

Comparison Analysis Between Accuracy of CAPM and APT Models in Predicting Return of IDX-30 Stocks during Covid-19 Pandemic

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This study is done to analyze and compare the accuracy of Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) Model in predicting stocks' actual return. The purpose of the study is to find the discrepancy of accuracy of CAPM and APT models in predicting company stocks' return registered in IDX-30 index from Indonesian Stock Exchange from January 2020-2022. The period is chosen because of the Covid-19 pandemic in Indonesia. The chosen stocks are the stocks which have positive return, never leave the index, never have any changes in stocks' amount in major and minor evaluation, never do stock split, and have routine dividend payout along the study's period. The result is there is a significant difference between CAPM and APT models in predicting the actual return based on the result from t-test independent samples. Observed from the Mean Absolute Deviation (MAD) of the two models, CAPM model MAD is smaller than those from APT model, thus CAPM is the more accurate model in calculating return from IDX-30 stocks from January 2020-2022.

INTRODUCTION

Investing is developing rapidly in all layers of society, whether they are common civilians or bona fide investors, thus increasing the enthusiasm and attracting more people to invest in the stock market. With developing economy and advanced technology, it is easier these days to start investing. The progress in stock market is also supported by the progress of technology especially in digital-based economy which gives more effectivity. Looking at the development of digital era, Indonesian Stock Exchange can make way for easier investing, more so with the rapid progress of fintech service that enables Indonesian society to freely access and invest in the stock market. That's why, stock market has a very important role for Indonesian economics especially for investors. If a country can attract investor's fund, then the country's income will also increase thus helping to stabilize the economy. The same principle also applied in Indonesia where foreign investors are also attracted to invest their funds in Indonesia (Tandelilin, 2010).

Investment is one of the most frequent sources of funding in a company. Investing is mostly done in stock market where stock asset is the most used instrument for investment. There are two main problems for investors, rate of return and rate of risk. Investors are willing to gain return as expected, but these two rates of risk and return are positively correlated-the higher the expected return, the higher the risk.

Investors when buying stocks are expecting the highest return with the lowest risk possible. Investors need to decide when investing by looking at the expected return with accurate prediction. Therefore, investors need a plethora of ways to make said decision to get

the investment's result as hoped. Investors also need to look out for undervalued and overvalued stocks. When choosing stocks in the market, investors need to calculate expected return with specific models. Two of the most used models are Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) Model.

Capital Asset Pricing Model (CAPM) was introduced by Sharpe in 1964 and Lintner in 1965 where the model is used to decide what to invest in equilibrium condition. Rate of return expected in an equilibrium state by an investor will be determined by the stock's risk. And then, Stephen A. Ross in 1976 formulated the Arbitrage Pricing Theory (APT) Model with assumption that the expected return will be influenced by many factors in economy and industry. But both CAPM and APT assume that there is a positive correlation between expected return and risk.

Based on the explanation above, the question is, is there any difference between the accuracy of CAPM and APT models to estimate the expected return. Thus, this study is conducted to determine the accuracy of CAPM and APT models in estimating the expected return of stocks registered in IDX-30 index of Indonesian Stock Exchange from January 2020-2022. The goal of the study based on this problem formulation is to find the difference of accuracy between CAPM and APT models in predicting the stocks' return of listed companies in IDX-30 index of Indonesian Stock Exchange from January 2020-2022. This period is chosen because of the Covid-19 pandemic in Indonesia.

LITERATURE REVIEW

Investment

Investment is a commitment that focuses on an amount of money in present time for some period with the expectation of getting return in the future to compensate investors for (1) the amount of time given, (2) the inflation forecast in this period, and (3) uncertainties of income in the future (Reilly and Brown, 2012). According to Jogiyanto (2010), investment is the postponement of consumption today to be put into productive assets for some time. Thus, it can be concluded that investment is a form of commitment of funds in the present time with the expectation of fruitful return in the future.

Return

If we talk about investment, then it's always connected to the expected return. Return is the result of investing and can be actual or expected. Actual return is the already realized one, and expected return is the amount one hoped to get in the future (Jogiyanto, 2010). When investing, risk will be correlated with return. It shows that investment will not give a certain return. Some investors will only expect some rate of return. The expectation is shown as expected return. The probability for expected return can't be forecasted from the data in the past. So, expected return must be calculated by dividing the amount of the return by the number of observations in some period (Husnan, 2015).

Risk

Risk from a stock and the market's risk can be measured from the stock's beta. Beta is the measurement of a systematic risk from a stock or a portfolio that correlates with the market. Beta is calculated by dividing correlated risk between stocks and market with the market's risk. Calculation of beta is decided with volatility measured by covariance, thus covariance between stocks can be surmised from market's return. When the covariance relates to the market's risk,

the result will determine the risk of stock-i according to the market's risk or can also be called beta (Jogiyanto, 2010).

Capital Asset Pricing Model

Capital Asset Pricing Model (CAPM) is a model for the price of an asset. The model is based on the equilibrium state where the required return of a stock by an investor will be influenced by the stock's risk. In this case, the calculated risk is the systematic risk, or the risk measured by beta. When using CAPM to analyze portfolio, one important thing to note is to choose stocks index that represents the actual portfolio. The goal of CAPM analysis is to explain the correlation stability between risk and return. Usually, the desired goal is to explain the balance in money market to determine the minimum required rate of return form a risky investment (Jogiyanto, 2010).

Arbitrage Pricing Theory

Arbitrage Pricing Theory (APT) is a study that shows how an asset and the market price, also a decision that tries to explain how an asset and the price in market and what is the right investment decision (Fahmi, 2015). Arbitrage itself is a way to gain profit without risk by utilizing chance from the difference of an asset's price with the same physical security. This can be done by buying security or commercial paper when low-priced and sell it when the price gone up is the arbitrage method of investment (Komaini, 2018).

Stock

CAPM and APT analysis usually uses stock as an asset, where stock is the proof of capital investment in a company. Buying a company's stocks means that investor will invest some of capital that will be used for that company's operational (Cherie, 2014). Stocks got many information that could influence the price, which are:

- News about the success of a company's research
- Government announcement on Gross National Product (GNP)
- News about malfunctioning on competitor's product
- Unexpected decline of interest rate
- Unexpected increase of sales (Husnan, 2015).

Analysis also calculates risk, which can be defined as the probability of loss suffered by the investor. Risk can also be regarded as uncertainty of return gained in the future (Maftuhah, 2014). Risk can be stated as a relation of deviation with the expected outcome. Risk defined by Van Horne and Wachowics, Jr. as the variability of return related to the expected return. Generally, risk can be calculated using standard deviation formula. Standard deviation formula measures the absolute deviation of the actual value from the expected value (Jogiyanto, 2010). Risk usually can be minimized with diversification or choosing lots of stocks to invest in. Basically, in diversification, there are two risks: systematic and unsystematic. Systematic risk is the risk that can't be reduced by diversification, and unsystematic risk is the risk that can be reduced with diversification. In the risk calculation, the most relevant and countable is the systematic risk (Husnan, 2015).

Study of accuracy from CAPM and APT models have been done by Laia and Saerang (2015) by comparing those models to analyze investment in national foreign exchange private general bank stocks that is registered in IDX. The method used to determine the accuracy is Mean Absolute Deviation (MAD) method and the significancy is tested using paired sample t-test. The result showed that CAPM is not accurate to predict the expected return in national foreign exchange private general banks. Another thing showed is that APT model with three

macroeconomic factors is more accurate in predicting return from national foreign exchange private general bank.

Another study was done by Ibrahim (2017) by compare g accuracy analysis of CAPM and APT models in predicting expected return from actual return LQ45 stocks in IDX. The study also utilized MAD method which is then tested using independent sample t-test. The result showed that there is no significant difference between CAPM and APT models in predicting expected return from actual return in LQ45 stocks. This is shown by the difference between the average MAD of CAPM and APT models is so minuscule that both CAPM and APT models are not an accurate way to predict expected return from actual return of LQ45 stocks in IDX.

METHOD

This study a quantitative study, where the variables analyzed and compared are portfolio of IDX-30 stocks using CAPM and APT models, with Mean Absolute Deviation (MAD) approach. The data is secondary data, taken from BEI to determine the BI 7-day Repo Rate as the return of risk-free asset and Yahoo! Finance website to get IHSG closing price and the closing price from stocks member of IDX-30 from January 2020-2022, which will be chosen with purposive sampling style. From 30 stocks member of IDX-30 in the beginning of January 2020, those will be included in the sample are stocks that: (1) never left the index until January 2022, (2) never had any changes to the stock amount in major and minor review of IDX-30, and (3) never did stock split in this study period. The calculation formula used are described in this following table.

Table 1. Variable Calculation Formula

No	Variable	Formula
1	Stock's return (R _i)	$R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$
2	Market's return (R _m)	$R_m = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}$
3	Expected return (E(R _i))	$E(R_i) = \frac{\sum R_i}{n}$
4	Risk-free return (R _f)	$R_f = \frac{\sum SBI}{12}$
5	Stock's beta	$\beta = \frac{\sigma_{im}}{\sigma_m^2}$
6	Inflation rate changes	$pInflasi = \frac{Inflasi_t - Inflasi_{t-1}}{Inflasi_{t-1}}$
7	Interest rate changes	$pSBI = \frac{SBI_t - SBI_{t-1}}{SBI_{t-1}}$
8	Currency exchange rate changes	$pKurs = \frac{Kurs_t - Kurs_{t-1}}{Kurs_{t-1}}$

9	CAPM Formula	$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$
10	APT Formula	$R_i = E(R_i) + \beta_i F_1 + \beta_{2i} F_2 + \dots + \beta_{ni} F_n$
11	Mean Absolute Deviation	$MAD = E(R_{it} - E(R_{it}))$
12	Linear Regression Analysis	$Y_i = \beta_0 + \beta_i X_i$
13	Multiple Linear Regression Analysis	$Y_i = \beta_0 + \beta_i X_1 + \beta_{2i} X_2 + \dots + \beta_k X_{ki}$

Source: Muslih (2008)

RESULTS AND DISCUSSION

The list of selected stocks from IDX-30 from January 2020-2022 have been chosen with purposive sampling. Based on the inclusion criteria, from 30 stocks in IDX-30 from January 2020, 13 stocks were chosen as samples: ADRO, ANTM, ASII, BBNI, BBRI, BBTN, BMRI, CPIN, INKP, KLBF, PTBA, TLKM, and UNTR.

1. Actual return (R_i) of IDX-30 Stocks

Actual return is calculated based on the monthly closing price of IDX-30 stocks from January 2020-2022. To calculate the actual return, formula in Table 1 is used. The average of the actual return is shown on Table 2.

Table 2. Actual Return Average of Stocks January 2020-January 2022 Period

No	Stocks	Actual Return (R _i)
1	ADRO	0,0334
2	ANTM	0,0573
3	ASII	0,0002
4	BBNI	0,0129
5	BBRI	0,0015
6	BBTN	0,0190
7	BMRI	0,0061
8	CPIN	0,0016
9	INKP	0,0177
10	KLBF	0,0080
11	PTBA	0,0154
12	TLKM	0,0072
13	UNTR	0,0134

Source: Processed data

2. Risk-free Return (Rf)

Risk-free rate of return is calculated based on Indonesia Interest Rate (SBI) which is determined by Bank Indonesia. Interest rate is used as risk-free return because interest rate is one of the factors that influence economy, including investment. The risk-free rate has been calculated and determined to be 0,0387.

3. Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) Model

The calculation for CAPM and APT models is done using linear regression method by using Solver program in Microsoft Excel. CAPM is built with Simple Linear Regression Model, while APT model is built using Multi Linear Regression Model. In this case, only the beta coefficient is taken. This is because beta value is an important predictor to estimate return from both CAPM and APT model. Beta value can be positive or negative, where positive beta factor shows that an increase of a factor will also increase the stock's return, and vice-versa. On the other hand, negative beta value will show that an increase of a factor will decrease the stocks' return, and vice-versa. Beta value of the stocks are listed below.

Table 3. Beta Value of Stocks Related to Market, Inflation, Currency Exchange, and Interest Rate

No	Stocks	Market Beta	Inflation Beta	Currency Exchange Beta	Interest Rate Beta
1	ADRO	0,810623654	-0,031632373	-0,12132085	0,051357599
2	ANTM	2,554918711	0,081458693	-0,003961165	1,280955016
3	ASII	1,312862351	0,026790297	-0,62450922	-0,744557611
4	BBNI	2,173660004	-0,167194043	-0,786896182	0,084549124
5	BBRI	1,509574178	0,013842764	-0,533758057	0,161108363
6	BBTN	0,581581101	-0,121943184	-0,883143855	0,889963097
7	BMRI	1,520779477	0,081784191	-0,730632226	-0,720902058
8	CPIN	0,790432364	0,074821831	-0,063468187	0,147385332
9	INKP	1,665140762	-0,166134124	0,244721726	-0,906318293
10	KLBF	0,403516443	-0,14202307	-0,275349715	0,08962842
11	PTBA	0,638169681	-0,095599658	-0,104767867	-0,05874559
12	TLKM	0,971571685	-0,13025052	0,100028901	0,151277669
13	UNTR	0,599365698	-0,002327844	-0,174602739	-0,371924466

Source: Processed data

Based on the table, CAPM is built upon market beta, where all the value is shown to be positive. This shows that the changes of market's return will be positively correlated with stock's return. In other words, if market's return increases, stocks' return will also increase. In Table 3, some company stock's beta value > 1: ANTM, ASII, BBNI, BBRI, BMRI, and INKP, thus marking them as aggressive stocks. Beta value of the other companies are about 1, shows that their stock's return is about the same with market's return.

Next is the APT model, which is built upon inflation, currency exchange, and interest rate beta. It is shown that some of the value is negative or less than 1, marking them as defensive stocks. In other words, the stocks of those companies are defensive when related to three economic factors (inflation, currency exchange, and interest rate). The average negative beta

value shows that an increase in those factors will decrease the return of the stock, and vice-versa. But not all of the beta value is negative, there are some that shows positive value which means an increase in those factors will also increase those stock's return.

4. CAPM Expected Return

The result of expected return ($E(R_i)$) calculation with risk-free rate of 0,0387 can be seen in Table 4.

Table 4. CAPM Expected Return ($E(R_i)$)

No	Stocks	Actual (R_i)	Market Beta	$E(R_m)$	R_f	$E(R_i)$
1	ADRO	0,033411335	0,810623654	0,006127388	0,0387	0,01229587
2	ANTM	0,057328187	2,554918711	0,006127388	0,0387	-0,044520376
3	ASII	0,000229744	1,312862351	0,006127388	0,0387	-0,004063356
4	BBNI	0,012977263	2,173660004	0,006127388	0,0387	-0,032101784
5	BBRI	0,001581409	1,509574178	0,006127388	0,0387	-0,010470774
6	BBTN	0,019082713	0,581581101	0,006127388	0,0387	0,019756385
7	BMRI	0,006190018	1,520779477	0,006127388	0,0387	-0,01083576
8	CPIN	0,001665911	0,790432364	0,006127388	0,0387	0,012953553
9	INKP	0,017762535	1,665140762	0,006127388	0,0387	-0,015537984
10	KLBF	0,0080505	0,403516443	0,006127388	0,0387	0,025556416
11	PTBA	0,015407152	0,638169681	0,006127388	0,0387	0,017913147
12	TLKM	0,007264527	0,971571685	0,006127388	0,0387	0,007053373
13	UNTR	0,013468021	0,599365698	0,006127388	0,0387	0,019177094

Source: Processed data

Based on the table, stocks of BBTN, CPIN, KLBF, PTBA, and UNTR have lower actual return average (R_i) compared to the expected return ($E(R_i)$). It can be concluded that these stocks are not suitable to invest in. Other company that has higher actual return average compared to the expected return are more suitable to invest in. This is because they will give higher return compared to the expectation thus more profitable.

5. APT Model Expected Return

The calculation results of expected return ($E(R_i)$) with risk-free rate of 0,0387, and using $E(\text{Inflation})$, $E(\text{Currency Exchange})$, and $E(\text{Interest Rate})$ which is calculated from the average changes (p) of inflation, currency exchange, and interest rate during the study period, can be seen in the table below.

Table 5. APT Model Expected Return

Stocks	Actual $E(R_i)$	R_f	Inflation Beta	Currency Exchange Beta	Interest Rate Beta	$E(\text{Inflation})$	$E(\text{Currency Exchange})$	$E(\text{Interest Rate})$	$E(R_i)$
ADRO	0,033411	0,0387	-0,031632	-0,12132085	0,051357	-0,001910	0,002076	-0,014424	0,04169
ANTM	0,057328	0,0387	0,081458	-0,003961165	1,280955	-0,001910	0,002076	-0,014424	-0,03251
ASII	0,000229	0,0387	0,026790	-0,62450922	-0,744557	-0,001910	0,002076	-0,014424	0,10003
BBNI	0,012977	0,0387	-0,167194	-0,786896182	0,084549	-0,001910	0,002076	-0,014424	0,06981
BBRI	0,001581	0,0387	0,013842	-0,533758057	0,161108	-0,001910	0,002076	-0,014424	0,04912
BBTN	0,019082	0,0387	-0,121943	-0,883143855	0,889963	-0,001910	0,002076	-0,014424	0,02871
BMRI	0,006190	0,0387	0,081784	-0,730632226	-0,720902	-0,001910	0,002076	-0,014424	0,10043

CPIN	0,001665	0,0387	0,074821	-0,063468187	0,147385	-0,001910	0,002076	-0,014424	0,03015
INKP	0,017762	0,0387	-0,166134	0,244721726	-0,906318	-0,001910	0,002076	-0,014424	0,08463
KLBF	0,008050	0,0387	-0,142023	-0,275349715	0,089628	-0,001910	0,002076	-0,014424	0,04979
PTBA	0,015407	0,0387	-0,095599	-0,104767867	-0,058745	-0,001910	0,002076	-0,014424	0,04954
TLKM	0,007264	0,0387	-0,130250	0,100028901	0,151277	-0,001910	0,002076	-0,014424	0,03228
UNTR	0,013468	0,0387	-0,002327	-0,174602739	-0,371924	-0,001910	0,002076	-0,014424	0,06494

Source: Processed data

The table above shows that only ANTM can give actual return above the expected return, making it the most suitable company to invest in. The other company stocks besides ANTM got smaller actual return compared to the expected return, making them not suitable to invest in according to APT Model calculation.

6. Comparison Analysis Between CAPM and APT Model

The comparison between CAPM and APT models is done to determine the accuracy of these two models in predicting stock's return. To determine the accuracy of these models, Mean Absolute Deviation (MAD) value is calculated as shown below.

Table 6. MAD Value from CAPM and APT Models

Stocks	MAD CAPM	MAD APT
ADRO	0,0211154	0,008288098
ANTM	0,1018485	0,089840723
ASII	0,0042931	0,09980769
BBNI	0,0450790	0,056839587
BBRI	0,0120521	0,04754559
BBTN	0,0006736	0,009634509
BMRI	0,0170257	0,094243963
CPIN	0,0112876	0,028490232
INKP	0,0333005	0,066869088
KLBF	0,0175059	0,041739877
PTBA	0,0025059	0,034132933
TLKM	0,0002111	0,025025162
UNTR	0,0058090	0,051479149
Average	0,0209698	0,05030282

Source: Processed data

Based on the MAD calculation, CAPM has value of 0,0209698 while APT model has value of 0,05030282. This result shows that CAPM is more accurate in predicting the return of IDX-30 stocks in January 2020-2022 period compared to APT model. This is known by the smaller value of MAD is, then the regression model is more accurate in predicting the dependent variable that is stock's return. This comparison is supported by past research by Wahyunny (2020) that shows CAPM is more accurate in predicting stock's return by lookg athe the MAD value (MAD CAPM < MAD APT).

7. T-test Independent Sample in MAD Data of CAPM and APT Model

T-test is done to determine if there is a significant difference between CAPM and APT models. T-test calculation is done by looking at the hypothesis based on t-stat and two tailed t-critical. The test is done with the hypothesis of significance between CAPM and APT models. In Excel Solver function, there are two t-test with equal and unequal variance. To determine the equality of the variance we will be using F-test and compare the F with F-critical, as shown below.

Table 7. F-Test Using MAD Data of CAPM and APT Model

	MAD APT	MAD CAPM
Mean	0,050302816	0,020969854
Variance	0,000928304	0,000764191
Observations	13	13
df	12	12
F	1,214754111	
P(F<=f) one-tail	0,370789664	
F Critical one-tail	2,686637112	

Source: Processed data

Based on the table, it shows the F value to be 1,2147 while the F-critical one tail value is 2,6866. From the difference shown, F less than F-critical, the t-test used for significance is assumed having equal variance. T-test assuming equal variance is done to decide which of these hypotheses to accept:

Hypotheses used for t-test Independent Sample:

Ho: No significant difference between CAPM and APT Model

H₁: There is a significant difference between CAPM and APT Model

Basis to determine which hypotheses to accept:

If sig. t-stat < t-critical two tailed, then accept Ho

If sig. t-stat > t-critical two tailed, then reject Ho

The result of the test can be seen in Table 8 below. The t-test independent sample will be done using equal variance assumption.

Table 8. T-test Independent Sample Using MAD Data of CAPM and APT Model

	MAD APT	MAD CAPM
Mean	0,050302816	0,020969854
Variance	0,000928304	0,000764191
Observations	13	13
Pooled Variance	0,000846247	
Hypothesized Mean Difference	0	

Df	24
t Stat	2,570774354
P(T<=t) one-tail	0,008387285
t Critical one-tail	1,71088208
P(T<=t) two-tail	0,01677457
t Critical two-tail	2,063898562

Source: Processed data

The t-stat value is 2,5707 which is larger than t-critical two tailed value of 2,0638 thus rejecting Ho hypothesis that there is no significant difference between the accuracy of CAPM and APT model in calculating actual return. That means, there is a difference between the accuracy of CAPM and APT model where CAPM is significantly more accurate than APT model. In thus research, both models have the same estimation therefore tested using equal variances because each of the model got beta factor that is important to measure the return when related to stock's return estimating factor.

If there is a large error value on beta, then the accuracy of the model used will influence the calculation of the actual return of stocks. Besides, data used when calculating beta can have anomalies such as data normality, inhomogeneous variance, the presence of another free variable and correlation between present observation and past observation, among other things.

CONCLUSION

The conclusion from this study is there is a significant difference between CAPM and APT models in predicting stock's actual return. It is supported by two things:

- From the Mean Absolute Deviation (MAD) value from both models, MAD of CAPM is smaller than MAD of APT model. Smaller MAD value shows that CAPM is more accurate in calculating the prediction of actual return of IDX-30 stocks from January 2020-January 2022.
- Based on the result from t-test Independent Sample, t-stat value is higher than t-critical two tail which means the accepted hypothesis is there is a significant difference between accuracy of CAPM and APT model in calculating actual return of IDX-30 stocks' return.

Our suggestions are the needs of further study to analyze the accuracy of CAPM and APT models for all the stocks in IDX-30 without eliminating any of the stocks based on leaving the index or not, stock split, and other criteria. And other macroeconomic factors can be tested to determine which factors influence stock's price the most.

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