Assignment 1: The Influence of Money Supply, BI Rate, and Exchange Rate of US Dollar per Indonesian Rupiah to Inflation Rate During 2019-2021

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I. Introduction

Inflation rate is one of the macroeconomic indicators which is used to measure a country's economic stability. Inflation is defined as the rise in average prices for goods and services and applies continuously. Many factors affect inflation of prices in a country, such as exchange rate, money supply, and interest rate. This assignment concentrates on analysing the influence of mentioned factors before on the inflation rate in Indonesia using multiple linear regression.

II. Data Analysis Result Discussion

The data is obtained from www.bps.go.id (the Indonesian Central Bureau of Statistics) and www.bi.go.id (Bank of Indonesia) from 2019 to 2021. The data is monthly historical data and consists of 34 observations since the data for November and December 2021 were not released at the time of analysis. Inflation rate is continuous dependent variable and BI-7 Day-RR (Bank Indonesia's interest rate), USD/IDR Exchange Rate, and Money Supply (M1) are continuous independent variables. The data is attached in the appendix.

Performing diagnostic tests for regression model is essential to verify that the model met the assumptions and there are no problems with the data that can skew the results. Below are some of diagnostic tests used for this analysis.

A. Normality Test

Regression Error Average	0.00
Standard Deviation of Errors	0.00
D Statistic	0.0902
D Critical at 1%	0.1381
D Critical at 5%	0.1485
D Critical at 10%	0.1768

Model must assume normality of residuals. The null hypothesis here is that the errors are normally distributed. Based on the output above, the value of D statistic is less than the value of D critical values at various significance values. Hence, the null hypothesis is accepted and the errors are normally distributed at the 1% alpha level.

B. Multicollinearity Test

	Correlation	VIF

Intercept		
BI-7 Day-RR		7.084677
USD/IDR	-0.231	1.062083
Money Supply (M1)	-0.925	6.947486

Variance Inflation Factor (VIF) is observed to detect the existence of multicollinearity. Multicollinearity can cause biased in the estimated regression equation and provide inaccurate results. Based on the output above, the value of VIFs are less than 10. It indicates no destructive multicollinearity among independent variables in the regression equation. However, the VIF value of money supply against BI-7 Day- RR is 6.95, which is above 2.0, and it indicates that severe multicollinearity exists between two independent variables. Correlation values also can be used to observe the existence of multicollinearity. From the table above, the values are less than 0.75, which means that no multicollinearity exists among independent variables.

C. Heteroskedasticity

	Heteroskedasticity	
	W-Test	Hypothesis Test
Variable	p-value	result
Y		
BI-7 Day-RR	0.8879	Homoskedastic
USD/IDR	0.1622	Homoskedastic
Money Supply (M1)	0.3784	Homoskedastic

The model assumes no heteroskedasticity or the residuals have the same variance (homoscedastic). In the output, it can be seen that the p-value for white-test is bigger than 0.05, hence the residuals are homokesdastic.

D. Autocorrelation

Durbin-Watson Test	
Alpha	0.05
D-stat	0.344517
D-lower	1.27074
D-upper	1.65189
sig	yes

The model must assume no autocorrelation in residuals. The value of D-stat is between D-lower and D-upper, hence there is no autocorrelation in residuals.

Multiple Linear Analysis Result

OVERALL FIT	
Multiple R	0.871489
R Square	0.759493
Adjusted R Square	0.735442
Standard Error	0.003916
Observations	34

The R-square value indicates that the model explains about 76% of variation in inflation rate. However, the adjusted R-square shows only about 74% of the variation in the inflation rate can be explained by independent variables. Adjusted R square value is used to determine the fitness of an additional variable when it is randomly added to the model. It is beneficial when the R-squared remains the same or increases and gives a false indication. The adjusted R-square value may decrease, indicating that the new variable does not fit the model.

ANOVA				Alpha	0.05	
	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	3	0.001453	0.000484	31.57884	2.05E-09	yes
Residual	30	0.00046	1.53E-05			
Total	33	0.001913				

$P(F > 31.57884) = 0.00000000205$ means that this probability is less than $\alpha = 0.05$ and we can conclude there is a linear relationship between inflation rate and independent variables. The model is statistically significant.

	coeff	*std err*	*t stat*	*p-value*	*lower*	*upper*
Intercept	-0.00947	0.03397	-0.27871	0.782382	-0.07884	0.059908
BI-7 Day-RR	0.548428	0.192183	2.853667	0.00776	0.155937	0.940919
USD/IDR	1.51E-06	1.5E-06	1.004702	0.323076	-1.6E-06	4.58E-06
Money Supply (M1)	-8.8E-09	9.44E-09	-0.93195	0.358804	-2.8E-08	1.05E-08

From analysis result, we can develop an equation for multiple linear regression as follow:

$$\hat{Y} = -0.00947 + 0.548428X_1 + 0.00000151X_2 - 0.0000000088X_3$$

Where

$\hat{Y} = \text{inflation rate}$
$X_1 = \text{BI} - 7\text{Day} - \text{RR}$

$X_2 = \text{USD / IDR Exchange Rate}$
$X_3 = \text{Money Supply (M1)}$

We can conclude that:

- A negative intercept implies that the model is overestimating on an average the inflation rate values; thereby, a negative correction in the predicted value is needed.
- A positive value for BI-7 Day-RR and USD/IDR variables indicates that as BI-7 Day-RR or USD/IDR value increases and the other independent variables are constant, the inflation rate value will also increase.
- The negative value for the money supply variable indicates that as money supply value increases and the other independent variables are constant, the inflation rate value will decrease.
- The p-value for USD/IDR and money supply variables is bigger than any correspondence level, which indicates that these variables are not statistically significant. On the other hand, the p-value for BI-7 Day-RR variable is statistically significant at 99% confidence level.

III. Conclusion

From analysis we can conclude that the multiple regression model has met several assumptions to determine that this model fits the data. Two independent variables, BI-7 Day-RR and USD/IDR have positive correlation to inflation rate and money supply has negative correlation to inflation rate. However, only one independent varible, BI-7 Day-RR, that is statistically significant. Thus, we can remove those two independent variables and change them with other independent variables that may influence inflation rate during 2019-2021.

Appendix

No	Period	Inflation Rate	BI-7 Day-RR	USD/IDR	Money Supply (M1)
1	Jan-19	2.82%	6.00%	14,033.00	1,376,135.53
2	Feb-19	2.57%	6.00%	14,015.00	1,386,329.31
3	Mar-19	2.48%	6.00%	14,233.00	1,428,606.53
4	Apr-19	2.83%	6.00%	14,191.00	1,454,278.57
5	May-19	3.32%	6.00%	14,401.00	1,508,039.89
6	Jun-19	3.28%	6.00%	14,184.50	1,513,519.72
7	Jul-19	3.32%	5.75%	14,066.40	1,487,801.78
8	Aug-19	3.49%	5.50%	14,231.00	1,475,544.35
9	Sep-19	3.39%	5.25%	14,158.00	1,508,817.97
10	Oct-19	3.13%	5.00%	14,060.00	1,504,156.28
11	Nov-19	3.00%	5.00%	14,081.67	1,553,134.22
12	Dec-19	2.72%	5.00%	13,919.00	1,565,439.34
13	Jan-20	2.68%	5.00%	13,643.18	1,484,500.12
14	Feb-20	2.98%	4.75%	14,311.50	1,505,491.28
15	Mar-20	2.96%	4.50%	16,346.96	1,648,727.77
16	Apr-20	2.67%	4.50%	15,234.64	1,576,444.33
17	May-20	2.19%	4.50%	14,639.60	1,653,528.84
18	Jun-20	1.96%	4.25%	14,470.20	1,637,724.85
19	Jul-20	1.54%	4.00%	14,486.67	1,683,270.19
20	Aug-20	1.32%	4.00%	14,618.00	1,765,210.74
21	Sep-20	1.42%	4.00%	14,910.00	1,780,692.49
22	Oct-20	1.44%	4.00%	14,585.02	1,782,220.95
23	Nov-20	1.59%	3.75%	14,061.64	1,799,007.50
24	Dec-20	1.68%	3.75%	13,832.56	1,855,692.57
25	Jan-21	1.55%	3.75%	14,023.00	1,762,295.71
26	Feb-21	1.38%	3.50%	14,332.40	1,784,763.23
27	Mar-21	1.37%	3.50%	14,605.00	1,827,391.16
28	Apr-21	1.42%	3.50%	14,439.70	1,850,950.91
29	May-21	1.68%	3.50%	14,278.00	1,861,766.90
30	Jun-21	1.33%	3.50%	14,629.10	1,915,429.33
31	Jul-21	1.52%	3.50%	14,419.70	1,933,291.47
32	Aug-21	1.59%	3.50%	14,362.00	1,938,389.63
33	Sep-21	1.60%	3.50%	14,385.00	1,968,434.37
34	Oct-21	1.66%	3.50%	14,228.50	2,071,417.83