Jurnal Manajemen
e-JM
E-ISSN: 2549-8797
ISSN: 1410-3583

Testing The Indonesian Stock Market Arbitrage Pricing Model

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Submitted *24-05-2022* ***Reviewed*** *19-08-2022* ***Revised*** *04-11-2022* ***Accepted*** *10-11-2022* ***Published*** *01-02-2023*

Abstract: This research aims to explain the return and risk premium using an APT model from the Indonesian stock market. The study uses a two-stage regression model. This study uses a sample of stocks included in the Kompas100 index. The stocks included in Kompas100 represent the market capitalization value from the Indonesian stock market. The originality of this research is the inclusion of foreign macro-factors and the use of surprise or unanticipated factors in the Pre-specified Macro-economic Arbitrage Pricing Theory Model. The results prove that there is a multi-factor APT model consisting of The risk premium for inflation, the risk premium for interest rates, and the risk premium for foreign macroeconomic factors represented by the Dow Jones index and the Shanghai index. The results of this study further strengthen the theory and previous research on the multi-factor APT model.
Keywords: Macroeconomic Pre-specified Variabel; Arbitrage Pricing Theory; two-stage regression model; Risk Premium.

Abstrak: Tujuan dari penelitian ini adalah untuk menjelaskan mengenai return dan premi risiko saham dengan menggunakan model APT di pasar saham Indonesia. Penelitian ini menggunakan model regresi dua tahap. Penelitian ini menggunakan sampel saham-saham yang masuk dalam indeks Kompas100 dengan alasan karena saham yang termasuk dalam Kompas100 mewakili kapitalisasi pasar di pasar saham Indonesia. Orisinalitas dari penelitian ini adalah memasukan faktor ekonomi makro luar negeri dan menggunakan nilai surprise/tidak terantisipasi dari faktor ekonomi makro yang ditentukan. Hasil pengujian membuktikan terdapat model multifactor APT yang terdiri dari Risk premium inflasi, risk premium suku bunga dan risk premium faktor ekonomi luar negeri yang diproksikan oleh index Shianghai dan index Dow Jones. Hasil penelitian ini semakin menguatkan teori dan penelitian sebelumnya tentang model multifactor APT.
Kata Kunci: Variabel Makroekonomi Yang Ditentukan; Arbitrage Pricing Teori; Model Regresi dua tahap; Risk Premium.

INTRODUCTION

APT provides a theoretical framework that can explain stocks' expected return. Unlike CPAM, APT is a multi-factor model, which means that stocks' expected return is influenced by more than one factor. However, the weakness of the APT model is that it does not determine the number and the identity of those factors (Kumar, 2015), the most prominent limitation of the APT model that one is faced with is that the types and numbers of factors are not known upfront (Nyanga and Qutieshat, 2022). APT does not offer any guidance about what factors should be important or even how many factors should be included. The Arbitrage Pricing Theory is an elegant model with two pricing identifications. The earlier one is called Factor Likelihood APT (FLAPT), while the latter one is referred to as Pre-specified Macroeconomic Variables APT (PMVAPT). The pre-specified, like the factor likelihood model, assumes that market risk can be captured best using multiple macroeconomic factors and estimating betas relative to each. Unlike the factor likelihood, pre-specified do attempt to identify the macroeconomic factors that drive market risk (Torbira and Agbam, 2017),

(Torbira and Agbam, 2017), That the basis of factor choice is how far the factor impacts the expected cash flow and discounts. In other words, the chosen factors are those that change the discount rate or the expected cash flow or both. The economic variable is a factor that will affect the discount rate or the expected cash flow. Investors, in carrying out their activities, face two types of risks, such as systematic risk and unsystematic risk. The non-systematic risk from one company does not correlate with other companies. Conversely, the systematic risk will correlate with each company (stock). It is because the factors that influence systematic risk are the same, often referred to as macroeconomic variables. Therefore changes in macroeconomic variables will affect all companies (shares) (Hidayat et al., 2018).

Chen, Roll, and Ross was the first researcher who suggested giving the economic interpretation. His idea was that expected cash flows and discount rates are sensitive to the effect of macroeconomic variables. There was a lot of research, either using the Chen et al. model or developing the model. However, the results of the research are different in every stock market of every country. This shows that the factors in the APT model are not the same in every country. Similarly, in the matter of variable measurement, there are also differences. There was previous research that used real macroeconomic factors, and there was also previous research that used surprise/unanticipated. The previous research that used real macroeconomic factors was from (Torbira and Agbam, 2017, Ihsan et al., 2017), Khudoykulov, 2017), and Mohammad Khaled Rahman and Mazumder, 2021). The previous research that used surprise/unanticipated macroeconomic factors was (Sakr and Gebeily, 2016, Zunara and Hartoyo 2016 and French, 2017). Mahdy F. Elhusseiny et al., 2019)

The purpose of this research is to explore APT factors in the Indonesian capital Market, where these factors were not previously researched by Chen, Roll, and Ross as the first researchers of the APT model or other researchers who had conducted research with the APT model. This research will consider foreign macroeconomic factors besides domestic ones. The inclusion of foreign macro factors in the APT model is the originality of this research. The development of foreign macroeconomic factors has not been performed by previous researchers. The foreign macroeconomic factors here are those that are represented by the market index of countries that have a strong influence, and the countries that currently have economic power are the USA and Shanghai Stock Exchange (SSE). This research will also use surprise or unanticipated macroeconomic factors; thus, the research results can formulate the APT model for the Indonesian capital market.

THEORETICAL REVIEW

The uncertainty of the marketed stock prices is the general problem faced when investing in the stock market in all stock exchanges. The change in stock prices from one period to another causes the uncertainty of stock return. The existence of the uncertainty factor, when an investor buys a stock at the beginning of the period, he does not know how much stock return he will get at the end of the period.

Several models have been developed by financial experts in order to minimize uncertainties by developing models that can be used to predict the expected return. Two models of expected return determination that are mostly applied by various research are the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT).

CAPM is a model to determine the price of an asset (expected return) in equilibrium conditions. In equilibrium conditions, the required rate of return will be affected by the stock risk. In this case, the affecting risk is systematic risk measured by beta. CAPM is a single-factor model with a market index as an efficient market portfolio proxy, which is the only factor that explains the stock return.

Even though CAPM has developed and been highly used either by academics or practitioners, its ability to explain the change in stock return is still in doubt. Therefore, APT provides a theoretical framework that can explain stocks' expected return. Unlike CPAM, APT is a multi-factor model, which means that stocks' expected return is influenced by more than one factor.

The APT model explains that the correlation among stock returns happens because the stocks are influenced by a number of common factors in the economy and industry. As well as CAPM, the APT model uses beta as a risk measurer. However, in the scope of the APT model, beta is a sensitivity measurement of a stock on a number of factors, where those factors are not identified systematically yet.

Based on the explanation, it can be mentioned that the APT model is based on the factor model; this is the second assumption of the APT model. The APT model assumes that investors believe that stock return will be determined by a factorial model with a risk factor. However, the APT model approach does not specifically explain how many numbers of factors and what factors influence the stock returns. There are three methods from the previous researchers to formulate APT factors; the Principal Component Analysis (PCA) method, which was first performed by Gehr in 1978. The second approach is one in which a researcher starts at the estimated covariance matrix of asset returns and uses his judgment to choose factors and subsequently estimate the matrix. The third approach is purely judgmental in that it is one in which the researcher primarily uses his intuition to pick factors (Ihsan et al., 2017).

(Ihsan et al., 2017), Explained the factors in the APT model. They explained that the factors are not systematic, where specific events connected to a condition of a company or a company's specific factor are not a factor in the APT model. Factors in the APT model are those which cannot be predicted by the market because they contain unexpected information or surprise the market (there is a difference between the occurred value and the expected value). The factors are macroeconomic factors.

Nevertheless, the crucial thing that needs to be observed is the amount of deviation between the actual value of the risk factor and the expected one. For example, if the expected inflation increases to 10 per cent per year, and it turns out that the actual inflation is 12 per cent. Accordingly, the deviation is 2 per cent. This deviation value is the inflation risk that will affect return during that period.

The use of surprise macroeconomic factor as an explanatory variable of stock return is based on a consideration that stock returns traded at the capital market consist of normal return or expected return and risk return. Risk return is a part of the unanticipated return. From the above description, an actual return equation can be determined for the i stock by using the formula :

$$R_i = E(R_i) + b_1 f_1 + b_2 f_2 \ldots + b_n f_n \quad (1)$$

R_i = i stock actual return
$E(R_i)$ = i stock actual return expectation
f = deviation of F systematic factor of the expected value

Jurnal Manajemen
e-JM
E-ISSN: 2549-8797
ISSN: 1410-3583

b_i = sensitivity of i stock to i-th factor
ei = random error.

The form of the APT model can also be made by an assumption that the actual profit rate of each traded stock in the factor model consists of two components. First normal or expected profit rate; this profit rate is a part of the profit rate assumed (expected) by the stockholders. Second, uncertain or risky profit rate, this profit part is from unanticipated or surprising information.

R_i = E(R) + U .... (2)
R_i = Actual return of i stock
$E(R_i)$ = Expected return from i stock
U = Unanticipated return.

Unanticipated return is a risks that must be encountered by investors. The unanticipated return comes from factors affecting all companies (systematic risk), it can also come from a company's specific risk factor (unsystematic risk). The unsystematic risk of a company does not correlate with other companies. On the other hand, systematic risk will correlate with every stock. This is because the factors affecting the systematic risk are the same: the macroeconomic factors. Therefore, the change in macroeconomic factors will impact the entire stock.

R_i = $E(R_i)$ + U .... (3)
R_i = $E(R_i)$ + unanticipated return that comes from systematic risk + unanticipated return that comes from unsystematic risk.

Unsystematic return is not taken into account because this risk can be omitted by diversification. The amount of unanticipated return that comes from systematic risk depends on the sensitivity of i stock on k factor and the unanticipated change from macroeconomic factors. The unanticipated return will add to or reduce the amount of the actual return.

R_i = $E(R_i)$ + unanticipated return that comes from systematic risk. .... (4)
R_i = $E(R_i) + b_1f_1 + b_2f_{2\,.....} + b_kf_k$ .... (5)
b_{ik} = sensitivity of i stocks return on k factor.
f_{ik} = surprise of k factor, $[F_k - E(F_k)]$; factor actual value subtracted by its estimation value.

Factor model equation, then APT balance model is formed.

$E(R_i) = a_{ot} + b_{i1}\overline{f_{1t}} + b_{i2}\overline{f_{2t}} + \cdots b_{ik}\overline{f_{1k}}$ .... (6)
a_{ot} = Expected return from i stock if systematic risk equals zero.
b_{ik} = Expected return from i stock on surprise from k factor.
$\bar{f}_k$ = Risk premium for a surprise from k factor.

The equation of the APT model balance shows that in the APT model, the risk is identified as stock sensitivity on macroeconomic factors (b_k), and the amount of the expected return will be affected by that sensitivity. The APT model states that investors want to get compensation for the entire factors that systematically affect the stock return. The mentioned compensation is a total multiplication result between systematic risk quantity for k factor, measured by stock beta related to the factor, where the market price for the risk is measured by the expected return deviation of the factor with a risk-free interest rate.

The writing of the APT balance equation can also be explained as follows: if a_{ot} is substituted by R_o, $\bar{f}\,\bar{f}$ FK is substituted by $[F_k - E(F_k)]$, and b_{ik} is substituted by β_i, F_j, the equation will become APT equation; therefore, the APT formula can be explained as follows:

$$E(R_i) = R_o + \beta_{1,F1}[F_{k1} - E(F_{k2})] + \beta_{2,F2}\ [F_{k2} - E(F_{k2})] + .. + \beta_{i,FH}[F_{k3} - E(F_{k3}] \quad \text{.....................} \quad (7)$$

In this case, $E(R_i)$ is the expected profit rate for i stock. R_o is the expected return of i stock if all risk factors equal zero. F_1 is the actual value of the 1st factor. F_2 is the actual value of the 2nd factor, and so forth. $\beta_{i.F1}$ is the expected sensitivity of i stock return on the 1st surprise factor (the factor starts from 1 til k). $E(R_{F1})$ is the estimation value of the F_1 factor, $E(R_{F2})$ is the estimation value of the F_2 factor, and so forth.

The APT writing can also be explained as follows. If R_o is substituted by λ_o, β_i, F_j is substituted by b_i, and $[F_{k1} - E(F_{k2})]$ is substituted by λ_1, and so forth, consequently, the APT equation can be written as follows :

$$E(R) = \lambda_o + b_1\lambda_1 + b_2\lambda_2 + \ldots + b_k\lambda_k \quad \text{...} \quad (8)$$

Upon macroeconomic variable modelling approach, (Chen et al., 1986) researched macroeconomic factors, consisting of innovations in industrial production, expected inflation, risk premia, term structure of interest rates, selected market indices, changes in real consumption and oil prices, to estimate and implement the APT model. The results of industrial production, risk premia change, and yield curve change are significant factors; inflation expectation is also significant, although it is on a lower level.

Upon using models and factors that are similar to the research and developing the research, there has been a lot of research performed, either at the capital market of developed countries or at that of developing countries. Even though there are no similarities of macroeconomic factors found in the APT model, the macroeconomic variable modelling approach has been proven as a method that can be accepted as a multi-factor model.

Research the emerging market using a similar method to Chen et al. researched Egypt's capital market (Ihsan et al., 2017), and (French, 2017) researched five ASEAN countries (Singapore, Thailand, The Philipines, Malaysia, and Indonesia), At Johannesburg stock exchange by (Ndlovu et al., 2018), at Nigerian capital market by (Michael et al., 2021) also (Obafemi et al., 2021), at Indian capital market (Yadav, 2021), at Tanzania capital market by (Gwahula, 2018), at Bangladesh Capital market by (Mohammad and Mazumder, 2021).

The increase in the inflation rate will trigger tight economic policy that, in its turn, will increase the nominal risk-free rate. Consequently, the discount rate increases as well. Moreover, cash flow will decline first because the adjustment of the cost is compared to that of the selling price because of the increase in the inflation rate. The increase in the inflation rate can also affect the discount rate, so it decreases the current value of the company's future cash flow. The increase in the inflation rate will increase the price of goods and services;

thus, the consumption rate of goods and services will decrease. Moreover, the increase in production factor price will also increase the cost of the company's capital. Thus the influence of the inflation rate increase will decline the price of the stock. A high inflation rate raises the cost of living and results in a shift of resources from investments to consumption. The demand for market instruments falls, leading to a reduction in the volume of stock traded. The description referred to (Worlu and Omodero, 2017, and Ihsan et al., 2017). Inflation premium risk is an inflation risk sensitivity towards stock return expectation. The higher the inflation risk measured by inflation beta, the more it reduces the stock return.

Accordingly, we have constructed this hypothesis as follows;

H1: There is a significant negative relationship between the risk premium surprise of inflation and the stock return expectation.

The asset that can give capital gain benefit and dividend at once is stock-formed securities. Income from the stocks will highly depend on emittance performance, while one of the emittance performance depends on the performing loans from the banking sector. The higher the interest rate, the bigger the operational burden of the company is; this will affect the company's performance as well as its cash flow. The high-interest rate will increase the company's debt burden and decrease the future net income of the company.

The higher operational burden caused by the increase in interest burden will impact the decline of the company's profitability, and it will impact dividends that will be distributed to the investors. To the investors, it surely becomes uninteresting to invest in the stocks if the company's profitability declines. The high rate of interest causes society to opt for more of the instrument of risk-free investments, such as deposit or obligation instruments, compared to investments in the stock market. Therefore, the interest rate has a negative effect on stock return. In theory, interest rates and stock prices have a negative correlation. An increase in the interest rate causes investors to make a change in the structure of their investment, generally from the capital market to fixed-income securities. An increase in interest rate can result in low demand for non-essential items and services, which can have an impact on the company and its stock values. The description refers to (Amata et al., 2016, Gwahula 2018) and (Yadav, 2021). The risk premium of interest rate is interest rate risk sensitivity on stock return expectation. The higher the interest rate risk measured by interest rate beta, the more it decreases the stock return.

Accordingly, we have constructed this hypothesis as follows;

H2: There is a significant negative relationship between the risk premium surprise of interest rate and the stock return expectation.

The change of rupiah currency against USD can affect the company caused of transaction exposure. During financing, companies in Indonesia abundantly use finance sources from debts in USD currency. The number of Indonesian companies' debts in USD can cause a decline in their financial performance caused by the increase in the debt burden. Consequently, it increases leverage risk affecting the stock demand decline. Currency depreciation encourages export, but at the same time, it increases production expenses exceeding income and its export products. Therefore, a reduction in the company's cash flow still keeps occurring because of the currency depreciation. In developing countries where enormous foreign exchange is needed, and businesses are intensively hit by domestic exchange rate depreciation, the explanation is supported by (Khudoykulov, 2017) and (Ndlovu et al., 2018). A higher exchange rate could lead to decreasing demand for exports, so sales decline, and thus, stocks decrease (Celebi and Hönig, 2019). The risk premium of rupiah/USD currency is The rupiah/USD currency risk sensitivity on stock return expectation. The higher the rupiah/USD currency risk measured by rupiah/USD currency beta, the more it declines the stock return.

Accordingly, we have constructed this hypothesis as follows;

H3: There is a significant negative relationship between the risk premium surprise of the Rupiah/USD currency and the stock return expectation.

The price fluctuation of oil will affect real sectors, either on the supply or demand side. From the supply side, this impact is related to production cost, where oil is a production input. As a result, the increase in oil prices causes an increase in the overall production cost, the increases in raw material cost, transportation cost, and employee wages. The increase in the fuel price will increase the company's expected cost, which will decline the expected earnings of the company, where in the end, it will decline the company's profit.

From the demand side, the change in the oil price affects consumption and investment. Consumption is directly affected by a positive relationship with disposable income. The increase in fuel prices reduces consumers' buying ability. The reciprocal relationship between the rise of production cost and the fall of people's purchasing power means to weaken the overall economic cycle in Indonesia. This condition can influence the overall investment climate, either in the short term or the long one. In the short term, the rise of the fuel price is addressed by the capital market actors as negative information that will disturb investment. The description is in accordance with the explanations of (Ihsan et al., 2017) and (Mahdy et al., 2019). increases in oil prices would cause a rise in production costs and a subsequent fall in aggregate economic activity. This would cause lower stock market returns (Ihsan et al., 2017). The risk premium of oil price is the risk sensitivity of the oil price on stock return expectation. The higher risk of oil price measured by oil price beta, the more it declines the stock return.

Accordingly, we have constructed this hypothesis as follows;

H4: There is a significant negative relationship between the risk premium surprise of oil price and the stock return expectation.

Economic growth indicates that the current economic activity is higher than the previous period. The growth of the economy can be interpreted as the happening of increase in productivity, where the physical number of the produced goods or services rises and causes the rise of people's income and the decline of the unemployment rate. The rise of economic growth has a positive effect on people's purchasing power. Consequently, it can increase demand for the company's products. (French, 2017), (Amata et al., 2016).

The economic growth in the US and Shanghai Stock Exchange (SSE) shows the rise of productivity in both countries. The increasing economic condition will increase the demand for the import towards domestic company products (Indonesia). An increase in exports may represent a good indicator of economic growth and, thus, affect stock prices positively. A decrease in exports results in the contraction of firm activities and thus show negative implications on stock prices. (Mohammad and Elshqirat, 2019). The economic growth rate in a country can be reflected by the stock price index of the country. Strong markets, such as the United States and China, can influence weaker markets, such as Indonesia (Hidayat et al., 2018).

Dow Jones index and Shanghai Stock Exchange (SSE) risk premium is the risk sensitivity of the Dow Jones index and Shanghai Stock Exchange (SSE) towards stock return expectation. The lower the risk of the Dow Jones index and Shanghai Stock Exchange (SSE) measured by the beta index of Dow Jones and Shanghai Stock Exchange (SSE), the more it declines the stock return.

Therefore, hypotheses 5 and 6 can be formulated that the risk premium surprise of the Dow Jones index and Shanghai Stock Exchange (SSE) has a positive impact on stock return expectations.

METHODS

This research used samples of stocks in the Kompas100 index. The reason for choosing the Kompas 100 index is because the stocks in Kompas100 represent approximately 70 to 80 per cent of the market capitalization value in the Indonesian capital market. The observation period was from 2017 up to 2020, with no missing data in the period. This study uses monthly time series data from January 2017 to December 2020. The reason for using this timeframe is mainly to explain the current phenomenon, which can be explained in the previous few months, since using long-term data several years earlier is less realistic than the short monthly period as conducted in this study (Assagaf et al., 2019)

There are two variables that are used in the research model, stock return as a dependent variable, calculated from the change of stock t price reduced by stockt-1 price divided by stockt-1 price and six independent variables, which are surprise /unexpected /unanticipated value of macroeconomic factors calculated from actual value reduced by expectation value. The expectation value is calculated using an average value approach, similar to the return expectation calculation on the Markowitz portfolio model.

The arbitrage Pricing Theory (APT) model in this research uses the Ordinary Least Squares technique for the pre-specified macroeconomic variable, which is a two-stage regression model (Ihsan et al., 2017 and Torbira and Agbam, 2017).

First-stage Regression. First-stage regression is estimating sensitivity/loading factor generated by using the following regression equation:

$$R_i = \beta_0 + \beta_1 f_1 + \beta_2 f_2 \ldots + \beta_n f_n \qquad (9)$$

where ‘R_{it}' is the return at stock i during 't ', 'β_{ik}' is stock i sensitivity on factor k/ loading factor k, f_{kt} is the surprise time series of macroeconomic factor k.

Referring to equation (9), to estimate the loading factor of stock i return on macroeconomic factor, the following equation is used:

$$R_i = \beta_o + \beta_{iSINF} SINF + \beta_{iSSB} SIR + \beta_{iSNT} SXR + \beta_{iSOILP} SOILP + \beta_{sis} IS_{SSSE} SIS_{SSSE} + \beta_{ISUS} SIS_{DJ} \qquad (10)$$

R_{it} = stock i return

β_{iSINF}; β_{iSIR}; β_{iXR}; β_{iSOILP}; β_{SSSE}; β_{ISDJ} =loading factor or the standardized beta coefficient of stock i return on surprise inflation, surprise interest rate, surprise currency, surprise oil price, surprise Dow Jones index, and Shanghai Stock Exchange (SSE).

Classical assumption assessment was performed on the first stage of data processing, the stage to find β (stock return sensitivity) on surprise factors of macroeconomics in order that the generated data is not biased.

Second-Stage Regression. The loading factor/sensitivity factor obtained from the first-stage regression is then used as an independent variable in the second-stage regression. The dependent variable is the stock return average of each stock that becomes an analysis unit during the research period (36 months). The equation of the second-stage regression is formulated below:

$$R = \lambda_o + \lambda_1 \beta_1 + \lambda_2 \beta_2 + \ldots + \lambda_k \beta_k \quad (11)$$

The equation, in order to estimate risk premium, is generated through an equation below:

$$R = \lambda_o + \lambda_{sinf}\beta s_{inf} + \lambda_{SIR}\beta_{SIR} + \lambda_{SSXR}\beta_{SXR} + \lambda_{Soil}\beta_{Soil} + \lambda_{SSSE}\beta_{SSSE} + \lambda_{SDJ}\, \beta_{SSDJ} \quad (12)$$

Where:
R_i = The average of stock return during stock i research period
λ_o = Intercept that is basically a risk-free return
λ_{sinf}; λ_{SIR}; λS_{XR}; λS_{oil}; λs_{SSE}; λs_{Dj}= Risk premium of inflation surprise, interest rate surprise, Currency surprise, Oil price surprise, Shanghai Stock Exchange surprise, Dow Jones index surprise.
β_{SINF} β_{SIR} β_{SXR} β_{SOIL} β_{SSSE} β_{SDJ}: sensitivity of stock return on the inflation surprise factor, interest rate surprise, currency surprise, oil price surprise, Shanghai Stock Exchange surprise, Dow Jones Index surprise.

According to the APT model on ten equations, the research hypothesis is constructed below:

Ho : $\lambda_0 = \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$

This hypothesis means that risk factors of inflation, interest rate, currency towards USD, oil price, Shanghai Stock Exchange (SSE), and Dow Jones Index are not valued as risk factors in the APT model.

Ha : $\lambda_0 \neq \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq 0$

This hypothesis means that risk factors of inflation, interest rate, currency towards USD, oil price, Shanghai Stock Exchange (SSE), and Dow Jones Index are valued as risk factors in the APT model.

These hypothesis tests give two result probabilities:

F_{table} more than $F_{statistic}$ = Accept Ho or reject Ha
F_{table} less than $F_{statistic}$ = Reject Ho or accept Ha

The T-test is performed to know the partial effect of the risk of macroeconomic factors determined for stock return at the Indonesian Capital Market.

$$`t = \frac{\overline{\lambda_k}}{\frac{\overline{\sigma_k}}{\sqrt{n}}} \quad (13)$$

$\overline{\lambda_k}$ = Mean of risk premium
$\overline{\sigma_k}$ = Mean Deviation Standard of risk premium
n = number of observation

Jurnal Manajemen e-JM
E-ISSN: 2549-8797
ISSN: 1410-3583

Ho : $\lambda_i = 0$

This hypothesis means that the regression coefficient of λ_i (risk premium i) does not partially affect the stock return. It means that the risk factor is not the valued one.
Ha: λ_i less than 0

This hypothesis means that the regression coefficient of λ_i (risk premium i) partially has a negative impact on the stock return. It means that the risk factor is the valued one.

The results of the hypothesis assessment give two result probabilities :
t_{table} more than $t_{statistic}$ = Accept Ho or reject Ha
t_{table} less than $t_{statistic}$ = Reject Ho or accept Ha

RESULTS

First-Stage Regression. After performing a series of classical assumption assessments on each regression model and having met all requirements of the classical assumption assessment, furthermore first-stage regression assessment is performed in order to generate beta value for every variable of macroeconomics. The regression model is that with a dependent variable of monthly return for every research sample, and its independent variable is a monthly variable surprise of macroeconomics. Therefore, because there are 59 research samples, accordingly, there are 59 regression equation models.

β value is a stock return sensitivity on the surprises of inflation factor, interest rate, Rupiah/USD currency, oil price, Dow Jones Index, and Shanghai Stock Exchange (SSE). The result of β (stock return sensitivity) for all samples is 59 emittances below:

Table 1. Beta Calculation of First-Stage Regression

No	Code of Stock	INF Beta	IR Beta	XR Beta	Oil Beta	SSE Beta	DJ Beta
1	AALI	10.223	1.297	0.000	0.006	-0.775	2.383
2	ACES	-1.710	-4.582	0.000	0.001	0.033	0.723
3	ADHI	16.567	-2.22	0.000	0.007	-0.175	1.433
4	ADRO	3.049	5.745	-0.000	-0.003	0.361	0.734
5	AKRA	7.212	-3.228	0.000	0.080	0.502	0.900
6	ITEM	13.582	3.413	0.000	0.006	0.649	0.193
7	ASII	8.160	-2.828	0.000	0.001	-0.449	0.663
8	BBC	3.165	0.856	0.000	0.001	0.044	0.237
9	BBNI	10.549	-5.415	0.000	0.002	-0.272	1.197
10	BBRI	8.765	-5.084	0.000	0.001	-0.300	0.783
11	BBTN	14.411	-5.668	0.000	0.006	0.608	1.417
12	BEST	17.691	-6.178	0.000	0.011	-0.235	0.904
13	BJBR	5.552	1.078	0.000	0.004	0.011	0.878
14	BJTM	5.009	-1.375	0.000	0.005	-0.126	0.992
15	BMRI	8.979	-3.397	0.000	0.001	-0.045	0.389
16	BMTR	3.638	-0.275	0.000	-0.030	0.086	1.585
17	BSDE	12.095	-0.2345	0.000	0.005	0.047	0.642

Jurnal Manajemen e-JM
E-ISSN: 2549-8797
ISSN: 1410-3583

18	SPIN	3.636	0.986	0.000	0.002	-0.524	0.632
19	CTRA	10.653	-6.125	0.000	0.005	-0.053	1.246
20	ELSA	11.014	2.301	0.000	0.003	-0.113	1.485
21	EXCL	0.107	-4.331	0.000	0.001	-0.116	1.218
22	GGRM	3.449	-5.865	0.000	0.002	-0.176	0.69
23	HMSP	5.952	-3.004	0.000	0.003	-0.299	0.872
24	ICBP	1.537	-1.498	0.000	0.001	-0.373	0.249
25	INCO	3.108	4.649	0.000	0.005	0.804	0.768
26	INDF	2.425	-1.908	0.000	0.004	-0.347	0.568
27	INDY	3.921	-14.246	-0.000	0.003	1.121	1.750
28	INTP	6.214	-2.500	-0.000	0.001	-0.099	0.653
29	ISAT	4.401	2.903	0.000	-0.001	0.574	0.810
30	ITMG	6.214	-2.500	-0.000	0.001	-0.099	0.653
31	JPFA	5.681	-1.521	0.000	0.003	-1.336	1.501
32	JSMR	-3.540	-1.929	0.000	-0.030	0.325	-0.158
33	KLBF	-0.322	-0.302	-0.000	0.004	0.058	0.801
34	LPKR	2.004	-5.725	0.000	0.004	-0.124	1.881
35	LPPF	8.299	-0.700	0.000	0.005	-1.274	1.379
36	LSIP	6.995	4.343	-0.000	0.002	0.486	0.537
37	MAPI	3.339	-0.621	0.000	0.008	-0.613	1.903
38	MEDC	13.973	0.101	0.000	0.004	0.016	1.701
39	MIKA	5.103	-0.685	0.000	0.002	0.472	-0.009
40	MNCN	4.022	-0.505	-0.000	0.002	0.112	0.856
41	PGAS	9.346	0.529	0.000	0.004	0.215	1.115
42	PNBN	6.891	-6.233	0.000	-0.080	0.057	1.328
43	PTPP	13.240	-5.272	-0.000	0.008	-0.053	1.824
44	PWON	9.132	-8.961	-0.000	0.005	-0.259	0.989
45	RAILS	11.548	-3.661	-0.000	0.005	0.562	1.241
46	SCMA	12.251	-0.300	-0.000	0.004	-0.345	0.833
47	SMG	4.392	-6.808	0.000	0.003	-0.187	1.457
48	SMRA	11.975	-8.433	-0.000	0.007	-0.286	1.312
49	SOIL	5.152	-3.303	0.000	-0.030	0.260	0.755
50	SSIA	14.244	-8.196	-0.000	-0.002	0.253	-0.362
51	SSMS	2.909	1.647	-0.000	-0.003	-0.069	-0.309
52	TBIG	-6.120	3.036	-0.000	0.001	0.272	0.958
53	TINS	17.911	-1.803	0.000	0.008	0.966	0.412
54	TLKM	0.999	-2.399	0.000	-0.030	-0.304	0.672
55	UNTER	1.468	5.064	-0.000	-0.002	0.781	0.355
56	UNVR	0.814	-0.902	-0.000	0.003	0.085	0.391
57	WIKA	13.407	-9.763	-0.000	0.007	-0.066	1.368
58	WSKT	16.583	-2.425	-0.000	-0.080	0.038	1.366

59	WTON	11.650	-4.630	-0.000	0.005	0.784	0.963

Source: Data Processing Result

In most samples, the surprise beta of inflation, Shanghai Index, and Dow Jones Index have a positive β value. It means stock return has a movement in the same direction as that of the three variables. Surprise is a deviation between estimation and actual. Estimation is an average in the relevant year, and actual is what happens in the relevant year. Consequently, a positive surprise value means the movement of the three variables happening in the relevant month is lower than the average of the relevant year. It can be stated that the three variables declined or were low in that month. The lower the three variables, the more decline the stock return is, or vice versa.

In most samples, the surprise beta of interest rate, currency, and oil price has a negative β value. It means stock return has a movement in the opposite direction from that of the three variables. Surprise is a deviation between estimation and actual. Estimation is an average in the relevant year, and actual is what happens in the relevant year. Consequently, a positive surprise value means the movement of the three variables happening in the relevant month is lower than the average of the relevant year. It can be stated that the three variables declined or were low in that month. The lower the three variables, the more it raises the stock return or vice versa.

Most of the inflation and interest rate beta value has a value less than and more than 1. This indicates that the beta of inflation and interest rate is too sensitive to the return of the shares at the IDX. The oil price, exchange rate, Dow Jones and Shanghai Stock Exchange indexes beta value has a value of less than 1. This indicates that the beta of oil price, exchange rate, Dow Jones and Shanghai Stock Exchange indexes is not sensitive to the return of the shares at the IDX.

Second-Stage Regression. Second-stage regression aims to find λ (risk premium) of the surprise factor of inflation, interest rate, Rupiah/USD currency, oil price, Dow Jones Index, and Shanghai Stock Exchange (SSE). Data processing of the second-stage regression is by regressing between expected stock return and β (stock return sensitivity) that is gained from the first-stage regression. Below is the result of the second-stage regression:

Table 2. Risk Premium Calculation

Variables	Unstandardized Coefficients Beta	t	Sig
INF Risk Premium	-0.002	-1.924	0.060
IR Risk Premium	-0.005	-3.311	0.002
XR Risk Premium	-3.625	-0.043	0.966
OIL Risk Premium	0.014	0.051	0.960
SSE Risk Premium	0.052	4.212	0.000
DJ Risk Premium	0.023	2.092	0.041

Source: Data Processing Result

Risk premium calculation from the result of the second-stage regression presented in **Table 2**, the risk premium surprise of the Shanghai index, risk premium surprise of the Dow Jones index, and risk premium surprise of oil price show positive coefficients, which means that the increase of stock return sensitivity of Shanghai Index, Dow Jones Index, and the oil price has an effect on the rise of expected return. On the other hand, the risk premium of inflation, the risk premium of interest rate, and the risk premium of currency show negative coefficients, which means that the rise of stock return sensitivity of inflation, interest rate, and currency has an effect on the decline of the expected return. The result of the hypothesis test presented in **Table 2**. is risk premium of inflation, the risk premium of interest rate, and the risk premium of the Shanghai Index have a significant effect on the level significance of 5 per cent, while the risk premium of Dow Jones Index is on that of 10 per cent.

The risk premium coefficient is correlated to investors' characteristics towards risks. The positive risk premium is when the risk factor has an exposure undesired by the investors, and the negative risk premium is when the risk factor has an exposure accepted by the investors. The more positive the risk premium, investors will act to avoid the risks. Conversely, the more negative the risk premium, investors will act to take risks. Therefore, the change factor of the Shanghai Index and Dow Jones Index is the risk factor that has exposures undesired by the investors since it has a positive value and the assessment result is proven significant. On the other hand, inflation and interest rate factors are the risk factors that have exposures that are acceptable by the investors since they have negative values, and their assessment result is proven significant.

DISCUSSION

Effect of Risk Premium Interest Rate on Expected Return. Based on data analysis and hypothesis testing that has been carried out in this study. The result of the hypothesis test showing Interest Rate was proven as significant in the APT model test. The negative response of the market actors was the implication of the increasing interest rate, referring to the signalling theory where the increasing interest rate is negative information because it is considered to be able to disrupt the company's profitability. On the other hand, it causes a declining demand for stocks because the investment will be shifting to low-risked assets, such as deposits or bonds. The high rate of interest causes society to opt more for the instrument of risk-free investment, and an increase in the interest rate causes investors to make a change in the structure of their investment, generally from the capital market to fixed-income securities, as high interest can result in low demand for non-essential items and services, which can have an impact on the company and its stock values. This finding aligns with the research conducted by (Yadav, 2021), (Mohammad Khaled Rahman and Mazumder, 2021),(Mahdy et al., 2019), (Amata et al., 2016), which states this negative relationship. It means that the higher the interest rate risk measured by interest rate beta, the more it decreases the stock return.

Effect of Risk Premium Inflation on Expected Return. Based on data analysis and hypothesis testing that has been carried out in this study. The result of the hypothesis test shows inflation as significant in the APT model test. Referring to the signalling theory, increasing inflation is also considered negative information. The increase or high inflation will impact the company's profitability. This happens because of the company's production cost caused by the increase in the production cost. On the investor's side, inflation declines real earnings; consequently, it declines investment ability. As a result, demands on stock investment decline as well. Raising the inflation rate will raise the cost of living and result in a shift of resources from investments to consumption, and the demand for market instruments will fall, leading to a reduction in the volume of stock traded. This finding aligns with the research conducted by (Ihsan et al., 2017, Obafemi et al., 2021, and Worlu and Omodero, 2017), which states this negative relationship. It means that the higher the inflation risk measured by inflation beta, the more it decreases the stock return.

Effect of Risk Premium Oil Price on Expected Return. Based on data analysis and hypothesis testing that has been carried out in this study. It can be seen that the risk premium oil price has no effect on expected return; these results are in accordance with research conducted by (Worlu and Omodero, 2017, Amata et al., 2016, and Gwahula, 2018). This is contrary to the previous hypothesis, which states that the risk premium oil price can have a negative effect on expected return. This result is not in accordance with the research of (Ihsan et al., 2017 and Mahdy et al., 2019).

Effect of Risk Exchange Rate on Expected Return. Based on data analysis and hypothesis testing that has been carried out in this study. It can be seen that the risk premium exchange rate has no effect on the expected return. These results are in accordance with research conducted by (Mahdy et al., 2019). This result is not in accordance with the research conducted by (Khudoykulov, 2017) and (Ndlovu et al., 2018). (Celebi and Hönig, 2019) state that the risk premium exchange rate has a significant effect on expected return. Although the exchange rate has no significant effect, the regression coefficient is negative, which means the depreciation of rupiah currency against the dollar will decrease the expected return. Depreciation of the rupiah currency against the dollar will affect the production cost because the raw material components still rely on imported raw materials. The implication is the investors responded to the foreign currency exchange through the decline of the stock price. A floating exchange rate system is a potential risk that must be encountered.

Effect of Risk Premium Dow Jones and Shanghai Stock Exchange indexes on Expected return. Based on data analysis and hypothesis testing that has been carried out in this study. The result of the hypothesis test showing both Dow Jones and Shanghai Stock Exchange indexes were proven significant in the APT model test. Both Dow Jones and Shanghai Stock Exchange indexes represent the rate of economic growth in both countries. The increasing economic condition of both countries will be able to increase the demand for imports towards the domestic company's products, which will then increase the company's earnings. The increase in the company's profitability is in accordance with the signalling theory, affecting the increase of stock market value. An increase in a country's economic growth indicates an increase in the welfare society in that country. Improving community welfare will encourage people to consume goods and services, thereby increasing exports. The increasing economic condition will increase export, increase in exports may represent a good indicator of economic growth and, thus, affect stock prices positively (Mohammad and Elshqirat, 2019). Both Dow Jones Stock Exchange and Shanghai Stock Exchange are strong markets, and increasingly strong market positively influences Indonesia's capital market (Hidayat et al., 2018). Referring to the signalling theory, increasing economic growth is also considered positive information, which will then increase stock demand. Variables of Shanghai and Dow Jones stock index are the representatives of foreign macroeconomic factors, a specific finding of this research that has not been performed by the previous research yet.

Coefficient of Determination (R2). The coefficient of determination explains how far the model's ability to explain the dependent variable is. The value of the coefficient of determination ranges between zero and one. If the value of the coefficient of determination (R2) is getting closer to one, it can be said that the independent variables in the model can explain the information needed by the dependent variable. This research finding the R-squared value is 38.100 per cent. This shows that the independent variables consisting of risk premium inflation, risk premium interest rate, risk premium exchange rate, risk

Jurnal Manajemen
e-JM
E-ISSN: 2549-8797
ISSN: 1410-3583

premium oil price, risk premium shanghai stock prices index, and risk premium Dow Jones stock prices index can explain the dependent variable in the form of expected return by 38.100 per cent and the rest of 68.900 per cent is explained by other variables not examined in this study.

CONCLUSION

This research aims to identify general risk variables among several macroeconomic variables that have been pre-specified (pre-specified macroeconomic variables) in such a way that they are significant risk premiums. This research has used the methodology of Chen, Roll, and Ross. Research period ranging from 2017-2020 by using 56 samples.

The conclusions of this study are: (1) Risk Premium Inflation has a negative and significant effect on the expected return on the IDX. (2) Risk Premium Interest Rate has a negative and significant effect on the expected return on the IDX. (3) Risk Premium Exchange Rate has a negative effect but has no significant effect on the expected return on the IDX. (4) Risk Premium oil price has a positive effect but has no significant effect on the expected return on the IDX. (5) Risk Premium Shanghai Stock Price Index has a positive and significant effect on the expected return on the IDX. (6) Risk Premium Dow Jones Stock Price Index has a positive and significant effect on the expected return on the IDX,

These results support the Arbitrage Pricing Theory multi-factor. The findings are in line with (Michael et al., 2021), (Yadav, 2021), (Gwahula, 2018), (Ihsan et al., 2017), (Torbira and Agbam, 2017), (Mohammad and Mazumder, 2021), (Obafemi et al., 2021), (Amata et al., 2016). Based on the result of the statistic prob t value in the second equation, the risk premiums interest rate, risk premiums inflation, and risk premiums of foreign macroeconomic factors are the representatives by Shanghai, and Dow Jones stock indexes have a significant effect on the expected stock returns at IDX.

The APT model shows that the maximum 38.100 per cent of return variants is explained by the risk premium variables of inflation, interest rate, Shanghai Index, and Dow Jones Index. According to the R-Square value, 61.900 per cent of return variants are explained by other variables. Therefore, although the APT model has been successfully found, this research found that identified macroeconomic variables cannot dominantly explain stock return variables. In other words, it cannot be fully explained by the has been identified APT model.

This research conveys several implications for APT theory, investors, government, and issuers. The findings in this research strengthen the APT that stock return will be determined by a factorial model with the risk factor. Inflation and interest rate are two connecting variables. The government performed monetary policy to control inflation. They use the interest rate as an instrument when inflation escalates and needs to be controlled. That is why the interest rate is increased. Therefore, inflation becomes an important variable; its stability must be maintained; it must be prevented from having high volatility. As a consequence, it must be controlled through the increase of interest rate. From this research, it is suggested that investors need to consider expectation inflation and expected interest rate when making decisions for investments. In addition, investors need to be more careful and need increased monitoring of foreign macroeconomic factors. Foreign macroeconomic factors are the risk that must be encountered because the government cannot play its role in controlling them. For the issuer, the information obtained from the proceeds of this research is very important to formulate a strategy and policies that need to be implemented to face and anticipate the significant impact of fluctuations in inflation, interest rates and global economic conditions. Business strategies and policies need to be formulated properly to maintain company stability so that company value can be stable.

This research has limitations, Pre-specified macroeconomic Arbitrage Pricing Model leaves the identification of these factors as an empirical matter for researchers to sort out, and the nature of these factors is likely to change over time. The pre-specified macroeconomic approach identifies different factors in a different market.

Future research can use a broader research sample to provide a bigger picture of the Pre-specified Macroeconomic Arbitrage Pricing Theory Model. In addition, future research can add domestic and global macroeconomic variables because R-Square only 38.100 per cent, which means 61.900 per cent are explained by other variables. Future research can also divide macroeconomic conditions into two conditions, namely when macroeconomic conditions with high volatility and low volatility are used to test the consistency of macroeconomic factors.

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