OPTIMAL PORTFOLIO OPTIMIZATION USING *MARKOWITZ* AND *STOCHASTIC DOMINANCE MODELS* AS A BASIS FOR INVESTMENT DECISIONS

(Study of Companies Included in the LQ-45 Index Listed on the BEI 2018-2022)

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ABSTRACT *:*

This research aims to determine the relationship between the optimal portfolio using the Markowitz and Stochastic Dominance models with stock prices as one of the bases for investment decisions. The population of this research is the LQ45 Index Companies Listed on the Indonesia Stock Exchange for 2018-2022, which consists of 45 companies. The sample used in this research was selected through a purposive sampling method. This research uses a quantitative approach with the comparative method SPSS version 22.0 software.

The results of the Markowitz Model research have a relationship with stock prices. This is because the results of bivariate analysis using Chi-Square obtained a P value/Asymp. Sig. of 0.000 < the alpha value (0.05) meaning that there is a relationship between the Markowitz Model which has a relationship with stock prices and the Stochastic Dominance Model also has a relationship with stock prices. This is because the results of bivariate analysis using Chi-Square obtained a P value/Asymp. Sig. of 0.000 < the alpha value (0.05), meaning that there is a relationship between Stochastic Dominance and stock prices.

Keywords: *Markowitz* , *Stochastic Dominance* and Stock Prices

ABSTRACT

This research aims to determine the relationship portfolio optimal with model *Markowitz* and *Stochastic Dominance* with stock prices as one of the bases for investment decisions. The population of this research is the LQ45 Index Companies Listed on the Indonesia Stock Exchange for 2018-2022, which consists of 45 companies. The sample used in this research was selected through a *purposive sampling method* . This research uses a quantitative approach with the comparative method SPSS version 22.0 software.

Markowitz Model research have a relationship with stock prices based on the results of bivariate analysis using *Chi-Square* to obtain the *P value /* Asymp value . Sig. of 0.000 < the alpha value (0.05), meaning that there is a relationship between the *Markowitz Model* and stock prices. Furthermore, the *Stochastic Dominance Model* has a relationship with stock prices based on the results of bivariate analysis using *Chi-Square* to obtain the *P value /* Asymp value . Sig. of 0.000 < the alpha value (0.05), meaning that there is a relationship between *Stochastic Dominance* and stock prices.

Keywords: *Markowitz* , *Stochastic Dominance* and Stock Prices

INTRODUCTION

Investment decisions are the most important policy of the two other policies in financial management, namely funding policy and dividend policy. Capital investment is the main aspect of financial management policy because investment is a form of capital allocation whose realization must produce benefits or profits in the future. On the other hand, the benefits of investment in the future are covered by uncertainty, which in the financial management concept is called investment risk. As a consequence, when making investments, you must go through a careful evaluation process regarding predicted levels of profit and risk (Tandelilin, 2021).

Making the right investment decisions is very important for every investor to ensure that the funds invested promise an appropriate rate of return in the *future* . The main problem faced by investors in investing is

determining which shares to choose and the proportion of funds invested to obtain optimal *returns* in a situation of uncertainty about the company's future condition. Investors are model individuals, meaning investors always expect optimal *returns from the investments they make.* On the other hand, it cannot be denied that risk is always inherent and positively correlated with the level of return expected by investors (Tandelilin, 2021). This shows that investment decisions also require the ability of investors
analyze *the returns* and risks that investors will face. The existence of risks in this investment means that investors must take appropriate steps to minimize the risks that may occur. Building a portfolio is one way to reduce the risk in investing.

The development of investment in Indonesia is currently increasingly rapid. More and more people are interested in investing. There are many instruments for carrying out profitable investment activities on offer. Investment instruments in Indonesia include property, deposits, shares, gold and bonds. Shares are one of the investment instruments most popular with the public, this is proven by the increase in the value of the Composite Stock Price Index (IHSG) from year to year.

Investment is an investment activity for one or more securities owned and usually has a long term period with the hope of making a profit in the future (Sunariyah, 2019). According to Abdul Halim (2020) Investment is essentially the placement of a certain amount of funds at this time with the hope of obtaining profits in the future.

Investments in securities can be made in the capital market, The capital market enables investors have various choices that investment in accordance with their risk preferences. The capital market is a meeting between parties who have excess funds and parties who need funds by buying and selling securities. Meanwhile, the place where buying and selling of securities occurs is called the stock exchange (Tandelilin, 2021). Capital market players are companies and governments (parties who need funds), investors (parties who own fund), And BAPEPAM-LK (that is body Which supervise all activities carried out in the capital market). All these parties work together so that the transaction process that occurs in the capital market can be guaranteed to be safe and structured neatly.

Investors who want to invest in the financial sector will be facilitated by companies that issue securities in the form of a debt certificate (bond) or ownership certificate (shares). Investors in securities diversify by trying to combine several securities to obtain *returns* and minimize risk. In other words, forming a portfolio. "Portfolio means a collection of investments that involves identifying which securities will be selected, and what proportion of funds will be invested in each security" (Husnan, 2020). The securities chosen can be similar or dissimilar with the aim of avoiding risk and generating income as large as expected, so they need to be analyzed further. how to create a portfolio that is able to provide optimal profits.

Portfolio is one aspect that cannot be underestimated. The portfolio will determine the desired return (*return) so that it is optimal.* According to Jogiyanto (2019) a portfolio is a collection of financial securities in a unit held or created by an investor, investment company, or financial institution. Efficient portfolio formation so that it can produce an optimal portfolio. "An efficient portfolio is a portfolio that produces a certain level of profit with the lowest risk, or a certain risk with the highest level of profit." (Husnan, 2020). This means that in forming a portfolio you can get the same profit with lower risk, or with the same risk but can provide higher profits. “Optimal Portfolio is a portfolio chosen according to an investor's preferences from among the many choices available in the collection portfolio efficient” (Tandelilin, 2021). Portfolio optimal can be obtained from choices that have been determined by each investor previously in a series of efficient portfolios.

Forming an optimal portfolio can be done using the *Markowitz Model* in its analysis technique. This *Markowitz* model is also called *Mean-Variance Model* . *Mean* (average) is a measurement of the level of *return* , and *variance* (variance) is a measurement of the level of risk. Portfolio risk is not calculated from the sum of all the risks of the assets in one portfolio, but must be calculated according to the contribution of each asset to the portfolio risk. The contribution of each asset to portfolio risk is referred to as *Covariance* . *Covariance* is an absolute measure that shows the extent *returns* from two securities in a portfolio tend to move together (Tandelilin, 2021).

Portfolio theory itself was initiated by *Markowitz* , an economist who graduated from the University of Chicago who won the Nobel Prize in economics in 1990. The basics of portfolios were introduced by *Markowitz* in 1952. *Markowitz* developed portfolio theory, which looks at how investment returns can be optimized. Economists have long had a common view of portfolio diversification where the saying "don't put all your eggs in one basket" has long been around. But *Markowitz* shows how to measure the risk of a number of securities and how to combine them in a portfolio to get maximum return on risk. (Wikipedia, 2023)

The aim of the *Markowitz model* is to distribute funds efficiently. According to *Markowitz* , expected risk depends on the diversity (diversification) of possible expected *returns* (Nurika, 2021). This diversification is an investment concept so that investors have several different types of investment. If an investor wishes to maximize the expected profit from the portfolio, funds are placed in securities that have the maximum expected profit. Therefore, there are regulations that recommend that investors diversify and need to maximize expected profits. This regulation states that investors need to diversify their funds into all securities that have maximum

profit expectations. This investment diversification can be similar, for example shares with shares or shares with bonds. Investment diversification will provide optimum benefits if *the returns* between investments in one portfolio are negatively correlated, this is because the portfolio will eliminate security risk (Ahmad and Othman, 2022).

Assumptions Which underlying portfolio formation using the *Markowitz Model* , namely time Which used in study only One period, investors base calculation on mark *returns* expectation And portfolio risk, no there is loan And savings free risk or not exists calculation cost transactions (Hartono, 2019).

Markowitz method in this research is because it can be used to calculate expected *returns* and portfolio risk, this is what the researchers use as the reason for using the *Markowitz Model* as an analytical tool to form an optimal portfolio for LQ 45 shares because the movement of LQ45 company share prices tends to fluctuate. (declining and increasing) and poses high portfolio risk.

The next method used to form an optimal portfolio is *stochastic dominance.* According to Kuswandanu (2020) *stochastic dominance* is a generalization of utility theory that eliminates the need to explicitly determine the company's utility function. Instead, general mathematical statements about wealth preferences, *risk aversion* , etc. are used to develop optimal decision rules for choosing between investment alternatives. According to Husnan (2019), *stochastic dominance* does not pay attention to the distribution of the profit levels of the investments being considered. *Stochastic dominance* does not require the distribution of profit levels to be normal.

Stochastic dominance is method analysis optimal portfolio that can be overcome problem determination And evaluation investment share along with portfolio , because not enough specifically theory economy predict period front about investor preferences and distribution profit . Method This have excess that is No see on distribution level profit in investment or evaluated portfolio And distribution level profit No required to be normal (Husnan , 2019).

Currently, the capital market in Indonesia is still characterized by the opportunity to gain high profits, but sometimes the *return distribution* is not normal, so by using the *stochastic dominance method*, investors can find favorite types of shares that may have an abnormal *return distribution.* According to Andriyani, quoted from Kjetsaa and Kieff (2021), the *stochastic dominance method* has three assumptions about investor behavior, namely: *First order stochastic dominance,* which assumes that investors prefer more than little. The meaning of the word "a lot" in this assumption is the risk of the stock. *Second order stochastic dominance,* which assumes that investors have a *risk averse attitude* or does not like risk, while *Third order stochastic dominance* assumes that investors have a *decreasing absolute risk aversion attitude,* which means that if wealth increases, more funds will be invested in risky assets.

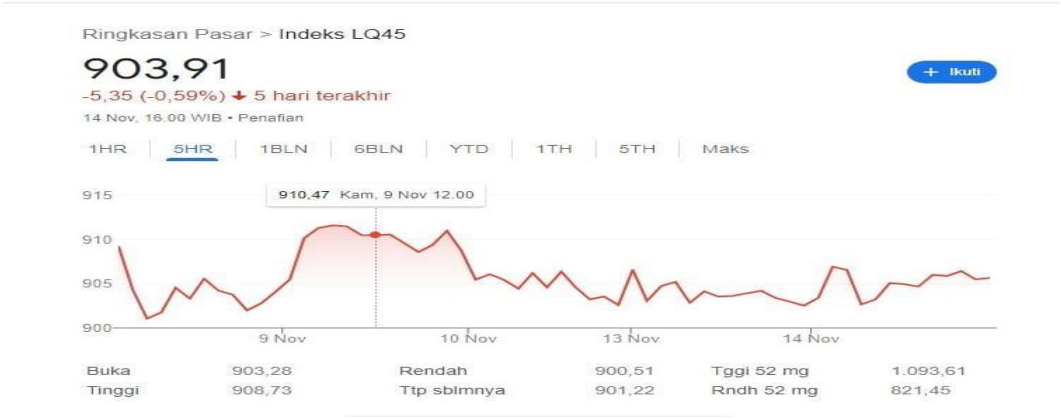
stochastic dominance method in this research is because it can be used to calculate probability, namely the chance of an event or events occurring and portfolio risk, this is what researchers use as the reason for using *stochastic dominance.* as an analytical tool to form an optimal portfolio for LQ 45 shares because LQ45 company share price movements tend to fluctuate (decrease and increase) and give rise to portfolio risk that is influenced by a high event or event.

Based on study Previously , there was nonconformity results study between *stochastic dominance* and models *markowitz* in form optimality portfolio . That matter seen from research by Melisa et al (2020), Wahyu et al (2018) and Amalia, et al (2018) state that *Markowitz* model more Good If applied in analyze formation optimal portfolio . Whereas on study Wulandari (20 16) And Arzelina et al (2021) stated that *stochastic dominance* produce formation more optimal portfolio profitable .

The object of this research is the shares of listed companies on the Indonesian Stock Exchange and included in the LQ-45 index for the 2018-2022 period. The reason for choosing the LQ-45 Index as the object of this research is the Index LQ45 is group shares Which tend Stable means a group of shares with a high level of liquidity, thus the resulting portfolio can show good *trade-off results* optimal between risk And *expected* level *the return* . According to Suta (2019) "share liquidity is a measure of the number of transactions of a particular share with the share trading volume on the capital market in a certain period". The more liquid the shares, the higher the number or frequency of transactions, which shows that investors' interest in owning these shares is also high. High interest is possible because shares with high liquidity provide a higher possibility of getting *a return* than shares with low liquidity, so that the level of stock liquidity will usually influence the price of the shares concerned, then companies that are members of the LQ45 index are one of the investment options that provide quite promising *returns* .

In this research, the phenomenon is the LQ 45 Index, which contains 45 companies listed on the IDX, which are selected companies that have the opportunity to provide profits for investors. Each company can bring profits or losses in investing. This means that even though the IDX has selected companies and included them in LQ 45, in this case it has not provided full benefits. The company's *returns* can go up or down. The shares in LQ45 cannot be separated from the ups and downs of *returns* . The following is the index of LQ45 companies listed on the IDX:

Figure 1.1
LQ45 Company Share Movement



Source: finance.yahoo.com, 2019

From Figure 1.1 above, it can be seen that the share price movement of the LQ45 company tends to fluctuate (decrease and increase). This condition means that in investing activities, an increase or decrease in a *return* means there is an element of risk in it, so it is embraced by optimal studies using the *Markowitz* and *stochastic dominance models* as the basis for investment decisions. Based on this background description, the researchers determined the title **"Optimal Portfolio Optimization Using *Markowitz* and *Stochastic Models." Dominance* as a Basis for Investment Decisions (Study of Companies Included in the LQ-45 Index Listed on the IDX in 2018-2022."**

LITERATURE REVIEW AND FORMULATION OF HYPOTHESES

Portfolio Theory

A portfolio can be defined as an investment in various financial instruments that can be traded on the Stock Exchange and Money Market with the aim of spreading sources of returns *and* possible risks. The financial instruments in question include shares, bonds, foreign exchange, deposits, stock price indexes, other *derivative products* (Samsul, 2019).

Investment

Profits can be obtained in various ways, one of which is by investing. The Indonesian Accountants Association (2021) explains "Investment is an asset that a company uses for the growth of wealth (*accreation of wealth*) through the distribution of investment returns or other benefits for the investing company, such as benefits obtained through trade relations." Kamarudin explained, "investment is placing money on funds with the hope of obtaining additional or certain benefits on that money or funds" (Kamarudin, 2021)

Theory Portfolio *Markowitz*

According to Fabozzi, (2019), portfolio risk is influenced by the weighted average risk of each individual asset and the covariance between the assets that make up the portfolio. The variance and standard deviation of *returns* are common measures of risk.

Stochastic Dominance

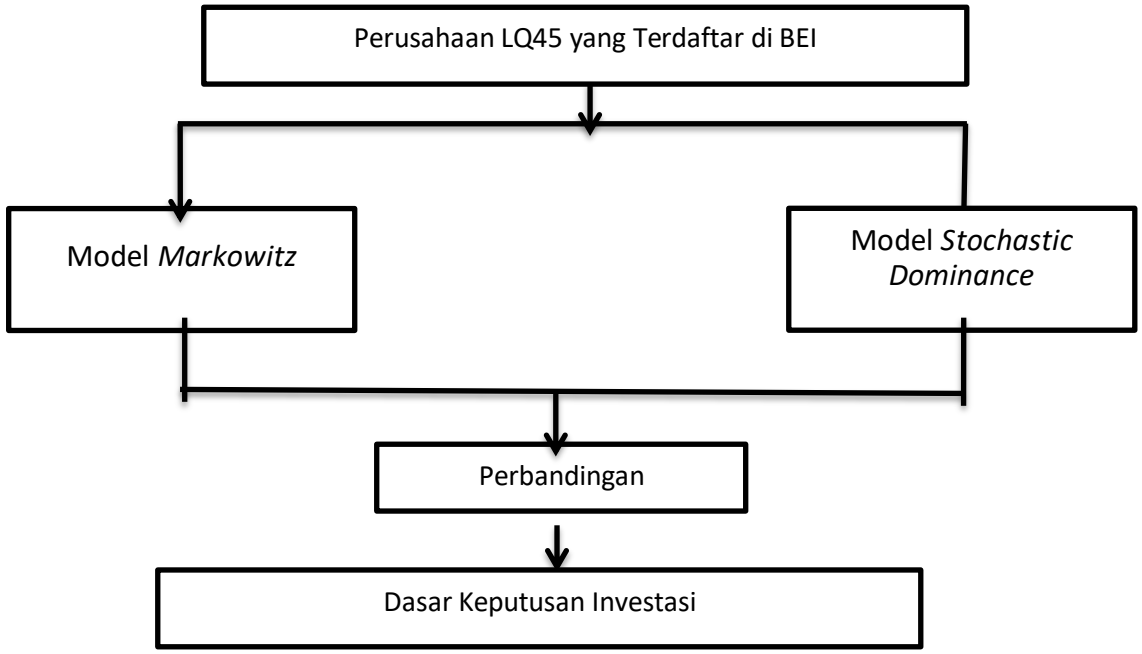
According to Husnan (2019) *stochastic dominance* is a technique for choosing risky investments without having to use a normal distribution for profit levels. According to Saputro (2018), *stochastic dominance* is applied to overcome problems regarding the selection and evaluation of stock and portfolio investments, due to the weakness of economic theory in providing predictions or a picture of the future regarding investor preferences and profit distribution.

Previous Research

No	Study	Research Title	Research methods	Research result
1.	Nugroho & Yohanes (2017),	Comparison of *Returns of* Three Sri Kehati Index Stock Portfolio Models Against the Composite Stock Price Index	The analytical method used is the cooperative analysis method	shows that of the three methods used to form portfolios, namely the *Markowitz model* , constant correlation model and *Markowitz model, the Markowitz* model method provides the largest *return value* compared to the other two methods. The expected *return* produced by the *Markowitz model* was 33.19%, the constant correlation model was

				23.86% and the *Markowitz model* was 22.22%.

Framework Conceptual



HYPOTHESIS

A hypothesis is defined as a conclusion or temporary answer made based on a framework for thinking about a research problem (Zulganef, 2019). The hypotheses in this research are:

Ho1 = There is a relationship which is significant in the optimal portfolio using the *Markowitz* model method with price share

Ho2 = There is a significant relationship with the optimal portfolio using the *stochastic dominance* model method with price share

METHOD

This research uses a quantitative approach with comparative methods. Comparative research is research carried out by comparing a variable in different samples to get answers or facts about whether there is a comparison or not from the research. The aim of this comparative research is to analyze two or more variables by comparing the value of one dependent variable with other dependent variables in a different group (Sugiyono , 2017) . Using a comparative type because it compares the results of forming an optimal portfolio with *the Markowitz* and *Stochastic dominance models* .

RESULTS AND DISCUSSION

Results Test Bivariate Analysis

Bivariate analysis in this research was carried out with the aim of seeing the relationship between one independent variable and one dependent variable. The statistical test used in this research is the *Chi Square test* . The results of the bivariate analysis of each variable with the help of the SPSS version 22 software application can be seen in the following table:

***Markowitz* With Stock price**

Table 4.4
Connection Markowitz With Stock Prices
Chi-Square Tests

	Value	df	Asymp . Sig. (2-sided)
Pearson Chi-Square	45215,000 [a]	45014	,246
Likelihood Ratio	2272.284	45014	1,000

Linear-by-Linear Association	12,797	1	**0,000**
N of Valid Cases	215		

a. 45450 cells (100.0%) have expected count less than 5. The minimum expected count is .00.

The results of bivariate analysis using *Chi-Square* obtained the *P value* / Asymp . Sig. of 0.000 < the alpha value (0.05), meaning there is a relationship between Markowitz and share prices.

Connection *Stochastic Dominance* With Share Prices

Table 4.5
Connection *Stochastic Dominance* With Share Prices
Chi-Square Tests

	Value	df	Asymp . Sig. (2-sided)
Pearson Chi-Square	40814.167 [a]	40602	,228
Likelihood Ratio	2239.013	40602	1,000
Linear-by-Linear Association	74,362	1	**0,000**
N of Valid Cases	215		

a. 41006 cells (100.0%) have expected count less than 5. The minimum expected count is .00.

The results of bivariate analysis using *Chi-Square* obtained the *P value* / Asymp . Sig. of 0.000 < the alpha value (0.05), meaning there is a relationship between *Stochastic Dominance* With Share Prices.

DISCUSSION

***Markowitz* Model Relationships With Stock price**

The first hypothesis in this research states that *Markowitz is suspected* of having a relationship with Stock price. Based on the results of bivariate analysis using *Chi-Square, the P* value / Asymp . Sig. of 0.000 < the alpha value (0.05), meaning there is a relationship between Markowitz and share prices. Results test the indicates that there is a significant relationship with the *Markowitz model* with Share Prices, so that can concluded that on study this supports first hypothesis (H1).

Markowitz model is one way to select and determine the optimal portfolio of share prices. This model is used to compare the level of stock prices from previous years by means of expecting returns *(* mean) and minimizing uncertainty or risk (*variance*) . The higher the optimal portfolio level of share prices using the *Markowitz model* , the greater the capital the company will obtain, thus the *Markowitz Model* has a relationship with share prices.

Portfolio theory which states that there is an effort to maximize the expected *return* (mean) and minimize uncertainty or risk (*variance*) to select and compile optimal portfolio analysis so prove that exists *Markowitz* significant relationship with Share Prices

Results study This in line with study owned by (Irawati Junaeni, 2018), (Pratiwi *et al* ., 2019) and (Simanjuntak, 2021). On fourth researcher the consider that *Markowitz* can made as signal in taking decision invest because *Markowitz* is a factor related to stock prices. However, these results are not consistent with research from (Handayati & Zulyanti, 2019) and (Yuliana & Hastuti, 2021) Which state that *Markowitz* not related to share prices.

***Stochastic Dominance* Model Relationship with Stock price**

The first hypothesis in this research states that *Stochastic Dominance is suspected* have a relationship with Stock price. Based on the results of bivariate analysis using *Chi-Square, the P* value / Asymp . Sig. of 0.000 < the alpha value (0.05), meaning there is a relationship between *Stochastic Dominance* With Share Prices. Results test the indicates that there is a significant *Stochastic Dominance relationship* with Share Prices, so that can concluded that on study this supports second hypothesis (H2).

Stochastic Dominance Model is a model for choosing optimal stock prices without having to use a normal distribution for profit levels . The higher the optimal portfolio level of share prices using the *Stochastic Dominance Model* , the greater the capital obtained by the company, thus the *Markowitz Model* has a relationship with share prices.

Portfolio theory which states that there is an effort to maximize in choosing risky investments without having to use a normal distribution for profit levels so prove that exists *Markowitz* significant relationship with Stock Price analysis

Results study This in line with study owned by (Murti & Kharisma, 2021), (Susanti *et al* ., 2021) and (Hamdan *et al* ., 2021) which proves that *Stochastic Dominance* has a relationship with share prices in the investment decision making process. However study This No in line with study owned by (Supriyadi And Sunarmi, 2019), (Wildan *et al* ., 2021) and (Inayah & Kaniarti, 2021) Which state that *Stochastic Dominance* do not have relationship with Stock price

CLOSING

Conclusion

This research aims to determine the relationship between *Markowitz* and *Stochastic Dominance* with share prices in LQ45 Index Companies listed on the Indonesian Stock Exchange in 2018-2022. In this study there were 43 company with The total sample was 214. The results of this research were processed using SPSS 22, with the result as following.

1. *The Markowitz* model has a relationship with stock prices. This is because the results of bivariate analysis using *Chi-Square* obtained a *P value /* Asymp . Sig. of 0.000 < the alpha value (0.05) meaning that there is a relationship between *the Markowitz Model* and the stock price
2. *Stochastic Dominance* model has a relationship with stock prices. This is because the results of bivariate analysis using *Chi-Square* obtained a *P value /* Asymp . Sig. of 0.000 < the alpha value (0.05), meaning that there is a relationship between *Stochastic Dominance* and stock prices.

SUGGESTION

1. Further research could use other industrial sectors such as property in accordance with research (Wulandari & Paramita, 2019) and For company sampling, we don't just focus on the IDX but Can narrowed like use index company listed in LQ 45 to find out the companies with criteria certain.
2. For investors to use the *Markowitz model* and the *Stochastic Dominance model* in determining the optimal portfolio because both models have a significant relationship with stock prices.

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