Implementing Markov Switching Regression Using Best Subset Approach for BSI Stock Price Prediction Analysis

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ABSTRACT – **Stocks are evidence of ownership of the capital or funds of a company or institution and are represented by a document that includes the par value, the company name, and the rights and obligations described for each owner. Since so many factors affect the rise and fall of stock prices, investors should pay attention to the factors that influence the rise and fall of stock prices to avoid incurring losses or profits when buying and selling stocks. The rise and fall of stock prices can be analyzed with Markov switching regression by trying all possible placements of factors to get the best subset. Public holdings will continue to increase due to nation-building and Sharia Bank Indonesia (BRIS) stock price appreciation. This study aims to determine the impact of increases and decreases in the closing price of BSI stock. The modeling used in this study is Markov switching regression using the best subset approach. The data used in this study are secondary in the form of daily data for the closing price of Bank Syariah Indonesia shares, Inflation, BI Rate, Selling Exchange Rate, Money Supply, and Gross Domestic Product (GDP). Data are obtained from the official BPS website. The results of this study show that Markov switching regression modeling can identify the feasibility of regimes as "bull" and "bear" periods. State 2 indicates an uptrend or "bullish," and State 1 indicates a downtrend or "bearish." The best subset approach obtains the best model with the lowest SSE value. The study concluded that the statistical modeling results of BSI stock's closing prices during "bull" and "bear" periods provide significant predictors: BI Rate, Selling Exchange Rate, and Money Supply.**

Keywords– **Close Price, Macroeconomics, Markov Switching Regression, Best Subset**

I. INTRODUCTION

A strong capital market can provide access to long-term funding sources for companies and help increase public share ownership. In addition, capital markets can be an indicator of a country's economic performance. Therefore, developing a healthy and transparent capital market is essential to support sustainable economic growth. The market performs two functions: the capital market as a means for business funding or obtaining funds from the investor community and the capital market as a means for the community to invest in financial instruments [1]. Investment in the capital market is one of the popular choices among investors. Investors must consider investment factors because investment growth in Indonesia increases national development; investment will also generate profits for investors [2]. The capital market is buying and selling securities such as shares. Shares are proof of ownership of capital or funds in a company or institution indicated by a document that includes a nominal value, company name, and the rights and obligations described to each holder [3]. The Composite Stock Price Index (CSPI) reached 6,850.52 on December 28, 2022. It increased by 4.09% from the position on December 30, 2021, and the daily transaction frequency reached 1.31 million transactions or increased by 1.1% compared to the end of 2021. besides that, the average daily transaction volume increased by 16% from the end of 2021 [4]. Bank Syariah Indonesia was listed on the Indonesia Stock Exchange (IDX) on May 9, 2018, under the name PT. Bank BRISyariah Tbk; based on IDX market capitalization, Bank Syariah Indonesia shares have IDX market capitalization and have a market capitalization of IDR 72.19 on March 6, 2023 [5]. Bank Syariah Indonesia shares have a stock code, BRIS.

Bank Syariah Indonesia (BSI) is a merger of three state-owned banks: Bank BRI Syariah, Bank BNI Syariah and Bank Syariah Mandiri [6]. This Islamic bank operates according to Islamic Sharia principles, which are readily accepted by the majority of the Muslim community. Of course, it is only natural that Sharia-based banking services began to be offered in Indonesia because conventional banking services are prone to an interest or usury system, which is prohibited in Islamic law; not only as a financial service, Islamic banking is also often used as an investment option for investors. The share price of Bank Syariah Indonesia (BRIS) has surged in recent days, with the BRIS share price rising 15% on February 15, 2023, recording another increase on February 16, 2023, closed at IDR 1,625 per share or up 0.93%, BRIS shares jumped 23.7% last week, BRIS's free float in the stock market is 9.91%, so public share ownership will continue to grow [7]. In this case, fundamental analysis needs to be done to help investors predict the right time to enter or exit the stock, know the fair value of the stock, and decide whether to buy or sell shares. Stocks are volatile and can go up and down like commodity prices. If the market is static, it will not attract investors, and the ups and downs of stock prices are typical because the forces of supply and demand drive it; if demand is high, then prices will rise; conversely, if supply is high,

prices will fall, this phenomenon is influenced by several factors, one of which is macroeconomic fundamental conditions [8]. The problem discussed in macroeconomics, which is taken into consideration by investors in investing, is inflation.

Inflation is a process of rising prices prevailing in an economy or a tendency to increase the price of general goods [9] continuously. Inflation is one of the economic factors that affect stock prices; inflation increases company costs and company revenues; investors are very concerned about inflation because it strongly influences the rate of return and the ability to pay debts to funders and loans [10]. The macroeconomic factor affecting stock prices is the exchange rate, which means the value of a regional or state currency against the price or value of a regional or other state currency. The exchange rate used in this study is the rupiah rate against the United States dollar [11]. In addition to inflation and exchange rates, BI or interest rates can affect stock prices. The BI Rate is an indicator of the level of short-term interest rates set by Bank Indonesia to achieve inflation targets or the price of borrowed funds; the BI rate is an essential factor in investment decisions [12]. The next macroeconomic factor is the money supply, as in the explanation [13], that the amount of money in circulation is the accumulation of the entire value of money circulating in the community and is in the hands of the Indonesian people, which in a broad sense is a combination of demand deposits, cards, and time deposits so that the increasing purchasing power of the community can be caused by the increasing growth in the amount of money in circulation. The next macroeconomic factor that affects stock prices is Gross Domestic Product (GDP), which is the product value of all final goods and services produced in the country in a certain period. GDP is the most critical factor in determining a country's economic growth level [14].

The application of Markov Switching models in economic and financial research has been extensively explored across various domains. Uzoma and Florence (2016) employed the MSVAR model to analyze regime dependency in the Nigerian stock market, revealing clear shifts in return series and highlighting the importance of recognizing regime changes for informed investment strategies [15]. Rahman et. al (2021) applied a two-state Markov switching model to investigate the impact of financial liberalization on Pakistan's economic growth, demonstrating that the relationship is nonlinear and regime-dependent, with more pronounced effects in high-growth regimes [16]. Anggana (2023) further explored regime dynamics in Indonesia's inflation data using an MSAR model, identifying distinct transition probabilities and durations for inflationary and deflationary states [17]. Complementing these macroeconomic perspectives, Inayati (2024) introduced the MSAR model with time-varying parameters (MSAR-TVP), which improves forecasting accuracy through dynamic parameter adjustments and advanced filtering techniques, showing superior performance in predicting U.S. GNP trends [19]. On the financial modeling side, Saleh et. al (2022) used best-subset selection to determine the most significant financial ratios (EPS and PER) that influence stock prices on the IDX, although the study did not incorporate regime-switching dynamics [18]. Nurdiansyah and Kartini (2019), meanwhile, combined the GRG optimization algorithm with a Markov-switching framework to construct more realistic portfolios by accounting for bull and bear market regimes, demonstrating the practical benefit of regime-aware models in portfolio optimization [20]. Collectively, these studies underscore the growing importance of regime-switching models in capturing structural changes and improving analytical accuracy across macroeconomic forecasting, financial risk management, and asset pricing. However, there remains a gap in integrating variable selection techniques—such as best-subset methods—within the Markov switching regression context, which this research aims to address.

Although the Markov Switching model has been widely applied in previous studies to capture regime changes in economic and financial data, most of these studies use predetermined predictor variables without thoroughly exploring all possible combinations of predictors. For instance, Uzoma (2016) and Rahman (2021) employed specific macroeconomic variables in their regime-switching analyses but did not address the selection process for identifying the most optimal predictors. Similarly, studies by Inayati (2024) and Anggana (2023) focused on the model's ability to detect structural dynamics without considering the relevance of variable selection. Therefore, the novelty of this research lies in its integration of the best subset selection method within the Markov Switching Regression framework, where all possible combinations of financial variables are examined, and the best subset is selected based on the lowest sum of squared errors (SSE). This approach not only enhances the model's accuracy in identifying regime shifts but also ensures that the predictor variables used are the most statistically significant in explaining stock price movements. As such, the study offers a methodological contribution to the literature on predictive modeling using regime-switching techniques.

The purpose of this study is to determine the results of descriptive statistics for the close price of Bank Syariah Indonesia shares and their predictors, then to understand the results of MSwR estimation with the Best Subset approach, and to understand the effect of inflation, BI rate, exchange rate, money supply and Gross Domestic Product on the close price of Bank Syariah Indonesia shares (BRIS code).

This research will apply the Markov-Switching Regression model with the Best Subset approach. This study will analyze macroeconomic variables such as inflation, BI Rate, exchange rate, money supply, and GDP that affect the Close Price Value of BSI (BRIS) shares. Markov Switching modeling can well model the phenomenon of regime change in the financial sector, about the rising and falling stock prices in Bank Syariah Indonesia. Thus, research on Bank Syariah Indonesia shares will be proposed titled "Implementing Markov Switching Regression Using Best Subset Approach for BSI Stock Price Prediction Analysis."

II. LITERATURE REVIEW

2.1 Best Subset Method

The Best Subset approach uses the best model selection technique to overcome multicollinearity. It is also used to determine the best model of BSI stock predictors to overcome multicollinearity. The Best Subset is a statistical technique for finding the most accurate regression [18]. By regressing a single response variable on all possible combinations of a subset of predictor variables and selecting the best subset for each information measure, the best model is selected based on the low AIC value and p-value. The best subset steps are as follows:

1. Identify all possibilities to regress, then regress Y with X incrementally.
2. From the possible models identified in the first step, determine the best predictor model according to the specified criteria.
3. Combine each possibility with one response variable to get the best model according to the criteria. In this study, there are five predictor variables, so each possibility is regressed with stage 1, stage 2, stage 3, stage 4, and stage 5 until all possibilities are exhausted.
4. Identify the best model that fits the criteria by looking at the p-value and the resulting AIC value.
5. Interpretation of the model generated from the Best Subset estimation.

2.2 Markov-Switching Regression

The Markov method is used when a sudden change in financial conditions, such as a monetary crisis or a change in government policy. The Markov-switching model, called the Regime Switching Model, is one of the most frequently used nonlinear time series patterns, and this model can also model time series data that experience structural changes; this Markov-switching model can describe correlated data and show clear, dynamic patterns over changing periods, changes can occur in the mean or variance, the following model with changes in the mean and variance in Equation 1 [20].

$$y_t = \mu_{s_t} + \varepsilon_t \quad (1)$$

In a two-regime situation, the values of s_t are assumed to be 1 and 2. Therefore, the Markov-Switching Regression (MSwR) formula in k regimes can be expressed in Equation 2.

$$\begin{aligned} y_t &= \mu_t + \varepsilon_t \\ y_t &= x_t\beta_{s_t} + \varepsilon_t \; ; \varepsilon_t \sim N(0, \sigma_{st}^2) \end{aligned} \quad (2)$$

with $\mu_t = [\mu_{t1} \quad \mu_{t2} \quad \cdots \quad \mu_{tk}]$, $x_t = [1 \quad x_{1t} \quad x_{2t} \quad \cdots \quad x_{mt}]$, and $\beta_{s_t} = \begin{bmatrix} \beta_{01} & \cdots & \beta_{0k} \\ \vdots & \ddots & \vdots \\ \beta_{m1} & \cdots & \beta_{mk} \end{bmatrix}$.

Where s_t represents the unobserved state or regime at time t, governed by a Markov process with a finite number of states {1,2,...,k}. $\beta_{s_t}$is the vector of regression coefficients specific to state s_t . ε_t is the error term, typically assumed to be normally distributed with mean zero and variance $\sigma_{s_t}^2$. The transition between states is governed by a Markov transition matrix P, where each element $p_{ij} = P(s_t = j | s_{t-1} = i)$ denotes the probability of transitioning from state i to state j. For two regimes, the state transition matrix is:

$$P = \begin{bmatrix} p_{00} & p_{01} \\ p_{10} & p_{11} \end{bmatrix}$$

The MSwR formula in two regimes can be expressed in Equation 3.

$$y_t = x_t\beta_{s_t} + \varepsilon_t \; ; \varepsilon_t \sim N(0, \sigma_{st}^2) \quad (3)$$

with $\mu_t = [\mu_{t1} \quad \mu_{t2}]$, $x_t = [1 \quad x_{1t} \quad x_{2t} \quad \cdots \quad x_{mt}]$, and $\beta_{s_t} = \begin{bmatrix} \beta_{00} & \beta_{01} \\ \beta_{10} & \beta_{11} \end{bmatrix}$.

For nonstationary series, the model with differencing is written in Equation 4.

$$\begin{aligned} \Delta y_t &= y_t - y_{t-1} \\ \Delta x_t &= x_t - x_{t-1} \\ \Delta y_t &= \Delta x_t\beta_{s_t} + \varepsilon_t \; ; \varepsilon_t \sim N(0, \sigma_{st}^2) \end{aligned} \quad (4)$$

III. METHODOLOGY

3.1. Data Source

The data used in this study are secondary in the form of daily data on February 01, 2021 - December 30, 2022, for the response variable, namely the Close Price of Bank Syariah Indonesia shares and the predictor variables, namely Inflation, BI Rate, Selling Exchange Rate, Money Supply, and Gross Domestic Product (GDP). Close price data is obtained from the Yahoo finance website. Inflation, BI Rate, Exchange Rate, and Money Supply data are obtained from Bank Indonesia's official website. In contrast, Gross Domestic Product (GDP) data are obtained from the official BPS website.

3.2. Research Variables

This study consists of independent variables and dependent variables, which are presented in Table 1.

Table 1 Definition of Research Variables for Response and Predictor Variables

Variable	Definition	Measurement Scale
Close Price (Y)	Bank Syariah Indonesia closing price data (Y) is the price data that appears when the stock exchange closes.	Ratio
Inflation (X_1)	Inflation is the universal and continuous increase in the prices of goods and services over some time in Indonesia, as calculated by Bank Indonesia.	Ratio
BI Rate (X_2)	The Bank Rate is the fee banks give to customers who buy or sell their products and is announced by the Board of Governors of Bank Indonesia at each monthly Board of Governors meeting.	Ratio
Selling Exchange Rate (X_3)	The selling rate is the price of foreign currency given or set by a bank or money changer to someone who wants to exchange rupiah for foreign currency.	Ratio
Money Supply (X_4)	Money supply is all the money supply in an economy; the Central Bank controls the money supply as the monetary authority.	Ratio
Gross Domestic Product (X_5)	GDP is the product value of all final goods and services produced in a country in a given period by all business units.	Ratio

In this study, the response variable used is the closing price data of Bank Syariah Indonesia, with predictor variables including inflation, BI rate, exchange rate, money supply, and GDP.

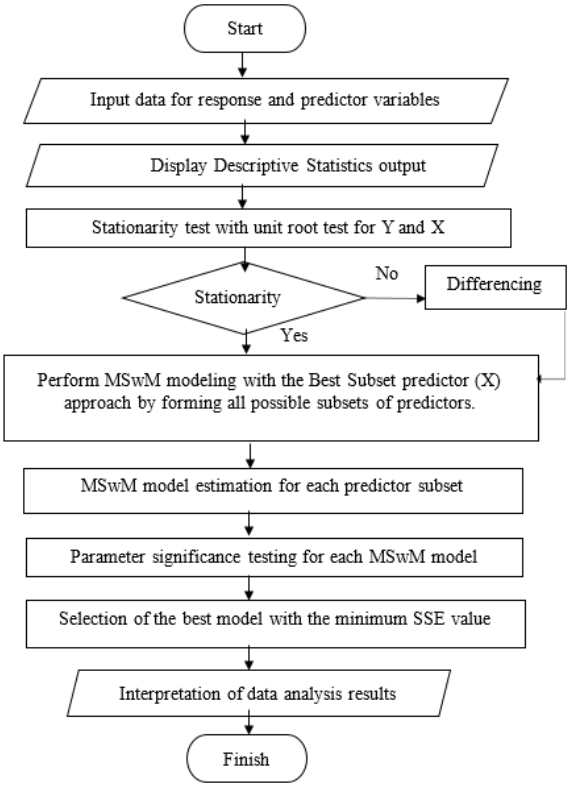

Figure 1. Flowchart of data analysis steps.

3.3. Data Analysis

The steps taken in this research are as follows:

1. Entering daily data on the Close Price of Bank Syariah Indonesia shares, inflation, BI rate, Selling Exchange Rate, Money Supply, and Gross Domestic Product.
2. Perform data exploration by calculating descriptive statistics on daily Close Price data, inflation, BI rate, selling exchange rate, money supply, and GDP.
3. Perform MSwR modeling with the Best Subset predictor approach with the following steps: In this study, the response variable used is the closing price data of Bank Syariah Indonesia, with predictor variables including inflation, BI rate, exchange rate, money supply, and GDP.
   - 3.1 Testing data stationarity with Unit Root test for Y and X; if not stationary, do the differencing process; if stationary, continue the next step.
   - 3.2 Forming all possible predictor subsets.
   - 3.3 Estimation of MSwR model for each subset of predictors.
   - 3.4 Testing the significance of parameters for each MSwR model.

3.5 Selecting the MSwR model that has the minimum SSE value.

3.6 Interpretation of analysis results from MSwR models that meet the criteria.

The analysis procedure contained in this study is described in the form of a flow chart as in Figure 1.

IV. RESULTS AND DISCUSSIONS

4.1. Descriptive Statistics

Before further analysis is carried out using Markov Switching Regression modeling with the Best Subset approach, descriptive statistics is carried out first to determine the description of the variables studied in this study such as Close Price, Inflation, BI rate, Selling Exchange Rate, Money Supply, and GDP, descriptive statistics will describe the data in the variables seen from the minimum, median, average, maximum, and variance values. Descriptive statistics also make data more transparent and easier to understand, which provides an overview of the variables used in the study. In this study, the tool used for descriptive statistical analysis is EViews 9 software (See Table 2).

Table 2 Descriptive Statistics of Close Price Data and its Predictors

Variable	Minimum	Median	Mean	Maximum	Variance
Close Price	1100.000	1735.000	1846.932	2960.000	445.1073
Inflation	0.001600	0.020600	0.028960	0.059500	0.017449
BI Rate	3.500000	3.500000	3.772775	5.500000	0.587950
Selling Exchange Rate	10.62000	12.06000	12.03928	13.21000	0.633601
Money Supply	6817.788	7690.135	7613.968	8528.022	463794.0
GDP	3971.159	4513.655	4605.554	5114.911	3881.427

4.2. Markov Switching Regression Modeling with Best Subset Approach.

4.2.1. Stationary Test with Augmented Dickey-Fuller (ADF).

The purpose of displaying a time series plot is to visualize data in the form of a line graph showing how a variable's value changes over time. Time series plots make it possible to see trends, patterns, fluctuations, or data changes over time.

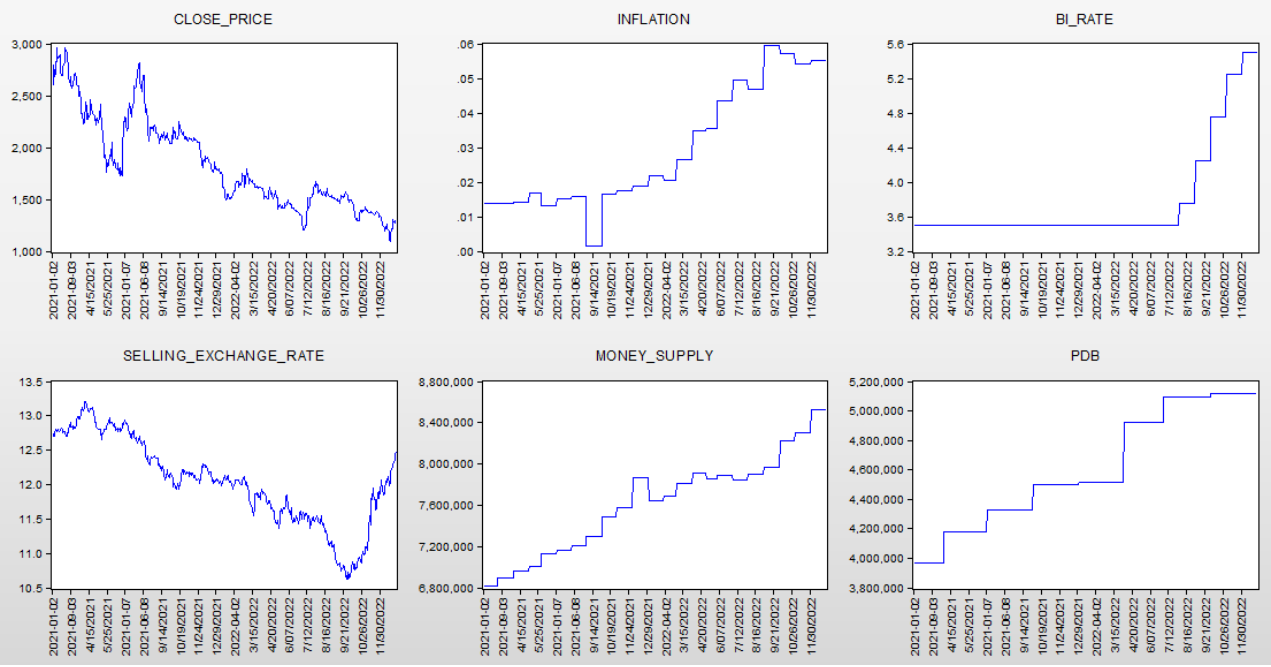

Figure 2. Time series plot of the close price variable and its predictor variables.

Based on Figure 2 displayed above, the close price pattern tends to be mixed (the upward trend at the beginning tends to be constant in the next period, returns to an upward trend pattern, then returns to constant), and cannot be called a stationary pattern. The closing price data reached its highest value at 2960 on February 08, 2021. Then, on the time series plot of inflation and BI rate data, it is clear that there is an upward trend, so that the average is not constant over time; there is also an increase in variance, especially towards the end of the period. Thus, the data is not stationary. The time series plot of money supply and GDP data shows that the time series data is not stationary in average and variance; then, to prove the plot results above, the Unit Root test using the Augmented Dickey-Fuller test statistic can be seen in Table 3.

Table 3 Unit Root Test for Levels

Variable	t-Statistic	P-Value
close_price	-1.911320	0.3270
inflation	-0.388784	0.9082
bi_rate	1.862964	0.9998
selling_exchange_rate	-1.177577	0.6855
money_supply	-0.324701	0.9184
gdp	-1.040620	0.7399

The results of unit root testing at the level of all variables are non-stationary because the P-value is greater than the α value with $\alpha = 0.05$, so it is necessary to determine whether y_t is stationary. Hence, it is necessary to do a differencing process with the following formula:

$$\Delta y_t = y_t - y_{t-1}$$

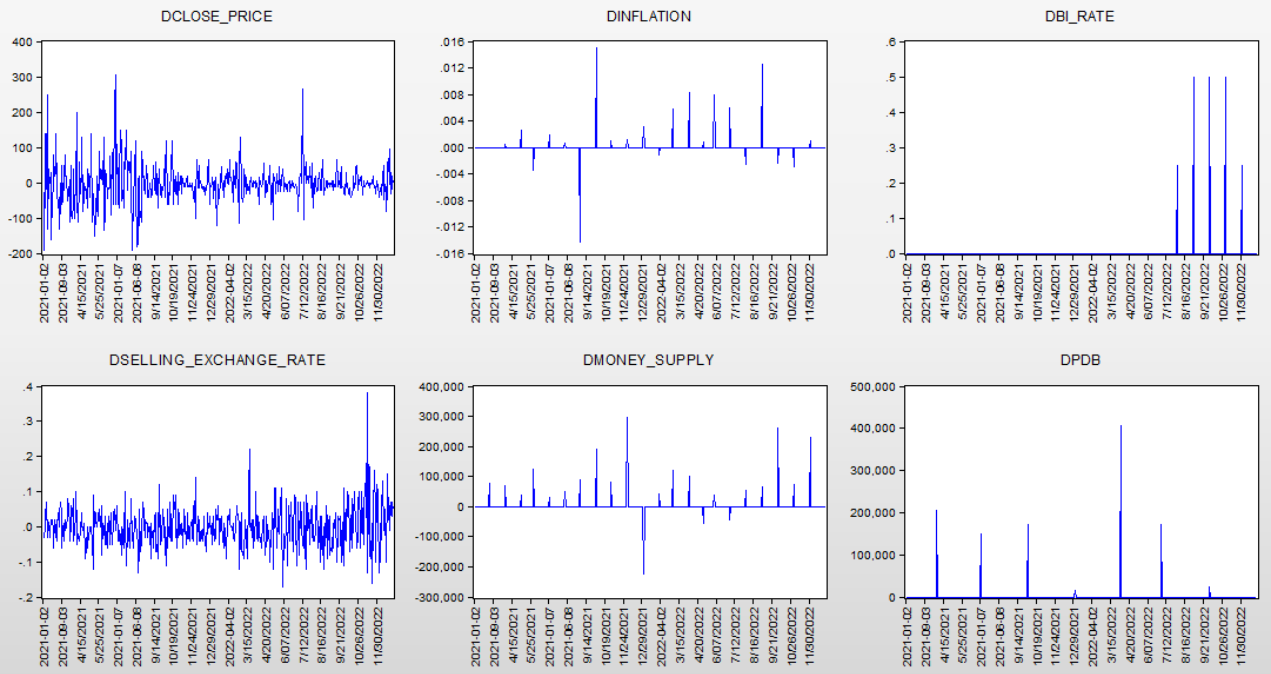

Figure 3. Time Series Plot for Stationary Data

In Figure 3, the time series plot on stationary data shows that the close price data is stationary, as seen in the graph that moves up and down at number 0 as the center. Besides that, the inflation variable also displays a graph that goes up and down from number 0 as the center. With the average trend and constant variance, the inflation data is stationary. Furthermore, the BI rate data also moves at zero to prove that the data is stationary, as seen in the unit root test results in Table 4.

Table 4 Unit Root Test for 1st Difference

Variable	t-Statistic	P-Value
dclose_price	21.83270	0.0000
dinflation	-21.74947	0.0000
dbi_rate	-21.86971	0.0000
dselling_exchange_rate	-21.45911	0.0000
dmoney_supply	-22.01173	0.0000
dgdp	-21.86718	0.0000

The unit root test results show that the data for each variable is stationary because the unit root test results show that all variables have a P-value smaller than α with $\alpha = 0.05$, so they meet the criteria.

4.2.2. Two Regimes Formed.

One of the advantages of using the Markov Switching Model is that it can determine the chances of cyclical changes in stocks, "this study uses 2 regimes to determine cyclical changes in stocks, namely "bull" and "bear in the "bull" period is defined as an increase in shares while in the "bear" period is defined as a decrease in shares, by looking at the resulting constant value if the value of one of the regimes produces a negative value, it is defined as a falling stock and if the resulting constant value is positive in one of the regimes, it is defined as a rising stock. The filtered regime probabilities in Figure 4.

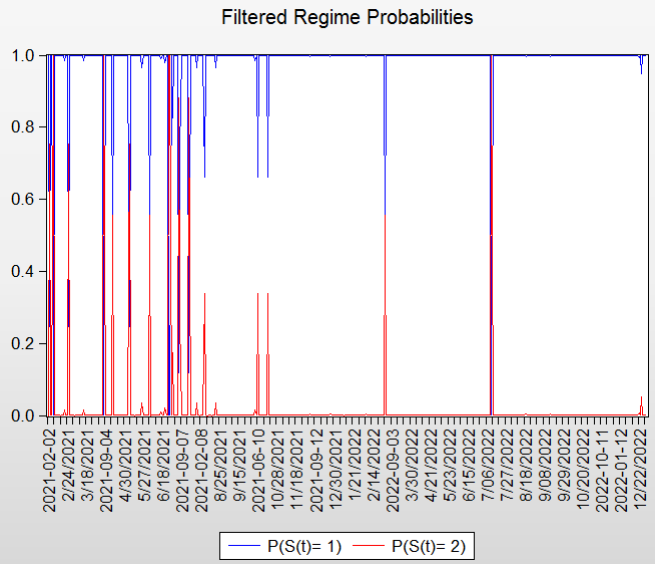

Figure 4. Filtered Regime Probabilities Graph

Figure 4 implies that there are 2 periods of close price fluctuations, so the number of states or regimes selected is 2. Then, the feasibility of regimes as a period of "bull" and "bear" is determined by looking at the graph generated from the filtered regime probabilities process. The blue line in state 1 tends to approach the value of 0, so that it can be said to be "bear" or the stock's close price is lower. In contrast, on the red line in state 2, the line tends to approach the value of 1, so that it can be defined as "bull" or the close price of the stock is higher, as evidenced by the value of the constants generated in Table 5.

Table 5 Identify Some of The Regimes Formed

Switching	Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1	C	-8.0762	2.3872	-3.3831	0.0007***
Regime 2	C	180.0625	21.7056	8.2957	0.0000***
Common	LOG(SIGMA)	3.8264	0.0418	91.5034	0.0000***

*, **, *** are significant for α at 10%, 5%, and 1%, respectively.

The regimes formed in the data are 2 regimes; by looking at the constant value generated, if one of the regimes' negative values is defined as a "bear" period, which is defined as down. If the value is positive in one of the regimes, then it is defined as a "bull" period or up; from Table 5, the constant value in regime 1 produced a negative value of -8.076169, so regime 1 is a "bear" period or down period. In contrast, in regime 2, the resulting value is a positive value of 180.0625 compared to the value in regime 1. The value of regime 2 is more significant, so regime 2 is defined as a "bull" period or up.

4.2.3. MSwR Model Estimation with Best Subset Method.

This section will estimate the MSwM model with all possible combinations of several predictor variables. From the estimation results, the MSwR model will be obtained with significant, insignificant, or non-convergent parameters or coefficients. The model estimation results will produce conjectural values that can be used to calculate the model error such that the Sum Square Error (SSE) is obtained, $SSE = \sum_t (y_t - \hat{y}_t)^2$. In its application, the MSwM model estimation is carried out with the help of Eviews9 software, and the results are summarized according to Table 6. In order to simplify observation, the difference variables in each of the research variables are symbolized as: dclose_price (Y), dinflation (X1), dbi_rate (X2), dselling_exchange_rate (X3), dmoney_supply (X4), and dgdp (X4).

Table 6 Results of All Possible Combinations of Predictor Variables

Model	Combination	SSE
1	$Y = C\ X_1$	1412568
2	$Y = C\ X_2$	-
3	$Y = C\ X_3$	1421381
4	$Y = C\ X_4$	1426166
5	$Y = C\ X_5$	-
6	$Y = C\ X_1\ X_2$	-
7	$Y = C\ X_1\ X_3$	1420818
8	$Y = C\ X_1\ X_4$	1425867
9	$Y = C\ X_1\ X_5$	-
10	$Y = C\ X_2\ X_3$	1419725
11	$Y = C\ X_2\ X_4$	-
12	$Y = C\ X_2\ X_5$	-
13	$Y = C\ X_3\ X_4$	-
14	$Y = C\ X_3\ X_5$	1413975
15	$Y = C\ X_4\ X_5$	1426158
16	$Y = C\ X_1\ X_2,\ X_3$	-
17	$Y = C\ X_1\ X_2\ X_4$	-
18	$Y = C\ X_1\ X_2 X_5$	1413662
19	$Y = C\ X_1\ X_3\ X_4$	1446850
20	$Y = C\ X_1\ X_3\ X_5$	1449291.
21	$Y = C\ X_1\ X_4\ X_5$	1425569
22	$Y = C\ X_2\ X_3\ X_4$	1409317
23	$Y = C\ X_2\ X_4\ X_5$	-
24	$Y = C\ X_3\ X_4\ X_5$	-
25	$Y = C\ X_1\ X_2\ X_3\ X_4$	-
26	$Y = C\ X_1\ X_2\ X_3\ X_5$	1417243
27	$Y = C\ X_1\ X_3\ X_4\ X_5$	1409470
28	$Y = C\ X_2\ X_3\ X_4\ X_5$	-
29	$Y = C\ X_1\ X_2\ X_3\ X_4\ X_5$	1421295

An empty SSE value indicates that the parameter estimation process does not encounter a unique or iterative solution that does not converge (diverge). In addition, the value of C represents the value of the intercept or constant.

4.2.4. **MSwR Model Estimation with Best Subset Method.**

The best model is produced from the estimation results using the Best Subset method, as well as the variables that affect the ups and downs of the close price of BSI shares. The criteria used to select the best model are models with the the Sum Square Error (SSE) value. From Table 6, the best model is obtained in Model 22 with an SSE value of 1409317, namely the MSwR model with a combination of predictor variables, namely BI rate (X_2), Selling Exchange Rate (X_3), and Money Supply (X_4). The following estimation results of model 22 are given in Table 7.

Table 7 Results of Estimation and Significance Testing of MSwR Model Parameters with Response Difference Close Price

Switching	Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1	**C**	-0.3844	2.547010	-0.150930	0.8800
	dbi_rate	38.3066	63.03483	0.607705	0.5434
	dselling_exchange_rate	-75.1426	41.18576	-1.824480	0.0681*
	dmoney_supply	-0.00005	0.0001	-0.473151	0.6361
Regime 2	**C**	180.0625	21.7056	8.2957	0.0000***
	dbi_rate	-129.2781	19.98532	-6.468654	0.0000***
	dselling_exchange_rate	-105.4316	651.7990	-0.161755	0.8715
	dmoney_supply	1161.270	478.8733	2.425004	0.0153**
Common	**LOG(SIGMA)**	3.924105	0.036911	106.3126	0.0000***

*, **, *** are significant for α at 10%, 5%, and 1%, respectively.

From the output results of Table 7, the best MSwR model is obtained based on the smallest SSE value, namely model 22, formulated as follows.

$$dclose\_price = \begin{cases} -0.3844 + 38.3066\ dbi\_rate - 75.1426\ dselling\_exchange\_rate - 0.00005\ dmoney\_supply + e_1 \ ; & S_t = 1 \\ 180.0625 - 129.2781\ dbi\_rate - 105.4316\ dselling\_exchange\_rate + 1161.270\ dmoney\_supply + e_2 \ ; & S_t = 2 \end{cases}$$

In Table 7, testing the significance of the parameters or coefficients of the MSwR model, the test conclusions are obtained, among others:

1) There is a significant effect of dbi_rate on dclose_price of -129.2781 (negative) in the "bull" period, meaning that an increase in the BI Rate spread will cause a decrease in the Close Price spread in the "bull" period by 129.2781 percent. On the other hand, a decrease in the BI Rate spread will cause an increase in the Close Price spread in the "bull" period by 129.2781 percent. On the other hand, there is no significant effect of dbi_rate on dclose_price in the "bear" period, meaning that an increase/decrease in the BI Rate difference will not affect the value of the Close Price difference in the "bear" period. In other words, the BI Rate negatively affects the Close Price of BSI Shares in the "bull" period, not the "bear" period.
2) There is a significant effect of dselling_exchange_rate on dclose_price of -75.1426 (negative) in the "bear" period, meaning that an increase in the Selling Exchange Rate difference will cause a decrease in the Close Price difference in the "bear" period by 75.1426 thousand rupiahs. On the other hand, a decrease in the selling exchange rate difference will cause an increase in the close price difference in the "bear" period by 75.1426 thousand rupiahs. On the other hand, there is no significant effect of dselling_exchange_rate on dclose_price in the "bull" period, meaning that an increase/decrease in the Selling Exchange Rate difference will not affect the value of the Close Price difference in the "bull" period. In other words, the Selling Exchange Rate negatively affects the Close Price of BSI Shares in the "bear" period, not the "bull" period.
3) There is a significant effect of dmoney_supply on dclose_price of 1161.270 (positive) in the "bull" period, meaning that an increase in the Money Supply gap will lead to an increase in the Close Price gap in the "bull" period by 1161.270 rupiahs, vice versa, a decrease in the Money Supply gap will lead to a decrease in the Close Price gap in the "bull" period by 1161.270 rupiahs. On the other hand, there is no significant effect of dmoney_supply on dclose_price in the "bear" period, meaning that an increase/decrease in the Money Supply gap will not affect the value of the Close Price gap in the "bear" period. In other words, Money Supply positively affects the Close Price of BSI Shares in the "bull" period, not in the "bear" period.

V. CONCLUSIONS AND SUGGESTIONS

MSwR modeling with the Best Subset approach results in the feasibility of regimes as "bull" and "bear" periods. From the model estimation results with the best subset method, the best MSwR model is obtained according to the predetermined criteria: the model with the minimum SSE value. From the results of testing the significance of the parameters, it is concluded that the BI Rate hurts the BSI Stock Closing Price in the "bull" period, not in the "bear" period; the Selling Exchange Rate hurts the BSI Stock Closing Price in the "bear" period, not in the "bull" period; and the Money Supply has a positive effect on the BSI Stock Closing Price in the "bull" period, not in the "bear" period.

Suggestions that can be given for development are the addition of variant models such as the GARCH family, seasonal models, and jump models, both in mean and variance. It is also recommended on other stocks because each stock has uniqueness in the existence and movement patterns of its time series data in the study.

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