.04728	0.06229	0.81735	1	0.00055	0.000081	6.85462
0.002	0.00600	0.06536	0.04485	0.06797	0.81582	1	0.00056	0.000081	6.91588
0.004	0.00661	0.06303	0.04242	0.07364	0.81430	1	0.00056	0.000081	6.97540
0.006	0.00723	0.06071	0.03998	0.07931	0.81277	1	0.00057	0.000081	7.03313
0.008	0.00784	0.05839	0.03755	0.08499	0.81124	1	0.00057	0.000081	7.08902
0.010	0.00845	0.05606	0.03512	0.09066	0.80971	1	0.00058	0.000081	7.14305

0.012	0.00906	0.05374	0.03268	0.09633	0.80818	1	0.00058	0.000081	7.19518
0.014	0.00967	0.05142	0.03025	0.10201	0.80665	1	0.00059	0.000081	7.24538
0.016	0.01029	0.04909	0.02782	0.10768	0.80512	1	0.00059	0.000081	7.29362
0.018	0.01090	0.04677	0.02538	0.11335	0.80360	1	0.00060	0.000082	7.33987
0.020	0.01151	0.04445	0.02295	0.11903	0.80207	1	0.00060	0.000082	7.38412
0.022	0.01212	0.04212	0.02052	0.12470	0.80054	1	0.00061	0.000082	7.42634
0.024	0.01273	0.03980	0.01808	0.13038	0.79901	1	0.00061	0.000082	7.46652
0.026	0.01334	0.03748	0.01565	0.13605	0.79748	1	0.00062	0.000082	7.50465
0.028	0.01396	0.03515	0.01322	0.14172	0.79595	1	0.00062	0.000083	7.54072
0.030	0.01457	0.03283	0.01078	0.14740	0.79442	1	0.00063	0.000083	7.57473
0.032	0.01518	0.03051	0.00835	0.15307	0.79290	1	0.00063	0.000083	7.60666
0.034	0.01579	0.02818	0.00592	0.15874	0.79137	1	0.00064	0.000084	7.63652
0.036	0.01640	0.02586	0.00348	0.16442	0.78984	1	0.00064	0.000084	7.66432
0.038	**0.01701**	**0.02354**	**0.00105**	**0.17009**	**0.78831**	**1**	**0.00065**	**0.000084**	**7.69006**
0.040	0.01763	0.02121	-0.00138	0.17576	0.78678	1	0.00065	0.000085	7.71374

A set of efficient portfolios lies within the efficient frontier, which is the efficient surface where portfolios are located whose returns are commensurate with their risks.

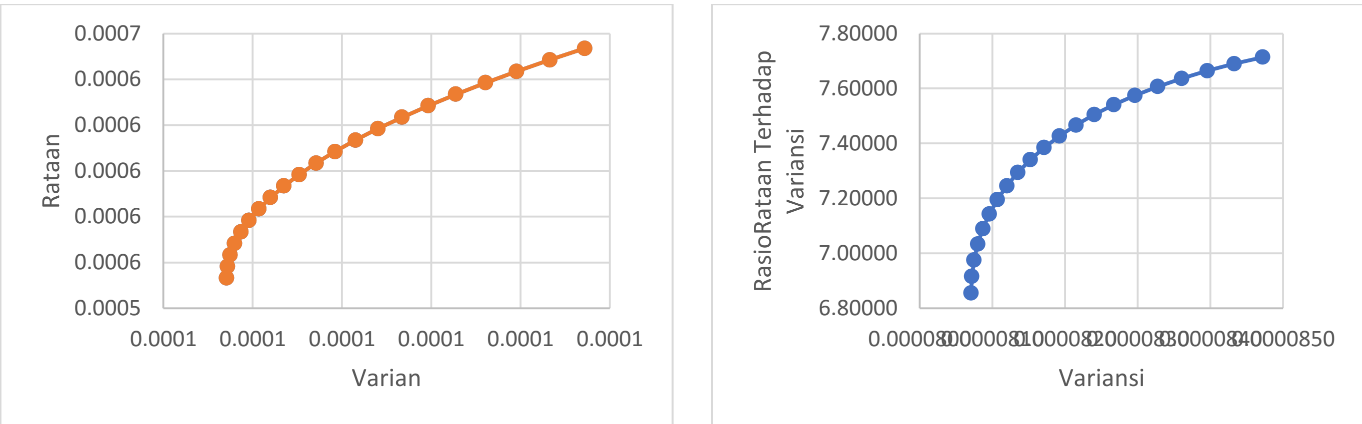


Figure 5. *efficient frontier and Mean-Variance portfolio ratio before the boycott*

4.6. Mean-Variance Investment Portfolio Optimization Process after Boycott

In the Mean-Variance portfolio optimization problem without risk-free assets, using the vectors μ^T and e^T and matrix Σ^{-1}, the weight vector w is calculated. Risk tolerance τ with the condition $\tau \geq 0$ in investment portfolio optimization is simulated by taking several values that satisfy the condition $e^T w = 1$. Taking the risk tolerance value is stopped when a value if for a risk tolerance value produces a weight $w_i, (i = 1, \dots, 4)$ which is not a positive real number and meets $e^T w = 1$. To simplify the calculation, excel software is used. The results of taking risk tolerance values and calculating efficient portfolio weights are shown in Table 6.

Table 6. Mean-Variance Investment Portfolio Optimization Process after boycotts

τ	AAPL	SBUX	AMZN	MCD	$e^T w$	μ_p	σ_p^2	$\frac{\mu_p}{\sigma_p^2}$
0	0.53693	-0.01222	-0.07323	0.54851	1	0.00244	0.000052	46.62287

Because when $\tau = 0$ results in $w_2, w_3 < 0$ so that SBUX and AMZN stocks are not included in the portfolio optimization model with mean-variance, so that only two stocks remain, namely AAPL, and MCD so that the results are obtained as follows in Table 7.

Table 7. Mean-Variance Investment Portfolio Optimization Process after elimination

τ	AAPL	MCD	e^Tw	μ_p	σ_p^2	$\frac{\mu_p}{\sigma_p^2}$
0	0.451127	0.548873	1	0.002433	0.000054	45.470935
0.01	0.466883	0.533117	1	0.002437	0.000054	45.513181
0.02	0.482639	0.517361	1	0.002441	0.000054	45.484937
0.03	0.498395	0.501605	1	0.002445	0.000054	45.386824
0.04	0.514150	0.485850	1	0.002449	0.000054	45.220095
0.05	0.529906	0.470094	1	0.002453	0.000055	44.986606
0.06	0.545662	0.454338	1	0.002458	0.000055	44.688773
0.07	0.561418	0.438582	1	0.002462	0.000056	44.329518
0.08	0.577173	0.422827	1	0.002466	0.000056	43.912202
0.09	0.592929	0.407071	1	0.002470	0.000057	43.440558
0.1	0.608685	0.391315	1	0.002474	0.000058	42.918616
0.11	0.624440	0.375560	1	0.002478	0.000059	42.350629
0.12	0.640196	0.359804	1	0.002482	0.000059	41.740995
0.13	0.655952	0.344048	1	0.002487	0.000061	41.094193
0.14	0.671708	0.328292	1	0.002491	0.000062	40.414711
0.15	0.687463	0.312537	1	0.002495	0.000063	39.706987
0.16	0.703219	0.296781	1	0.002499	0.000064	38.975359
0.17	0.718975	0.281025	1	0.002503	0.000065	38.224015
0.18	0.734731	0.265269	1	0.002507	0.000067	37.456959
0.19	0.750486	0.249514	1	0.002512	0.000068	36.677977
0.2	0.766242	0.233758	1	0.002516	0.000070	35.890619
0.21	0.781998	0.218002	1	0.002520	0.000072	35.098180
0.22	0.797754	0.202246	1	0.002524	0.000074	34.303695
0.23	0.813509	0.186491	1	0.002528	0.000075	33.509928
0.24	0.829265	0.170735	1	0.002532	0.000077	32.719380
0.25	0.845021	0.154979	1	0.002536	0.000079	31.934293
0.26	0.860776	0.139224	1	0.002541	0.000082	31.156653
0.27	0.876532	0.123468	1	0.002545	0.000084	30.388207
0.28	0.892288	0.107712	1	0.002549	0.000086	29.630474
0.29	0.908044	0.091956	1	0.002553	0.000088	28.884758
0.3	0.923799	0.076201	1	0.002557	0.000091	28.152164
0.31	0.939555	0.060445	1	0.002561	0.000093	27.433612
0.32	0.955311	0.044689	1	0.002565	0.000096	26.729857
0.33	0.971067	0.028933	1	0.002570	0.000099	26.041496
0.34	0.986822	0.013178	1	0.002574	0.000101	25.368991
0.35	1.002578	-0.002578	1	0.002578	0.000104	24.712680

A set of efficient portfolios lies within the efficient frontier, which is the efficient surface where portfolios are located whose returns are commensurate with their risks.

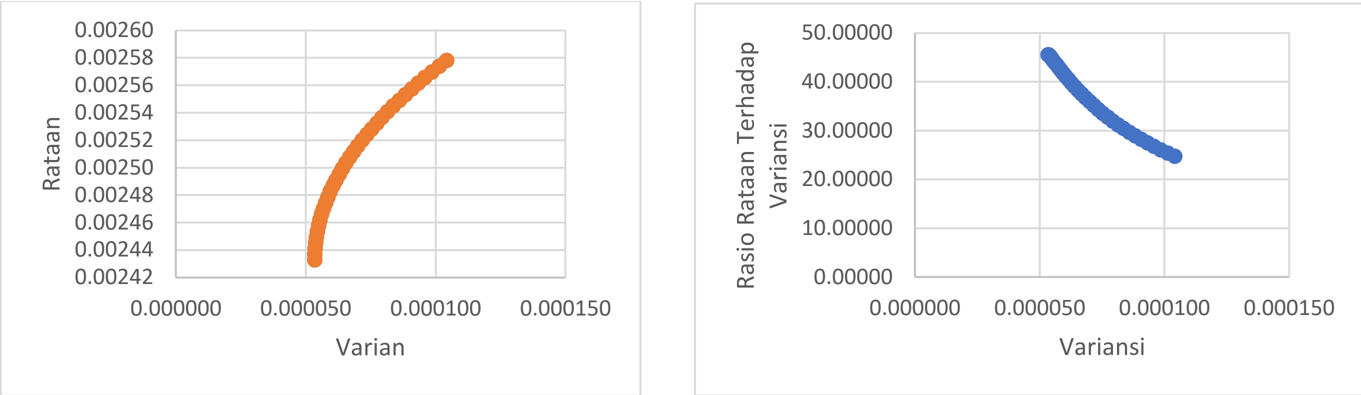


Figure 6. *efficient frontier and Mean-Variance portfolio ratio after the boycott*

4.7. Discussion

Risk tolerance for the Mean-Variance model on stocks before boycotting ranges from $0 \leq \tau \leq 0.04$. Obtained an optimal portfolio composed of five stocks, namely a portfolio with a weight composition $w^T = (0.01701 \ \ 0.02354 \ \ 0.00105 \ \ 0.17009 \ \ 0.78831)$ sequentially for AAPL, SBUX, AMZN, GOOGL, and MCD stocks. This optimal portfolio return composition at $\tau = 0.038$ produces an average return value of 0.00065 and a portfolio variance of 0.000084.

As for the Mean-Variance model on stocks after boycotting ranges from $0 \leq \tau \leq 0.35$. Obtained an optimal portfolio composed of two stocks, namely a portfolio with a weight composition $w^T = (0.46688 \ \ 0.53312)$ sequentially for AAPL and MCD stocks. The composition of this optimal portfolio return at $\tau = 0.01$ by producing an average return value of 0.00244 and a portfolio variance of 0.000054.

5. Conclussion

The boycott of products produced by companies supporting Israel has a major impact on the share price of these companies. This can be seen from the portfolio optimization model using Mean-Variance to determine the optimal proportion of shares of companies supporting Israel before the boycott and after the boycott. At the time before the boycott, the five stocks (AAPL, SBUX, AMZN, GOOGL, MCD) generated positive returns and obtained a portfolio with a composition of $w^T = (0.01701 \ \ 0.02354 \ \ 0.00105 \ \ 0.17009 \ \ 0.78831)$ respectively. So that the optimal portfolio is obtained at $\tau = 0.038$ produces an average return value of 0.00065 and a portfolio variance of 0.000084.

While the optimal portfolio on the company's shares after the boycott leaves only two stocks, namely AAPL and MCD with the composition of each in order $w^T = (0.46688 \ \ 0.53312)$. So that the optimal portfolio is obtained at $\tau = 0.01$ by producing an average return value of 0.00244 and a portfolio variance of 0.000054.

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