OPTIMAL PORTFOLIO FORMATION WITH SINGLE INDEX METHOD
(Study on Stocks Listed on The IDX High Divided 20 Index on The Indonesia Stock Exchange Period 2019-2022)

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Abstract

This study aims to (1) find out the composition of shares that can be formed into an optimal portfolio of IDX High Dividend 20 shares listed on the IDX for the period 2019 - 2022 using the single index model. (2) Knowing the proportion of funds that must be invested in each of the IDX High Dividend 20 shares listed on the IDX for the 2019 - 2022 period which forms a portfolio. (3) Knowing the amount of return and risk from the optimal IDX High Dividend 20 portfolio recorded on the IDX for the period 2019 - 2022 using the single index model. The sample of this research is 29 company shares selected based on purposive sampling technique. Data collection techniques are carried out with documentation. Data analysis technique uses a single index model. The results of this study indicate that there are 12 company shares included in the optimal portfolio, namely ADRO of 11.9%, BBCA of 8.7%, BBRI of 2.5%, BMRI of 13.1%, LPPF of 3.5%, ITMG of 11.3%, PTBA of 0.6%, TOWR 0.5%, DMAS 2.2%, ANTM 14.5%, HEXA 25.3%, and MPMX 5.9%. The expected return that investors get from the optimal portfolio formed is 0.0279 or 2.79% per month. The portfolio risk borne by the investor on investment from the optimal portfolio is (portfolio variance of 0.0144 or 1.44% and a standard deviation of 0.12 or 12% per month.

Keywords: *Optimal Portfolio, Single Index Model, IDX High Dividend 20*

1. INTRODUCTION

Stock investment is channeling existing sources of funds with the expectation of future profits by placing money or funds in purchasing securities in the form of shares in the hope of obtaining additional or certain benefits for the funds invested in trading these shares on the stock exchange.(Adnyana, 2020). Investments are made to gain profit or return, but there is no safe investment, so it is necessary to consider the risks of the investments made. When investing, investors will try to minimize the various risks that can arise, both long-term and short-term risks.

One of the attractive investment vehicles for investors is the capital market. One of the things that affect the increase and decrease in stock prices is demand and supply. Based on data from Investing.com, the closing price for the JCI for the last 5 years has shown increasing growth. This can be seen from the 2019 growth of 1.70%. This growth then experienced a significant decline again in 2020 of 5.09% where in that year the COVID-19 Pandemic had entered and attacked Indonesia.

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In 2021 it will increase again with an increase of 10.08%. Furthermore, in the following year, namely 2022, it will increase by 4.09%.

According to data quoted from the Indonesian Central Securities Depository (KSEI), there has been an increase in the number of stock investors in the capital market every year, especially after the COVID-19 pandemic occurred in Indonesia.

*return*the IDX High Dividend 20 index (IDXHIDIV20) experienced fluctuations that tended to increase during the 2019-2021 period. This indicated fluctuations that caused investors to be in uncertainty and there were symptoms on the market which had an impact on the returns of stocks on the IDX High Dividend 20 index This.

In this uncertainty, investors are faced with challenges in making decisions under uncertainty(Huda et al, 2022). Although investors in general are parties who really don't like risk but want maximum returns(Anggraeni, 2020). The more fluctuating the price of a stock, the riskier the stock. One way to reduce risk in this regard is to diversify. Diversification means investors must build a portfolio by selecting a number of assets that minimize risk without sacrificing expected returns. Therefore, an optimal portfolio is needed which is one of the best suggestions for investors who want to minimize or diversify risk (Hartono, 2022: 497). The existence of a portfolio causes investors to have the potential to obtain greater returns compared to the risks obtained in the future.

Portfolio analysis can use various models where one of them is the Markowitz Model and the Single Index Model(Huda et al., 2022). The single index model provides ease of calculation in analyzing portfolio formation.

2. RESEARCH METHOD

The type of research used in this study is quantitative research. This research is research in which the data are presented in numbers and uses statistical analysis which aims to show the relationship between variables, test theories, and seekgeneralizations that have predictive value.This research was conducted by library research. This study uses documentation techniques for data collection. The population in this study are all company shares included in the IDX High Dividend 20 market index on the Indonesia Stock Exchange for the period 2019 – 2022 of 30 companies. With a total sample of 30 companies using a purposive sampling strategy.

3. RESULTS AND DISCUSSION
RESEARCH RESULT
3.1 Determining the Optimal Stock Portfolio Based on the Single Index Model
3.1.1 Calculating Realized Return and Expected Return on Individual Stocks

The steps taken to get an optimal portfolio using the single index method are: looking for the monthly closing price of stocks listed in the IDX High Dividend 20 index during the 2019-2022 period. The results of the calculations carried out obtained 30 shares. Then look for the value of the Indonesian Interest Rate (SBI) and the JCI for the same period. The results of calculations using Ms Excel obtained the results of realized returns and expected returns for each stock as follows:

Table 1 Realized Return and Expected Return of Individual Shares

No	Company name	Stock code	Realized Return	Expected Return
1	Adaro Energy Tbk.	ADRO	17,968	0.0382
2	Astra International Tbk.	ASII	-0.0414	-0.0009
3	Bank Central Asia Tbk.	BBCA	0.6684	0.0142
4	Bank Negara Indonesia (Persero) Tbk.	BBNI	0.462	0.0098
5	Bank Rakyat Indonesia (Persero) Tbk	BBRI	0.5536	0.0118
6	Bank Mandiri (Persero) Tbk.	BMRI	0.8265	0.0176
7	Charoen Pokphand Indonesia Tbk	CPIN	-0.0282	-0.0006
8	HM Sampoerna Tbk.	HMSP	-10,901	-0.0232
9	Indofood Sukses Makmur Tbk.	INDF	0.1085	0.0023
10	Indocement Tunggal Prakarsa Tbk.	INTP	-0.2884	-0.0061
11	Gudang Garam Tbk.	GGRM	-10,456	-0.0222
12	Kalbe Farma Tbk.	KLBF	0.4379	0.0093
13	Matahari Department Store Tbk.	LPPF	0.9594	0.0204
14	Indo Tambangraya Megah Tbk.	ITMG	16,387	0.0349
15	Bukit Asam Coal Mine Tbk	PTBA	0.571	0.0121
16	Sarana Menara Nusantara Tbk.	TOWR	0.5702	0.0121
17	Telekomunikasi Indonesia (Persero) Tbk.	TLKM	0.234	0.005
18	United Tractors Tbk.	UNTR	0.4334	0.0092
19	Unilever Indonesia Tbk.	UNVR	-0.4219	-0.009
20	State Gas Company (Persero) Tbk.	PGAS	0.2903	0.0062
21	Regional Development Bank of West Java and Banten Tbk.	BJBR	0.0221	0.0005
22	East Java Regional Development Bank Tbk.	BJTM	0.4157	0.0088
23	Indah Kiat Pulp & Paper Tbk.	INKP	0.0955	0.002
24	State Savings Bank (Persero) Tbk.	BBTN	-0.0358	-0.0008
25	Waskita Beton Precast Tbk	WSBP	-0.7389	-0.0157
26	Puradelta Lestari Tbk.	DMAS	0.6089	0.013
27	Adira Dinamika Multi Finance Tbk	ADMF	0.375	0.008
28	Aneka Tambang (Persero) Tbk	ANTM	14,251	0.0303
29	Hexindo Adiperkasa Tbk	HEXA	14,842	0.0316
30	Mitra Pinasthika Mustika Tbk.	MPMX	17,839	0.038

Description: Green   : Highest
                      Red   : Lowest
                      Gray   : Negative returns
Source: Processed data, 2023

It is known that realized return and expected return have a positive or unidirectional relationship, which means that the greater the realized return value of a stock, the greater the expected return value. For investors who invest in the short term (short term) it will be very profitable to see changes in prices and dividends within a certain period.

3.1.2 Calculating Alpha, Beta, Stock Residual Variance Error (σ_{ei}^2)

Once the expected return, variance and standard deviation are known, then there are 22 stocks with positive expected returns and 8 stocks with negative expected returns, so stocks with negative expected returns are not included in the calculation because of the possibility that these stocks will not be profitable. The following are stocks with positive expected returns after the results of beta, alpha, and stock variance errors are obtained.

Tabe 2 Alpha (α), Beta (β), Stock Residual Variance Error

No	Company name	Issuer Code	Ai	βi	Σei
1	Adaro Energy Tbk.	ADRO	0.0359	12,000	0.0379
2	Bank Central Asia Tbk.	BBCA	0.0124	0.9091	0.0016
3	Bank Negara Indonesia (Persero) Tbk.	BBNI	0.0056	21,507	0.0049
4	Bank Rakyat Indonesia (Persero) Tbk	BBRI	0.0089	14,351	0.0027
5	Bank Mandiri (Persero) Tbk.	BMRI	0.0147	14,826	0.0036
6	Indofood Sukses Makmur Tbk.	INDF	0.0018	0.268	0.0041
7	Kalbe Farma Tbk.	KLBF	0.0083	0.5011	0.0037
8	Matahari Department Store Tbk.	LPPF	0.0161	21,809	0.0278
9	Indo Tambangraya Megah Tbk.	ITMG	0.0313	18,242	0.0179
10	Bukit Asam Coal Mine Tbk	PTBA	0.0102	0.9644	0.0092
11	Sarana Menara Nusantara Tbk.	TOWR	0.0105	0.8402	0.0083
12	Telekomunikasi Indonesia (Persero) Tbk.	TLKM	0.003	0.9933	0.0027
13	United Tractors Tbk.	UNTR	0.0075	0.8889	0.0086
14	State Gas Company (Persero) Tbk.	PGAS	0.0008	27,219	0.0064
15	Regional Development Bank of West Java and Banten Tbk.	BJBR	-0.0029	17.108	0.0064
16	East Java Regional Development Bank Tbk.	BJTM	0.0059	14,983	0.0032
17	Indah Kiat Pulp & Paper Tbk.	INKP	-0.0014	17,264	0.0145
18	Puradelta Lestari Tbk.	DMAS	0.0096	17,062	0.0081
19	Adira Dinamika Multi Finance Tbk	ADMF	0.0061	0.9598	0.0025
20	Aneka Tambang (Persero) Tbk	ANTM	0.0249	27,346	0.017
21	Hexindo Adiperkasa Tbk	HEXA	0.0295	10612	0.004
22	Mitra Pinasthika Mustika Tbk.	MPMX	0.036	0.9816	0.0208

Source: Processed data, 2023

A positive alpha in a company's stock indicates that the stock can benefit from a security's expected return regardless of market returns. There are 8 company stocks out of 22 that are suitable for the optimal portfolio. This shows that the company's stock has a lower share than the market return with a value of $<1.\beta_i$

3.1.3   Calculates the Cut-Off Rate value and determines the Cut-Off Point

Before determining the cut-off rate (Ci), we first calculate the values of Ai and Bi. the following table calculates the value of Ai, Bi, Ci, and C* individual shares.

Table 3 Value of Ai, Bi, Off Rate (Ci) and Cut Off Point (C*)

No	Issuer Code	Ai	Mrs	ci
1	ADRO	35,800	1,136,706	0.0056
2	BBCA	78,786	5.195.108	0.0075
3	BBNI	41,506	9,501,076	0.0028
4	BBRI	59,307	7,503,021	0.0046
5	BMRI	71,512	6,182,055	0.0062
6	INDF	0.1211	646,047	0.0002
7	KLBF	11,929	1,343,044	0.0018
8	LPPF	15,668	784,300	0.0026
9	ITMG	35,099	1,019,400	0.0056
10	PTBA	12225	1,043,559	0.0019
11	TOWR	11,855	1,013,555	0.0019
12	TLKM	16,890	3,717,488	0.0019
13	UNTR	0.9109	1,036,648	0.0014
14	PGAS	24,483	4,263,754	0.0026
15	BJBR	0.0096	2,668,091	0
16	BJTM	38,994	4,636,956	0.0039
17	INKP	0.1909	1,194,740	0.0003
18	DMAS	26,513	2,117,441	0.0036
19	ADMF	28,556	3,785,834	0.0031
20	ANTM	48,027	1,607,029	0.007
21	HEXA	8,285,994	266,064,051	0.010434
22	MPMX	1,769,367	471,565,312	0.003076

Description: Blue :Cut-Off Point
Source: Processed data, 2023

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Based on the table above, it can be seen that the shares of the company Hexindo Adiperkasa Tbk (HEXA) have the highest cut-off rate, with a value of 0.0104 which is also the cut-off point or limiting point.

3.1.4 Determination of Shares Included in the Optimal Portfolio With Comparison of Excess Return To Beta (ERB) Value of Individual Shares With Cut-Off Point (C*)

After obtaining the results in the table above, the calculation is continued by finding the excess return to beta (ERB)>Ci for each stock. Stocks included in the optimal portfolio are stocks that have an excess return to beta value greater than or equal to the cut of point (C*) value.

Table 4 Comparison of ERB Values with Cut-Off Point (C*)

No	Company name	Issuer Code	ERB		C*
1	Adaro Energy Tbk.	ADRO	0.0379	>	0.0104
2	Bank Central Asia Tbk.	BBCA	0.0137	>	0.0104
3	Bank Negara Indonesia (Persero) Tbk.	BBNI	0.0096	<	0.0104
4	Bank Rakyat Indonesia (Persero) Tbk	BBRI	0.0115	>	0.0104
5	Bank Mandiri (Persero) Tbk.	BMRI	0.0173	>	0.0104
6	Indofood Sukses Makmur Tbk.	INDF	0.0007	<	0.0104
7	Kalbe Farma Tbk.	KLBF	0.0084	<	0.0104
8	Matahari Department Store Tbk.	LPPF	0.0202	>	0.0104
9	Indo Tambangraya Megah Tbk.	ITMG	0.0346	>	0.0104
10	Bukit Asam Coal Mine Tbk	PTBA	0.0117	>	0.0104
11	Sarana Menara Nusantara Tbk.	TOWR	0.0116	>	0.0104
12	Telekomunikasi Indonesia (Persero) Tbk.	TLKM	0.0045	<	0.0104
13	United Tractors Tbk.	UNTR	0.0087	<	0.0104
14	State Gas Company (Persero) Tbk.	PGAS	0.006	<	0.0104
15	Regional Development Bank of West Java and Banten Tbk.	BJBR	0.0002	<	0.0104
16	East Java Regional Development Bank Tbk.	BJTM	0.0086	<	0.0104
17	Indah Kiat Pulp & Paper Tbk.	INKP	0.0018	<	0.0104
18	Puradelta Lestari Tbk.	DMAS	0.0127	>	0.0104
19	Adira Dinamika Multi Finance Tbk	ADMF	0.0075	<	0.0104
20	Aneka Tambang (Persero) Tbk	ANTM	0.0302	>	0.0104
21	Hexindo Adiperkasa Tbk	HEXA	0.0312	>	0.0104
22	Mitra Pinasthika Mustika Tbk.	MPMX	0.0375	>	0.0104

Source: Data processed, 2023

Company shares included in the optimal portfolio are Adaro Energy Tbk (ADRO), Bank Central Asia Tbk (BBCA), Bank Rakyat Indonesia (Persero) Tbk (BBRI), Bank Mandiri (Persero) Tbk (BMRI), Matahari Department Store Tbk (LPPF), Indo Tambangraya Megah Tbk (ITMG), Bukit Asam Coal Mine Tbk (PTBA), Sarana Menara Nusantara Tbk (TOWR), Puradelta Lestari Tbk (DMAS), Aneka Tambang (Persero) Tbk (ANTM), Hexindo Adiperkasa Tbk (HEXA), and Mitra Pinasthika Mustika Tbk (MPMX).

3.2 Determining the Proportion of Funds that Should Be Invested in a Combination of Selected (Optimal) Shares

Figure 1 Proportion of Portfolio Funds
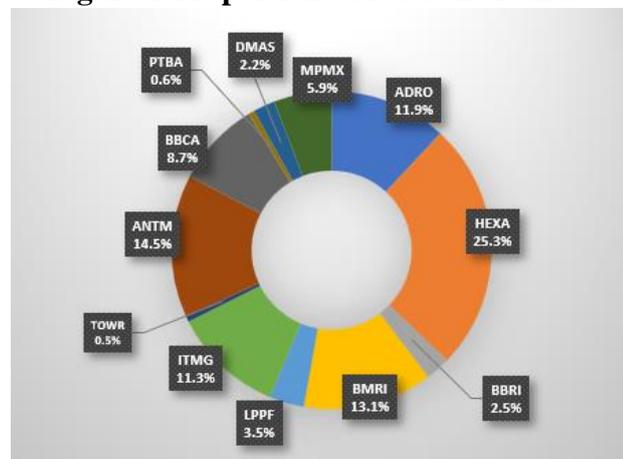
Source: Processed data, 2023

The figure above shows that the largest proportion of funds to be invested is in shares of the company Hexindo Adiperkasa Tbk (HEXA), which is 25.3% of the total funds to be used for investment compared to other stocks in the optimal portfolio of IDX High Dividend 20 index shares. (IDXHIDIV20) in the 2019-2022 research period that has been established. Meanwhile, shares with the smallest proportion of funds, namely shares of Sarana Menara Nusantara Tbk (TOWR), amounted to 0.5%. The proportion of this fund describes the amount of funds that must be invested by investors to invest in stocks included in the optimal portfolio.

3.3 Calculating Expected Return and Risk of optimal stock portfolio

Table 5 Portfolio Alpha and Beta Values

No	Company name	Issuer Code	Ap	Mr	Wi2. Oei2
1	Adaro Energy Tbk.	ADRO	0.00427	0.142889	0.001508
2	Bank Central Asia Tbk.	BBCA	0.001077	0.078803	0.000138
3	Bank Rakyat Indonesia (Persero) Tbk	BBRI	0.000223	0.035834	0.000069

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4	Bank Mandiri (Persero) Tbk.	BMRI	0.001921	0.194265	0.000466
5	Matahari Department Store Tbk.	LPPF	0.000566	0.076645	0.000977
6	Indo Tambangraya Megah Tbk.	ITMG	0.003534	0.206154	0.002022
7	Bukit Asam Coal Mine Tbk	PTBA	0.000062	0.005835	0.000056
8	Sarana Menara Nusantara Tbk.	TOWR	0.000057	0.004607	0.000045
9	Puradelta Lestari Tbk.	DMAS	0.000211	0.037539	0.000177
10	Aneka Tambang (Persero) Tbk	ANTM	0.003621	0.397248	0.002472
11	Hexindo Adiperkasa Tbk	HEXA	0.007453	0.268249	0.001008
12	Mitra Pinasthika Mustika Tbk.	MPMX	0.002108	0.057436	0.001218
Total			**0.025104**	**1,505,505**	**0.010157**

Source: Processed data, 2023

Expected return portfolio is the expected return of the portfolio that has been formed. Expected return is calculated from the sum of the returns for each stock that forms the optimal portfolio. The formula for the expected return portfolio is as follows:

$$E(R_p) = \alpha_p + . \, E() \beta_p R_m$$
$$= 0.0251 + 1.5055 \times 0.0020$$
$$= 0.0281 \text{ or } 2.8\%$$

Based on the results of these calculations, it can be seen that the optimal portfolio formed is able to provide an expected return of 0.0281 or 2.8%.

Portfolio risk is the risk of the investment portfolio that is formed. The amount of risk associated with each stock in the optimal portfolio produces this portfolio risk. The results of calculating portfolio risk are as follows:

Variant formula:

$$. = . + (\, . \,) 2 \sigma_p^2 \beta_p^2 \sigma_m^2 \sum_{i-1}^{n} W_i \sigma_{ei}$$
$$= 1.5055 \times 0.0020 + 0.0101$$
$$= 0.0131 \text{ or } 1.30\%$$

Standard deviation formula

$$. = \sigma_p \sqrt{\sigma_p^2}$$
$$= = 0.1144 \text{ or } 11.44\% \sqrt{0.0131}$$

Based on the calculation results above, it is known that the portfolio formed contains risk with a variance value of 0.0131 or 1.30% with a standard deviation of the portfolio of 0.1144 or 11.44%.

DISCUSSION

Based on data analysis using the single index method for company shares in the IDX High Dividend 20 index (IDXHIDIV20), 22 of the 30 sample company shares had a positive return, while the other eight stocks had a negative return. A positive return on a company's

stock indicates that a profit or capital gain occurred during the study period, 2019-2022. Conversely, stocks with negative return values indicate that the company's shares or capital have decreased during the study period.

The company stock that has the highest return is Adaro Energy Tbk (ADRO) with a realized return value of 1.7968 or 179.68% and an expected return of 0.0382 or 3.82%. This is because the amount of increase in share price is greater than that of other companies. The company that has the smallest return value is HM Sampoerna Tbk (HMSP) realized return with a value of -1.0901 or -109.01% and an expected return of -0.0232 or -2.32%. This was due to a decrease in the price of the largest share of HM Sampoerna Tbk during the study period. Matahari Department Store Tbk (LPPF) is the company with the biggest risk.

In this study, the expected return value for the JCI or market was 0.0019 or 0.19% per month, containing risks indicated by a variance of 0.0018 or 0.18% and a standard deviation of 0.0430 or 4.3%. The positive realized and expected returns obtained by the JCI have led to investment in the capital market being able to provide benefits for investors.

This research also produced risk free which was calculated from the average level of the BI Rate during the 2019-2022 period, which was 0.0434 or 4.34% per year and the monthly risk free rate of return was 0.0036 or 0.36% per month with 0% risk.

4. CONCLUSION

In forming an optimal portfolio using the single index method for stocks listed on the IDX High Dividend 20 (IDXHIDIV20) index on the Indonesia Stock Exchange (IDX) for the 2019-2022 period, 12 company shares were included in the optimal portfolio out of a total of 30 company shares that were the research sample.

The proportion of funds for each company share formed in this optimal portfolio is 11.9% for ADRO shares, 8.7% for BBCA shares, 2.5% for BBRI shares, 13.1% for BMRI shares, 3.5% for LPPF shares, 11.3% for ITMG shares, 0.6% for PTBA shares, 0.5% for TOWR shares, 2.2% for DMAS shares, 14.5% for ANTM shares, 25.3% for HEXA shares, and 5.9% for MPMX shares.

*Expected returns*that will be received by investors from the optimal portfolio using the single index method for stocks listed on the IDX High Dividend 20 index on the Indonesia Stock Exchange (IDX) for the 2019-2022 period that has been formed is 0.0279 or 2.79% per month with a portfolio risk of 0.0144 or 1.44 % per month and a standard deviation of 0.12 or 12% per month which must be borne by the investor. This will also provide benefits not only for long-term investors but also for short-term investors.

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