

COMPARATIVE ANALYSIS OF ACCURACY BETWEEN CAPITAL ASSET PRICING MODEL (CAPM) AND ARBITRAGE PRICING THEORY (APT) IN PREDICTING STOCK RETURN (CASE STUDY: MANUFACTURING COMPANIES LISTED ON THE INDONESIA STOCK EXCHANGE FOR THE 2015-2018 PERIOD)

Try Wahyuni¹⁾, Tri Gunarsih²⁾

¹Faculty of Economics and Business, Universitas Teknologi Yogyakarta
email: wahyunytry@gmail.com

²Faculty of Economics and Business, Universitas Teknologi Yogyakarta
email: trigunarsih@uty.ac.id

ABSTRACT

This study aims to analyze the accuracy comparison between the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) in predicting stock return in manufacturing companies listed on the Indonesia Stock Exchange (BEI) for the period 2015 - 2018. CAPM is a model of the relationship between risk and expected return of a security or portfolio. It can be used to determine the price of a risky asset, whereas APT is an approach in determining the price of an asset that is not only based on one variable, but many variables. The variables used in this study consist of market risk premium, inflation, exchange rates (Rp / USD), interest rates, and stock returns. The method used in sampling is purposive sampling. Based on the method, 20 samples of companies with certain criteria were obtained. The data used in this study are secondary data. Secondary data collection was obtained from the Yahoo Finance website, the Bank Indonesia website, and the Ok Stock website, which includes monthly time series data on closing stock prices and the Composite Stock Price Index (CSPI), as well as monthly time series on macroeconomic variables. Data analysis in this study uses Mean Absolute Deviation (MAD) by comparing the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The results of data calculations show that the Mean Absolute Deviation (MAD) value on the CAPM model has a value of 0.1096 and the APT model has a value of 0.3631. The smaller the value of Mean Absolute Deviation (MAD), it indicates that the regression model is more precise or accurate in predicting the dependent variable, namely stock returns. The results of data analysis show that the CAPM model is more precise or accurate than the APT model in predicting stock returns.

Keywords: CAPM, APT, Accuracy, Stock Return

1. INTRODUCTION

In predicting the return on assets required or expected, there are two types of models that are often used by investors. These two models are the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). The first model is the Capital Asset Pricing Model (CAPM) introduced by Treynor, Sharpe, and Lientner. The CAPM model is a balance model that allows to determine the relevant risks, and how the relation between risks for each asset if the capital market is in a balanced state. In other means, the CAPM model is a model that illustrates the relationship between risk and expected return, this model is used in valuation of security prices. One alternative theory of equilibrium models other than CAPM is Arbitrage Pricing Theory (APT). APT is a theory developed by Stephen A. Ross in 1976 where he stated that the price of an asset can be influenced by various factors. APT bases itself on the concept of one price (Herlianto, 2013).

Herlianto (2013) explained that CAPM provides an exact prediction between the risk relation of an asset and the expected level of return. Although CAPM cannot be proven empirically, but CAPM is widely used because it has a high degree of accuracy. CAPM shows simplify the relation of return and risk in the real world, which is sometimes very complex. Like the CAPM, APT describes the relation between risk and return, but uses different assumptions and procedures. Estimation of expected return of the security using APT, are not as influenced by market portfolios as only in the CAPM. In the APT model, security return is not only influenced by market portfolios because of the assumption that the expected return of a security can be influenced by several other sources of risk.

In addition, APT also doesn't use the assumptions used in the CAPM. In the APT model is not only influenced by market risk, but also other factors such as macroeconomic factors. These macroeconomic factors such as inflation, interest rates, and currency exchange rates (IDR / USD) are also taken into account in predicting stock returns. Some macroeconomic factors as shown in the table below:

Table 1. Basic Assumptions for Macroeconomics on 2015 – 2018 Period

Economic Indicator	2015	Realized (2016)	APBN-P 2017	RAPBN 2018
Economic growth	5,8	5,0	5,2	5,4
Inflation (% YoY)	4,4	3,0	4,3	3,5
Exchange rate (Rp/USD)	11.900	13.307	13.400	13.500
Interest rate of sovereign paper – 3 months (%)	6,0	5,7	5,2	5,3
Crude oil price (US\$/barel)	105	40	48	48
Oil lifting (1000 barrel/day)	900	825	815	800
Gas lifting (1000 barrel/day)	1.248	1.193	1.150	1.200

Source: Kementerian Keuangan Republik Indonesia

In investing, not a few people who invest their capital in the capital market. According to Hartono (2017), the capital market is a company facility to increase long-term funding needs by selling stocks or issuing bonds. With the capital market, the public can invest in it by becoming an investor.

Investment is an activity of investing both directly and indirectly with the hope that in time the capital owner will get a number of benefits from the investment. One of the capital market instruments that are widely known by the public is stocks. Stocks are proof of partial ownership of the company. Publicly listed companies that have issued their stocks on the capital market consist of various types of companies that are grouped according to their fields of business into various sectors. Each sector of companies listing on the Indonesia Stock Exchange (IDX) has a different price, so the return rate is also different.

Return is the return (profit or loss) obtained from a stock investment. Investor invests in stocks will get a profit (*capital gain*) when the stocks are resold and got dividends (*profit sharing*) every year. Getting the maximum return is the hope of investors. Return can motivate investors to invest and is a courage for investors to bear the risk of their investments. Therefore, the company always provides information about the rate of return as expected by investors (*stock returns*) in the form of capital gains and dividends.

The industrial sector, which is listed on the Indonesia Stock Exchange (BEI) has experienced development. Many types of businesses are developed, ranging from service companies, trade, and others. One of the largest industrial scale today is manufacturing. Manufacturing companies are companies with good prospects considering the rapid population growth. This is a strategic sector for investment. Manufacturing companies have the largest number of issuers compared to the number of listed companies on the Indonesia Stock Exchange (IDX) which is divided into several sectors, such as the basic and chemical industry sector, various industry sectors, and the goods and consumption industry sector. Based on the profile of listed companies in the Indonesia Stock Exchange (IDX), as many as 625 issuers and 162 manufacturing companies as listed companies, if presented as total is 25.92%. With such a large amount, manufacturing companies have a significant influence on the dynamics of stock trading on the Indonesia Stock Exchange (www.idx.co.id).

Much research has been done on CAPM and APT testing of stock returns. Research conducted by Febriantiwi, *et al.* (2019) shows that the CAPM model is more precise or accurate than the APT model in predicting stock returns. Similarly, research conducted by Komaini, *et al.* (2018) which explains that the CAPM model is more accurate than the APT model in predicting stock returns. In contrast, to research conducted by Juwana (2014) which concluded that, APT is a more accurate model used in calculating expected returns from stocks compared to CAPM. Research conducted by Ibrahim, *et al.* (2017) shows that, the APT model is more accurate than the CAPM model.

Seeing the phenomenon of stock returns and the existence of conflicting previous studies, thus reinforcing the need for further research in predicting stock returns using the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The purpose of this study is to analyze the Capital Asset

Pricing Model (CAPM) or Arbitrage Pricing Theory (APT) which is more accurate in predicting stock returns on manufacturing companies listed on the Indonesia Stock Exchange for the 2015-2018.

This study aims to compare the accuracy of the CAPM and APT methods in calculating stock returns in manufacturing companies listed on the Indonesia Stock Exchange for the period 2015-2018. The results of research conducted by Juwana (2014) conclude that, APT is a more Accurately used in calculating expected returns of stocks compared to CAPM. Comparison of the two methods was carried out by the comparison method of the mean difference test, Davidson and Mckinnon, and posterior odds ratio. All three tests give the result that APT is a more appropriate method in calculating expected returns. Similarly, research conducted by Ibrahim, *et al.* (2017) which shows that the APT model is more accurate than the CAPM model in predicting stock returns. This is seen from the MAD APT value (0,0797)<MAD CAPM value (0.0802). However, both of them there is no significant difference.

In contrast to studies conducted by Fibrantiwi *et al.* (2019) which shows that the MAD CAPM value is smaller than the MAD APT value. It means, the CAPM method is more accurate than the APT model in predicting expected stock returns. Research conducted by Komaini, *et al.* (2018) also shows that, the CAPM model is more accurate in predicting stock returns than the APT model. This can be seen from the MAD CAPM value (0.629) <MAD APT (3,308).

2. RESEARCH METHOD

In determining the population and sample in this study are manufacturing companies listed on the Indonesia Stock Exchange for the 2015-2018 period with certain criteria. The sample collection method used is the purposive sampling method. The criteria for sampling are as follows: (1) Manufacturing companies that have not been delisted from the Indonesia Stock Exchange during the study period; (2) Manufacturing companies included in the 100 biggest capitalization markets for the period December 2018; (3) Manufacturing companies that have accountable financial statements.

The type of data used in this study are secondary time series secondary data on closing prices and CSPI, and monthly time series on macroeconomic variables. The data sources used in this study are as follows: (1) A list of stocks of manufacturing companies incorporated in the Indonesia Stock Exchange (IDX) for the period January 2015 to December 2018, obtained from the website www.idx.co.id; (2) Monthly data on closing prices of manufacturing companies' stocks that are consistently listed on the Indonesia Stock Exchange from January 2015 to December 2018, obtained from the website www.finance.yahoo.com; (3) Monthly data on Composite Stock Price Index (CSPI) of manufacturing companies listed on the Indonesia Stock Exchange from January 2015 to December 2018, obtained from the website www.finance.yahoo.com; (4) Monthly data on inflation, exchange rates (Rp / USD) and interest rates for the period January 2015 to December 2018, obtained from publication data www.bi.go.id and www.sahamok.com.

The analysis of data used in this study are as follows.

2.1 Calculating the Expected Return of Manufacturing Company Stocks on the Indonesia Stock Exchange using the CAPM Method

Expected return is the income of each stock expected by investors in the future. By using the CAPM method, the expected return can be calculated using the following formula (Bodie, *et al.*, 2016)

$$E (ri) = rf + \beta_i [E (rM) - rf]$$

Information:

$E (ri)$	= Expected return of the <i>i-th</i> asset
$E (rm)$	= Expected return on the market portfolio
rf	= Risk free interest rate
$E (rM) - rf$	= Market risk premium
β_i	= <i>i-th</i> 's asset risk

Based on the formula above, there are several variables used. Then the variables related to the CAPM formula above are:

(1) Actual return Selected Manufacturing Company Stocks on the IDX (Ri)

Based on understanding *return*, that return is the result obtained from investment. Stock returns can be calculated using the following formula:

$$\text{Return Stock} = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Information:

P_t = Investment price now
 P_{t-1} = Investment price in the past period

(2) Market Return (R_m)

Market Return is the income earned by investors in the future. Market return can be calculated using the following formula:

$$R_m = \frac{IHS G_t - IHS G_{t-1}}{IHS G_{t-1}}$$

Information:

R_m = Return market
 $IHS G_t$ = Composite stock price index in period t
 $IHS G_{t-1}$ = Composite stock price index in the t-1 period

(3) Beta (β)

Beta is a measuring tool *volatility* between stock returns and the market as a whole. Beta value is considered to be able to measure the risk of well-diversified stocks beta is also considered as a tool to measure stock sensitivity to price changes (Gojali, 2011). The beta of an asset i, denoted by β , can be expressed by the following formula (Bodie *et al*, 2016):

$$\beta = \frac{Cov(r_i, r_m)}{\sigma^2 M}$$

Information:

Covarians r_i, r_m = $\sum (r_i - E(r_i)) (r_m - E(r_m))$
 r_i = Return stock
 r_m = Return market
 σ = Variance of market return
 σ = $\frac{(r_m - E(r_m))^2}{n}$

2.2 Calculating the Expected Return of Manufacturing Company Stocks on the Indonesia Stock Exchange using the APT Method

Based on the formula for calculating expected return with the APT model in the previous chapter, the formula for expected return with three factors that will be used in this study is shown by the following formula:

$$E(r_i) = R_f + (R_{inflation} - R_f) b_{inflation} + (R_{Exchange Rate} - R_f) b_{Exchange Rate} + (R_{Interest Rate} - R_f) b_{Interest Rate} + e_i$$

Information:

R_i = Level of expected security gains i
 R_f = Return of risk-free stock
 $R_{inflation}$ = Expected return of inflation which affects the return stock
 $R_{Exchange Rate}$ = Expected return that affects the exchange rate return stock
 $R_{Interest Rate}$ = Expected return interest rates are affect stock returns
 $b_{inflation}$ = Sensitivity of stock returns to inflation
 $b_{Exchange Rates}$ = Sensitivity of stock returns to exchange rates (Rp / USD)
 $b_{Interest Rate}$ = Sensitivity of stock returns to interest rates
 e_i = Random error with mean=0 and standard of deviation $\sigma^2 e_i$

Based on the formula above, there are several variables used. Then the variables related to the APT formula above are:

(1) Actual Return of the Selected Manufacturing Company Stocks on the IDX (R_i)

Actual return of the APT model is the same as the actual return on the CAPM model, then the actual return is also calculated with the same formula, namely:

$$\text{Return Stock} = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Information:

- P_t = Investment price now
- P_{t-1} = Investment price in the past period

(2) Income of Risk-Free Assets (R_f)

Income of risk-free asset used is income derived from the monthly interest rate. Interest rates are obtained from Bank Indonesia Certificates.

(3) Calculate Beta (β)

Bodie (in Aqli, 2015) explained that in contrast to CAPM which is sensitivity return stock i (R_i) to market return (R_m), while beta in APT is the sensitivity of stock return i (R_i) to a factor (F). Then the beta formula (β) in APT is as follows:

$$\beta = \frac{Cov(r_i, F)}{\sigma^2 F}$$

(4) Surprise Factor (R)

Husnan (in Aqli, 2015) explained that surprise factor is the difference between the actual value and the expected value of a factor. In APT, more than one factor can be affected stock returns. This study uses a three-factor APT model and is the same as the factor used by Umi Rosyidah (2018), namely CPI inflation (Consumer Price Index), the rupiah exchange rate (Rp / USD) and the interest rate of SBI (Bank Indonesia Certificate).

Changes in the inflation rate (R_1) which is not expected is the difference in expected inflation rate changes (Aqli, 2015). The expected change founds in inflation is calculated using the Exponential Smoothing method.

$$R_1 = \text{Inflation}_{\text{actual}} - \text{Inflation}_{\text{expected}}$$

$$\text{Inflation}_{\text{actual}} = \frac{\text{Inflation}_t - \text{Inflation}_{t-1}}{\text{Inflation}_{t-1}}$$

Changes in exchange rates (IDR/USD) (R_2) which is not expected is the difference between the actual exchange rate (IDR/USD) and the expected exchange rate (IDR/USD) (Aqli, 2015). Expected exchange rate is calculated using the Exponential Smoothing method.

$$R_2 = \text{Exchange Rate}_{\text{actual}} - \text{Exchange Rate}_{\text{expected}}$$

$$\text{Exchange Rate}_{\text{actual}} = \frac{\text{Exchange Rate}_t - \text{Exchange Rate}_{t-1}}{\text{Exchange Rate}_{t-1}}$$

Changes in SBI interest rates (R_3) which is not expected is the difference in expected SBI interest rate changes (Aqli, 2015). Expected changes in SBI interest rates are calculated using the Exponential Smoothing method.

$$R_3 = \text{SBI}_{\text{actual}} - \text{SBI}_{\text{expected}}$$

Exponential writing technique is a procedure that can continuously revise forecasting results with the latest information. The following is the equation of the *Exponential Smoothing* method (Rosyidah, 2018):

$$Y_t = \alpha Y_{t-1} + (1-\alpha)F_{t-1}$$

Information:

- Y_t = Period forecast value t
- α = Weighting of *smoothing* ($0 < \alpha < 1$)
- Y_{t-1} = Actual rate of the previous period
- F_{t-1} = Forecasting of the previous period

2.3 Selection of Accurate Methods

To determine an accurate method between the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT), in this study using Mean Absolute Deviation (MAD). The smaller the MAD value, the better or more accurate the method. MAD value can be calculated by the formula (Rosyidah, 2018):

$$MAD = \frac{\sum |R_i - E(R_i)|}{n}$$

Information:

- MAD = Average of absolute deviation
- R_i = Return actual of stock i (actual return)
- $E(R_i)$ = Return expected of stock i (expected return)
- n = Amount of data

3. RESULTS AND DISCUSSION

To determine an accurate method between the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT), in this study using Mean Absolute Deviation (MAD). The smaller the MAD value, the better the method. The results of the calculation of the Mean Absolute Deviation (MAD) can be seen in the table below:

Table 2. Mean Absolute Deviation (MAD) of CAPM and APT model

No	Code	Company name	MAD CAPM	MAD APT
1	ASII	Astra International Tbk	0,0366	0,1173
2	IKAI	Intikeramik Alamasri Industri Tbk	0,3788	0,5232
3	UNVR	Unilever Indonesia Tbk	0,0584	0,3292
4	HMSA	Hanjaya MandalaSampoerna Tbk	0,0527	0,6181
5	CPIN	Charoen Pokphand Indonesia Tbk	0,0926	0,4414
6	GGRM	Gudang Garam Tbk	0,0577	0,1665
7	INKP	Indah Kiat Pulp & Paper Tbk	0,1271	0,1807
8	SMGR	Semen Indonesia (Persero) Tbk	0,0596	0,466
9	INDF	Indofood Sukses Makmur Tbk	0,0475	0,1212
10	BRPT	Barito Pasific Tbk	0,1412	0,3053
11	INTP	Indocement Tunggul Prakasa Tbk	0,0664	0,3527
12	PTSN	Sat Nusapersada Tbk	0,1558	0,3321
13	ULTJ	Ultra Jaya Milk Industry and Trading Company Tbk	0,0696	0,3227
14	INAF	Indofarma Tbk	0,2529	0,673
15	TKIM	Pabrik Kertas Tjiwi Kimia Tbk	0,1456	0,2868
16	KLBF	Kalbe Farma Tbk	0,0397	0,2773
17	JPFA	Japfa Comfeed Indonesia Tbk	0,108	0,2736
18	TPIA	Chandra Asri Petrochemical	0,111	0,3059
19	SMCB	Holcim Indonesia Tbk	0,0893	0,4023
20	KBLI	KMI Wire & Cable Tbk	0,1015	0,7674
Average			0,1096	0,3631

Source: Author's estimation

Based on the calculation of Mean Absolute Deviation (MAD), the CAPM model has a value of 0.1096 and the APT model has a value of 0.3631, this shows that the CAPM method is better than the APT method in predicting stock returns of manufacturing companies listed on the Indonesia Stock Exchange period 2015 - 2018. The smaller the value of Mean Absolute Deviation (MAD), it indicates that the regression model is more precise or more accurate in predicting the dependent variable, namely stock returns.

This is in accordance with previous research conducted by Fibirantiwi *et al.* (2019) which shows that the MAD CAPM value is smaller than the MAD APT value, which means the CAPM method is more accurate than the APT model in predicting expected stock returns. And research conducted by Komaini, *et al.* (2018) which shows that, the CAPM model is more accurate in predicting stock returns than the APT model. This can be seen from the MAD CAPM value (0.629) < MAD APT (3,308).

4. CONCLUSIONS

This study aims to examine the differences in accuracy between the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) in predicting stock returns of manufacturing companies listed on the Indonesia Stock Exchange for the 2015-2018 period. The conclusions that can be drawn from this study are: (1) Expected return value that is calculated by the highest CAPM model is owned by

TPIA that is equal to 0.07834, while the lowest expected return value is owned by CPIN that is -0.04670. Based on the calculation of stocks of UNVR, GGRM, INDF, INTP, KLBF, and TPIA are undervalued stocks; (2) The value of expected return calculated by the highest APT model is owned by KBLI, that is 0.78542. While the lowest expected return value is owned by TPIA that is -0,24766. Based on calculations, besides stocks of BRPT and TPIA are undervalued; (3) Based on the calculation results, the CAPM model is more precise or accurate than the APT model in predicting stock returns of manufacturing companies listed on the Indonesia Stock Exchange in the period 2015 - 2018. This can be seen from the calculation of Mean Absolute Deviation (MAD), the CAPM model has a value of 0.1096, while the APT model has a value of 0.3631. The smaller the value of Mean Absolute Deviation (MAD), it indicates that the regression model is more precise or more accurate in predicting the dependent variable, namely stock returns; (4) Based on the calculation results, it shows that hypothesis is accepted. It means, the CAPM model is better than the APT model in predicting the manufacturing company's stock returns listed on the Indonesia Stock Exchange for the period 2015 - 2018.

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