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Review of Time Series Forecasting Methods for Predicting Monetary Policy Impacts in Indonesia

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Abstract

This research aims to forecast monetary policy impacts in Indonesia. There are two measures of monetary policy impacts in this research, namely exchange rate and inflation rate. Exchange rate is the USD/IDR exchange rate. Both these measures are resulted from monetary policy taken by the central bank, Bank Indonesia. The data for the monetary policy are extended from January 2015 until April 2024. The data were divided into training and test data. Training data extend from January 2015 until December 2023. Test data extend from January 2024 until April 2024. Training data will be used to generate parameters and forecasts for January until April 2024. The forecasts will be compared with the test data to derive the performance. The forecasting models were ARIMA (1,1,0), ARIMA (1,1,1), ARIMA (1,1,2), ARIMA (2,1,1), ARIMA (2,1,2), and ARIMA (3,1,3). The results showed that for forecasting the exchange rate, ARIMA (1,1,0) and ARIMA (1,1,1) perform best. While for inflation, forecasting inflation, ARIMA (3,1,3) and ARIMA (2,1,2) perform best. This implies that exchange rate forecasting is more random walk in nature, because only autoregressive of order 1 is influential, for inflation, the autoregression order of 2 and 3 are still influential.

Keywords: ARIMA, autoregressive, inflation, exchange rate, forecasting

1. Introduction

The conduct of Monetary policy is the main function and responsibility of a central bank. To achieve goals and objectives set by the constitution, central banks need to gear up themselves to achieve stability in the financial system, payment system, general price of goods and services, and the well-functioning of the general economy (Qanas & Sawyer, 2024). Central banks can respond well to the shocks occurring within the economy by utilizing the monetary policy under their mandates (Arintoko & Kadarwati, 2022; Manullang, Hutasoit, Matondang, & Indiriani, 2023). One of the main targets of monetary policy is inflation. Inflation constitutes the level of general price for goods and services. Uncontrolled inflation may harm the purchasing power of the general population that can lead to the decrease in welfare (Baltensperger, 2023) although according to Triandewo (2019) inflation did not give effect on income distribution based on study in Indonesia in the era of post Asian Crisis. Besides, productivity of workers will subsequently drop because companies see shrinking demand as the cause for decreasing production (Arikpo, Ulayi, Anipi, & Ojong, 2024). Central banks need to set the targeted inflation for the future period and utilize the tools or instruments at their disposal to achieve it. Uncontrolled increase in the general price level has proven to hamper economic growth, although a mild inflation might be desirable (Ezako, 2023). Therefore, central banks and government will try to maintain a stable inflation rate. Stable inflation will help to create a conducive atmosphere that contribute to the teeming business opportunities that subsequently lead to more employment and better standard of living (Atigala, Maduwanthi, Gunathilake, Sathsarani, & Jayathilaka, 2022). To curb inflation, central banks may want to determine the appropriate level of interest rate. When inflation soars, tight monetary policy by increasing the interest rate might be instrumental to slow down the increase (Ogege, 2019). The interest rate targeted by the central bank is the discount rate or discount window rate. In Indonesia, the central bank will provide guidance on its desired level of interest rate by indicating the level of BI rate (Putri, 2022). Astuti & Udjianto (2022) showed that, in the long-run, monetary policy using interest rate impacts inflation favorably. Komala & Widodo (2022) stated that the effectiveness of monetary policy to control inflation is moderated by financial inclusion. The same results were also stated by Arshad et al. (2021). Higher interest rate will lower the amount of money circulating in the economy and thus will lower the general price increase. As corroborated by Fadilah & Kusumastuti (2023), monetary policy by employing interest rate will drive quick and strong response from inflation. Although interest rate cannot be associated directly with economic growth, it has become the instrument engaged by the central bank to stimulate the economy (Lee & Werner, 2022). Low interest rates will drive people to borrow more money that increase money supply and therefore, it can be expected that there will be more purchases and investments due to the increase in the supply (Mohsen, Hoang, & Tariq, 2022). Mehar (2023) identified an increase in the infrastructure and investment due to the availability of credit expansion and low interest rate. In similar vein, El Husseiny (2023) showed that the availability of money supply will further enhance economic activity. In addition, Li, Sun, & Chen (2021) showed that, during the pandemic, the interest rate was decreased to recover deteriorating consumption due to social and physical restriction. This way, more money was available and purchasing power would increase. However, the research conducted by Suhandi & Sutrisno (2022) concluded that the systematic risk arising from government policies in determining interest rates does not affect the company's income (cumulative abnormal return), and the capital structure from the use of debt in manufacturing companies in Indonesia positively influences the company's income. On the contrary, higher interest rate may stifle the economic growth due to the increase in the cost of capital (Tan, Mohamed, Habibullah, & Chin, 2020). Subsequently, the interest rate set by the central banks will determine the rate exists in the financial industry. Bakshi & Elangbam (2022) proved the significance of interest rate to the foreign direct investment flowing into the country from abroad, as well as the openness of the country that is computed by adding export to import and then dividing it with gross domestic product as well (Ghazi, M. 2019). Based on the above explanation, monetary policy is of paramount consideration for the parties impacted by it. The effectiveness of monetary policy can be assessed from the impacts it results in. Therefore, it is pivotal to be able to forecast the impacts of monetary policy in order to find out how well the economy is going at the current moment.

2. Methods

This research will compare the performance of various forecasting methods in forecasting monetary policy consequences. The exchange rate of USD/IDR and inflation rate constitute the monetary policy. Therefore, this research has two forecasting objects. The data for the monetary policy are extended from January 2015 until April 2024. All data are monthly data. The data will be divided into two, training and test data. Training data will be used to develop models and their parameters. The resulting models then will be employed to generate forecasts. The forecasts will then be compared to the actual data to derive their performance. Training data extend from January 2015 until December 2023. Test data extend from January 2024 until April 2024. The information was taken from the Bank Indonesia website. First, we attempted to chart the movement of each currency over time. In addition to providing a visual analysis of the currencies' stationarity, the plot would show off how volatile the currencies were. We also planned to plot the partial autocorrelation function (PACF) and autocorrelation function (ACF) to support the visual assessment. The series' correlation is calculated by ACF and PACF at various lag times apart. Additionally, we can learn a few things from the data's stationarity plots. Second, we conducted a formal test to verify the currency exchange's stationarity. The equations for the models are as follow:

$\Delta y_t = \alpha + \beta y_{t-1} + v_t$

$\Delta y_t = \alpha + \beta_{yt-1} + \gamma_t + v_t$

Apart from the independent variable, only constant factors are used in the first model. A trend factor (γ_t) and a constant are used in the second equation. We know that the model is stationary if the value of β is statistically significant (at the 5% level). It is not stationary otherwise. We would first difference the series to attain stationarity if it weren't stationary. We would rerun the formal test with Augmented Dickey Fuller models after the initial differencing. We then moved on to the following phase, which involved creating forecast results using the ARIMA, once the variables had stabilized. Generally, the ARIMA models are denoted as ARIMA(p,d,q). The autoregressive component is denoted by the letter "p." p may have a value greater than 1. This indicates that the current value may vary because of the autoregressive component of more than one leg. The symbol β will represent the coefficient for p. The integration component is indicated by the d component. The series must have this many differencing points to remain stationary. The standard d value for nonstationary data is 1 but it could also be 2 if the data are severely nonstationary. The moving average component is referred to by the q component. The residuals obtained by regressing the series against a constant are shown below. For q, the coefficient will be represented by γ. Whether or not the series is stationary affects the ARIMA models used in this study. The models ARIMA(0,0,1), ARIMA(1,0,0), and ARIMA(1,0,1) are used for stationary series. If the data are not stationary, then we use an order of integration of 1 or 2. Specifically for nonstationary data, we will test the performance of ARIMA (1,1,0), ARIMA(1,1,1), ARIMA(1,1,2), ARIMA(2,1,1), ARIMA(2,1,2), and ARIMA(3,1,3). We utilize mean absolute error (MAE) and mean absolute percentage error (MAPE) to gauge the performance of the forecast. The formula for MAE is as follows:

$$\textbf{MAE} = (\sum_t |\textbf{At} - \textbf{Ft}|)/t$$

Whereas **Ft** is the forecast value, **At** is the actual value at time t. Meanwhile, the following is the formula for MAPE.

$$\textbf{MAPE} = (\sum_t |\textbf{At} - \textbf{Ft}|/\textbf{At})/t$$

The best performing model would be the model with the lowest value of MAE and MAPE.

3. Results

The variables used are all time series variables. Therefore, we will firstly plot the movement of the variables over time as follows.

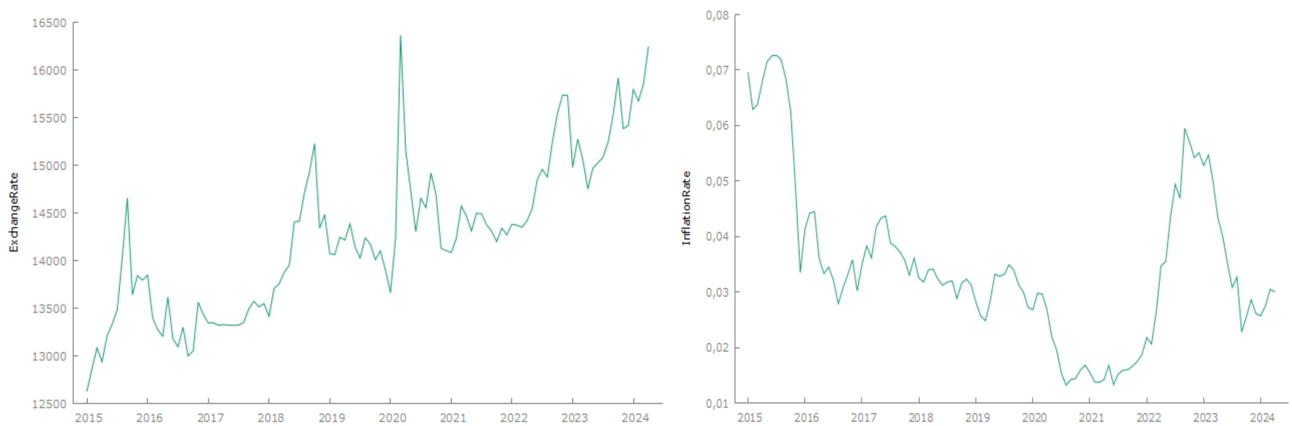

Figure 1 Time Series Plots of the Variables

The time series plot for the exchange rate is displayed in the first panel of Figure 1. The USD/IDR exchange rate is expected to trend higher through 2024. The pattern is blatantly obvious. The plot, though, does not follow a straight ascending trend. It is evident that the exchange rate is quite unstable. As 2016 draws to a close, the exchange rate fluctuates dramatically. The abrupt increase recurs in the middle of 2018 and the beginning of 2020. There is another increase toward the end of 2023, albeit it is not as significant as the ones before. In general, the pattern and fluctuations are apparent. The movement of inflation is plotted in the second panel on the upper right side. The rate of inflation is a little bit higher at the start of the study period. It may even go above 7%. The period of declining trend spans from 2016 to 2021. It's not a particularly smooth trend. There are fluctuations from 2016 to 2021. Inflation increased at the start of 2017 despite the downward trend. The gain is temporary and not very significant. Inflation hits its lowest point in 2021. This occurs at the same time as the epidemic. Because of the decline in demand in Indonesia during the epidemic, the general rate of increase in the price of goods and services was slowing down. The year 2023 sees a dramatic increase in inflation. It lasts for a long time before getting smaller. It lasts for a long time before getting smaller. Inflation reaches over 3% at the end of the study period. Studying the graphs of each monetary policy element's partial autocorrelation function (PACF) and autocorrelation function (ACF) will provide more insights into the series' stationarity. The exchange rate's ACF and PACF are displayed in the following figure.

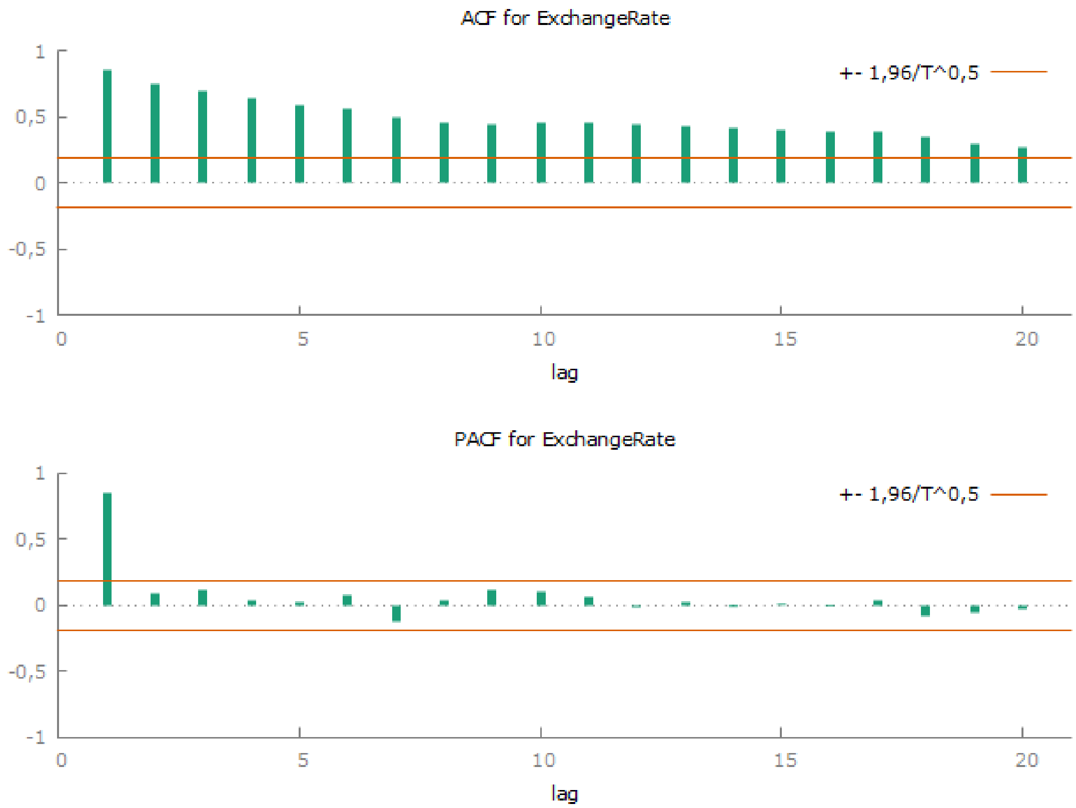

Figure 2 ACF and PACF of USD/IDR

The exchange rate correlogram is displayed in Figure 2 above. Plots of the autocorrelation function (ACF) and the partial autocorrelation function (PACF) are the two types available. The significance level is set at +/- 1.96/$\sqrt{112}$, or +/- 0.1852. All longer delays exhibit a substantial association with the current lag, as indicated by the ACFs. The association is evident even at lag 20. At lag 1, the PACF exhibits a noteworthy association. This is a common feature of data that is purportedly nonstationary. An ACF with substantial correlations at very long lags and a PACF with significant correlations at lag 1 are characteristics of nonstationary data.

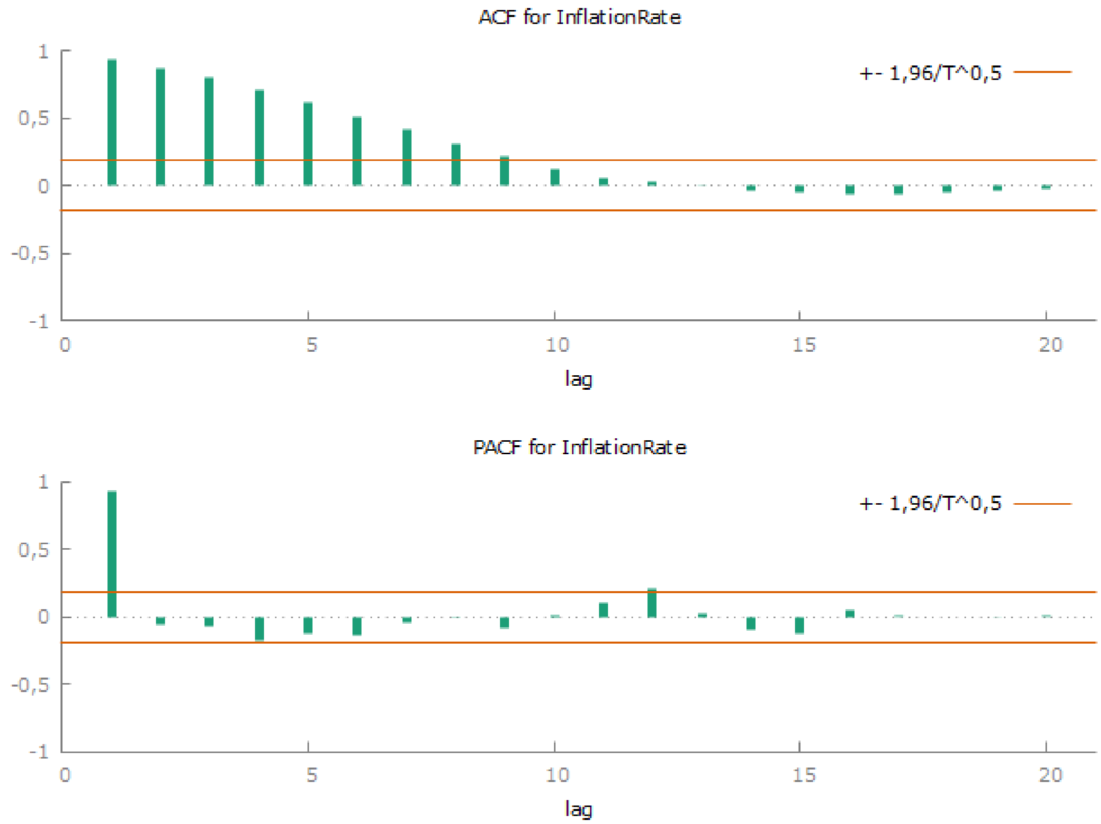

Figure 3 ACF and PACF of Inflation

Figure 3 shows that inflation has an impact on current conditions even at longer lags. Figure 3 demonstrates the influence of even lag 9. Lag 10 forward was when the influence disappeared. The correlation is nearly zero at lag 13. The figure also shows that there is a negative association between lags 14 and 20. The PACF of inflation is displayed in the panel below. Lag 1 exhibits a very strong correlation, much like the exchange rate. Only lag 12 exhibits a meaningful association after lag 1. It is reasonable to assume that the inflationary ACF and PACH exhibit nonstationarity. Subsequently, the money supply's ACF and PACF are shown below. For every variable, these outcomes support the nonstationarity hypotheses. In order to formally validate the nonstationarity, the Augmented Dickey-Fuller (ADF) test results are displayed below.

Table 1 Stationarity test using Augmented Dickey-Fuller at Level

Series	**ADF Test**	**Coefficient of β**	**p-value**
Exchange Rate	With a constant	-0,0950689	0,2013
	With a constant and a trend	**-0,3301560**	**0,0013**
Inflation	With a constant	-0,0633148	0.3894
	With a constant and a trend	-0,0605106	0.7972

From table 1, we can see that exchange rate is moderately stationary. Testing using a constant and a trend managed to reject the null hypothesis that the series is nonstationary. However, when we conduct the test using only a constant, we fail to reject the null hypothesis. Inflation and money supply are proven to be nonstationary. We fail to reject the null hypothesis using a constant and a constant and a trend. Therefore, we will redo the Augmented Dickey-Fuller method (ADF) at first difference.

Table 2 Stationarity test using Augmented Dickey-Fuller at First Difference

Series	ADF Test	Coefficient of β	p-value
Exchange Rate	With a constant	**-1,56893**	**0,0000**
	With a constant and a trend	**-1,56999**	**0,0000**
Inflation	With a constant	**-1,01006**	**0,0001**
	With a constant and a trend	**-1,06756**	**0,0009**

Table 2 above shows the effect of first differencing to the stationarity of the data. The variables of exchange rate and inflation become stationarity after first differencing. This means that the ARIMA and SARIMA methods employed must use an order of integration of 1 to ascertain the stationarity of the data. Unfortunately, the money supply variable remains nonstationary after first differencing. Therefore, money supply must be second differenced and retest for stationarity. Having conducted second differencing, the result shows p-value of 0,0000 for both ADF model with a constant and a constant and a trend. The coefficients of lagged residuals are -12,6003 and -12,6088. Therefore, the ARIMA models for Money supply must use an order of integration of 2.

Table 3 ARIMA Parameter Estimation

Exchange Rate						
	ARIMA (1,1,0)	**ARIMA (1,1,1)**	**ARIMA (1,1,2)**	**ARIMA (2,1,1)**	**ARIMA (2,1,2)**	**ARIMA (3,1,3)**
Constant	25.7589	20.4 ***	20.4522	20.454***	20.505***	20.266***
β_1	-0.14990	0.666***	0.65033	0.6767***	-0.185009	-0.533***
β_2	-	-	-	-0.016548	0.583***	-0.149790
B_3	-	-	-	-	-	0.572***
γ_1	-	−0.99***	-0.97***	-0.999***	-0.1643***	0.2911***
γ_2	-	-	-0.02760		-0.8356***	-0.291***
γ_3	-	-	-	-	-	-1.000***
R-Square	0.77830	0.80175	0.80185	0.801845	0.802238	0.815580
Adj R-Square	0.77830	0.79986	0.79804	0.798803	0.796478	0.806450
Inflation						
	ARIMA (1,1,0)	**ARIMA (1,1,1)**	**ARIMA (1,1,2)**	**ARIMA (2,1,1)**	**ARIMA (2,1,2)**	**ARIMA (3,1,3)**
Constant	-0.0004	-0.00042	-0.00042	-0.00042	-0.00042	-0.00043
β_1	0.1770*	0.6531*	0.7322**	0.7959**	0.131838	-0.8931***

β_2	-	-	-	-0.05565	0.438565*	0.0494928
B_3	-	-	-	-	-	0.614663*
γ_1	-	−0.5117	-0.5570*	-0.63334*	0.0655089	1.1465***
γ_2	-	-	-0.06585		-0.45148*	0.179357
γ_3	-	-	-	-	-	-0.498782
R-Square	0.93083	0.93155	0.93170	0.931665	0.932538	0.938327
Adj R-Square	0.93083	0.93090	0.93039	0.930351	0.930573	0.935274

***significant at 0.01
**significant at 0.05
*significant at 0.1

The upper section of the table shows the parameter estimation of ARIMA models for exchange rate. Six ARIMA models are employed in this research. ARIMA(1,1,0) has the largest constant, 25.7589. Other models' constants hover around the number 20. There is no significant parameter in this model. ARIMA(1,1,0) also has the lowest R square and adjusted R square compared to the other models. ARIMA(1,1,1) has a constant of 20.47. All the parameters are significant in this model. The coefficient for β_1 is very similar for ARIMA (1,1,1), ARIMA(1,1,2), and ARIMA(2,1,1). However, the parameter is not significant for ARIMA (1,1,2), while it is significant for ARIMA(1,1,1) and ARIMA(2,1,1). Ths also applies for γ_1 that is very similar for the three models. This time, however, all the models have this parameter significant. The R square and adjusted R square are very similar and comparable among the three models. ARIMA(2,1,2) has a constant of 20.505, the second largest constant. While the constant for ARIMA(3,1,3 is 20.266. ARIMA(2,1,2) and ARIMA(3,1,3) have negative coefficient for β_1 and γ_2. For γ_1, they have opposing coefficient (positive for ARIMA(3,1,3) and negative for ARIMA(2,1,2)). ARIMA(3,1,3) has better R square and adjusted R square than ARIMA(2,1,2). The lower section of the table presents the estimation result of inflation. Parameters with the most significant p-value exist on ARIMA(3,1,3) model. The first order autoregressive component, together with the first order of moving average component, is significant at 0.01. The third order autoregressive component is significant at 0.1. The constant is not significant. ARIMA(3,1,3) has the highest R square and adjusted R square number namely 0.938327 and 0.935274. If ARIMA(3,1,3) has a very low forecasting performance then we can conclude that it has overfitting problem. It performs very well against training data but very poorly against test data. ARIMA(2,1,2) is the second best model whose R square is 0.932538. ARIMA(2,1,2) has similar constant with ARIMA(1,1,1),ARIMA(1,1,2), and ARIMA(2,1,1). However, the constant is not significant in these models. The coefficient β_1 is significant in all models except in ARIMA(2,1,2). This shows the importance of autoregressive component in making prediction about the future value. In terms of R square, ARIMA (1,1,2) has the lowest value followed by ARIMA(1,1,0). The figure below depicts the plot for forecasts of exchange rate.

Figure 4 Exchange Rate Forecasts Plot

The upper-left panel of above figure shows the forecasting graph for ARIMA(1,1,0). ARIMA(1,1,0) predicts that the exchange rate will gradually increase. The forecast starts at IDR 15,440 and ends at IDR 15,518 per USD. The upper-right panel shows the forecast using ARIMA(1,1,1). This model predicts that the exchange rate will relatively be stable in the first quarter of 2024. In January, the exchange rate will be IDR 15,389 while in April 2024 it will be IDR 15,386. There is not much volatility in this model. The middle-left subpanel shows the forecasts for ARIMA(1,1,2). Somehow, the trajectory is very much like ARIMA(1,1,1). They even start at the same point namely IDR 15,389. Just like ARIMA(1,1,1), ARIMA(1,1,2) has the same forecasts for the month of February and March 2024, IDR 15,376. For April, it predicts the exchange rate to be IDR 15,382. The middle-right subpanel shows the forecasts of ARIMA(2,1,1). ARIMA(2,1,1) forecasts resemble those of ARIMA(1,1,2). The only difference lies at the forecast for January 2024. According to ARIMA(2,1,1), the exchange rate in January

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2024 will be IDR 15,388, a meagre one point difference to the forecast of ARIMA(1,1,2). The lower-left panel shows the forecasts of ARIMA(2,1,2). Clearly there is a volatility in the forecast results. From January to February, the exchange rate is predicted to increase. However, it will decline from February to March before rising again in the April. Therefore, exchange rate is not very stable. The last subpanel is the graph for ARIMA(3,1,3). The graph shows some volatilities in the forecasts. The starting exchange rate will be at 15317. This is the lowest forecast among all models. Finally, the exchange rate will be IDR 15,332. The second lowest point for April 2024 forecast compared to other models, except ARIMA(1,1,0). Below is the forecast results for inflation.

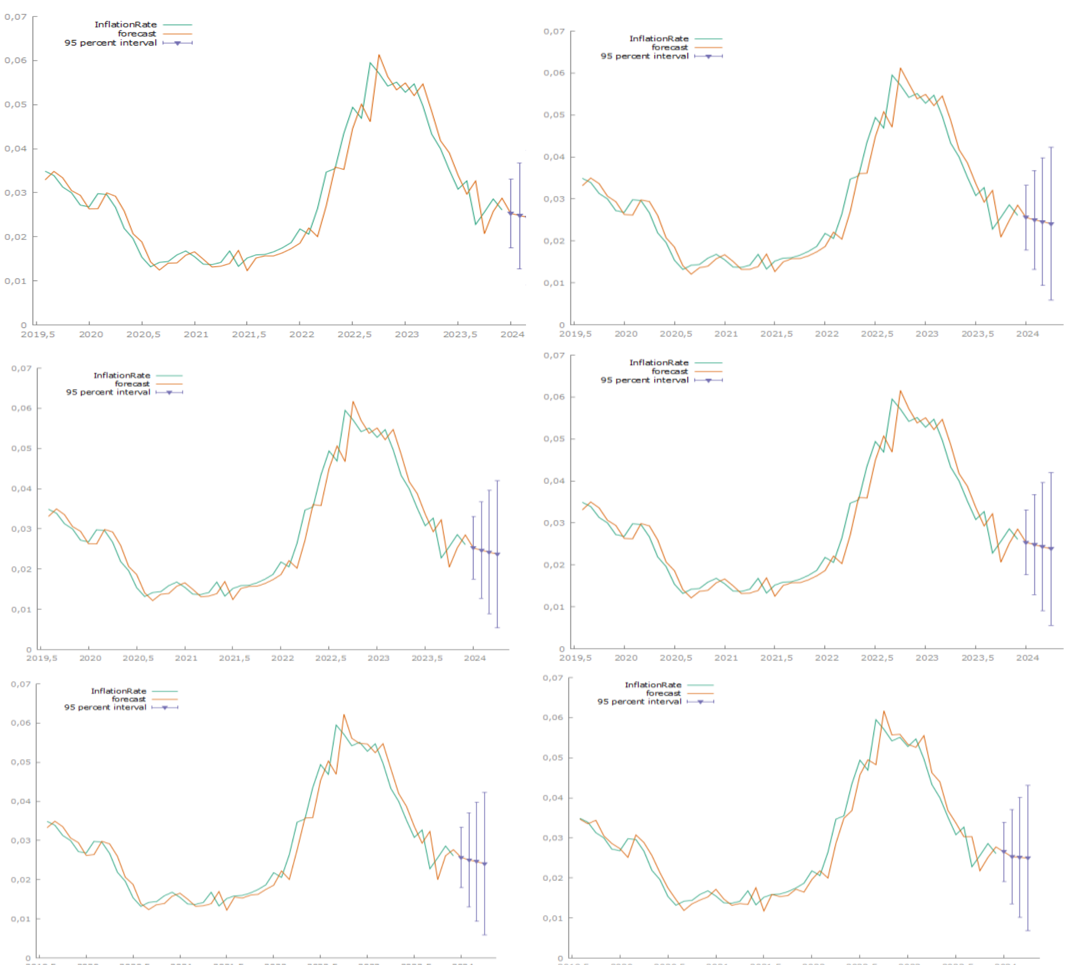

Figure 5 Inflation Forecasts Plot

Figure 5 displays the plots of forecasts for inflation. All ARIMA models predict that the future inflation will have a downward trend. This is reasonable remembering that the actual inflation also has a downward movement beginning from mid-2022. Therefore, ARIMA models conjecture that downward movement will continue to persist in the future. The upper panel consists of ARIMA(1,1,0) and ARIMA(1,1,1) models. ARIMA(1,1,0) predicts the first inflation forecast to be 2.53%, while ARIMA(1,1,1) predicts it to be 2.56%. ARIMA(1,1,1) predicts closer to the actual value of 2.57%. ARIMA(2,1,2) prediction is the most accurate. The prediction for ARIMA(2,1,2) lies in the lowest left subpanel. To the right of it is ARIMA(3,1,3). ARIMA(3,1,3) overshoots the actual value by predicting the inflation to be 2.65%. ARIMA(1,1,0) and ARIMA(1,1,2) (mid left subpanel) has the exact same prediction for January 2024, that is 2.53%. ARIMA(2,1,1) predicts inflation on January 2024 to be 2.54%. Fore February 2024, ARIMA(1,1,0) and ARIMA(2,1,1) yield the same forecast, 2.48%. Again, ARIMA(3,1,3) has predicted the highest among all ARIMA models for February 2024 followed by ARIMA(2,1,2). In fact, ARIMA(3,1,3) consistently yield highest forecasts compared to the other models. The second highest is always generated by ARIMA(2,1,2). Next, we turn to the forecast results and peformance in table 5 below.

Table 4 ARIMA Forecast results

EXCHANGE RATE							
Exchange Rate (2024)	**ARIMA (1,1,0)**	**ARIMA (1,1,1)**	**ARIMA (1,1,2)**	**ARIMA (2,1,1)**	**ARIMA (2,1,2)**	**ARIMA (3,1,3)**	**ACTUAL**
January	15440	15389	15389	15388	15377	15317	15795
February	15466	15379	15376	15376	15385	15383	15672
March	15492	15379	15376	15376	15374	15367	15852
April	15518	15386	15382	15382	15393	15332	16249
RMSE	**912.3716**	**1104.166**	**1109.377**	**1109.743**	**1103.772**	**1178.185**	
MAPE (%)	**2.5829**	**3.1837**	**3.31994**	**3.2010**	**3.1903**	**3.33933**	
INFLATION							
Inflation (2024)	**ARIMA (1,1,0)**	**ARIMA (1,1,1)**	**ARIMA (1,1,2)**	**ARIMA (2,1,1)**	**ARIMA (2,1,2)**	**ARIMA (3,1,3)**	**ACTUAL**
January	0.0253	0.0256	0.0253	0.0254	0.0257	0.0265	0.0257
February	0.0248	0.0250	0.0247	0.0248	0.0251	0.0253	0.0275
March	0.0244	0.0246	0.0242	0.0243	0.0246	0.0251	0.0305
April	0.0240	0.0241	0.0237	0.0238	0.0241	0.0249	0.0300
RMSE	**0.008981**	**0.008711**	**0.009348**	**0.009179**	**0.008682**	**0.007788**	
MAPE (%)	**12.8437**	**12.1227**	**13.3485**	**12.9950**	**11.9346**	**11.4544**	

The upper panel of the table above shows the forecast results and performance of each ARIMA models. The right-most column is the actual data that were used in conjunction with the forecast results of all the models. By comparing the actual data with the forecast results, we derive the number for RMSE and MAPE. The lower the RMSE and MAPE, the better the results. Table 4 shows that ARIMA(1,1,0) has the best performance whose error percentage is just 2,5829%. There are no other models that have error percentage below 3%. The second best performer is

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ARIMA(1,1,1) followed by ARIMA(2,1,2). The error percentage is 3.18 and 3.19% respectively. ARIMA(1,1,2) and ARIMA(3,1,3) are the worst whose error percentage is more than 3.3%. We can see that an autoregressive component with the order of 1 and moving average component of not more than 1 is the best model. ARIMA(1,1,0) in particular is very successful in even predicting the trend of the out-of-sample forecasts. It predicts an ever-increasing trend that specifically match the actual data. Therefore, ARIMA(1,1,0) and ARIMA(1,1,1) are recommended for exchange rate prediction in Indonesia. Overall, the ARIMA models perform well because the error percentage is less than 4%.

The lower subpanel of table 5 shows the forecast results and performance of all the ARIMA models. The right most column shows the actual inflation data for January to April 2024. We can see that the inflation always increases, beginning from 2.57% and end with 3.05%. All the inflation models predict a downward trend. ARIMA(3,1,3) has the best performance whose MAPE is 11.4544%. Although the forecasts are in downward trend, ARIMA(3,1,3) always results in the highest forecasts among all the models. This contributes to the accuracy of the model. The second best performer is ARIMA(2,1,2) that has error percentage of 11.9346%, just below 12%. ARIMA(2,1,2) also always generate high forecasts. The third best performer is ARIMA(1,1,1). Its error percentage is 12.1227%. The worst performer is ARIMA(1,1,2) whose error exceeds 13%. Based on the results, we recommend the USE of ARIMA(3,1,3) for forecasting the inflation rate in Indonesia.

4. Discussion

This research aims to determine whether ARIMA models are capable of predicting the monetary policy consequences taken by the central bank in Indonesia. The consequences of monetary policy can be seen from the exchange rate and inflation rate. There are 6 ARIMA models chosen in this research namely ARIMA(1,1,0), ARIMA(1,1,1), ARIMA(1,1,2), ARIMA(2,1,1), ARIMA(2,1,2), and ARIMA(3,1,3). In terms of forecasting the exchange rate, ARIMA(1,1,0) and ARIMA(1,1,1) perform best. This sheds light on the importance of the autoregressive component in the order of 1 in forecasting the future exchange rate. For the autoregressive component of order 2 and above, the forecasting performance will decrease. Therefore, there is no need to include higher order autoregressive component. Lag 1 exchange rate has significance influence in predicting the present exchange rate. The worst performer for exchange rate is ARIMA(3,1,3). This models has more autoregressive components that are not decisive for forecasting. This research supports Islam & Chowdury (2022) that proved ARIMA(1,1,0) as the best model to forecast the exchange rate of BDT (Bangladeshi Taka) against several major currencies.

In terms of forecasting inflation, ARIMA(3,1,3) and ARIMA(2,1,2) perform best. This shows how lag 3 and lag 2 autoregression still determine the present magnitude of inflation. We can infer that high inflation correlates with high inflation and low inflation correlates with low inflation. There were no periods in which inflation abruptly recede or increase dramatically. There is an upward or downward movement with some volatilities. Therefore, we must take into account the magnitude of inflation from the previous three or two periods to have an accurate forecast. The worst performer is ARIMA (1,1,2). The second worst is ARIMA(1,1,0). Those models have only one autoregression and thus not enough forecasting power. This research corroborates the findings of Marpaung et al (2022) that also showed the forecasting performance of ARMA(3,0,3) and AR(3) for inflation forecasting. However, the setting for Marpaung et al (2022) is in Central Java province. This research proves the efficacy of ARIMA with 3 autoregressive component for Indonesian forecasting.

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