

SEMINAR HASIL

Prediksi Harga Emas Dengan Pendekatan Model Seasonal Autoregressive Integrated Moving Average (SARIMA)

OLEH

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DOSEN PEMBIMBING

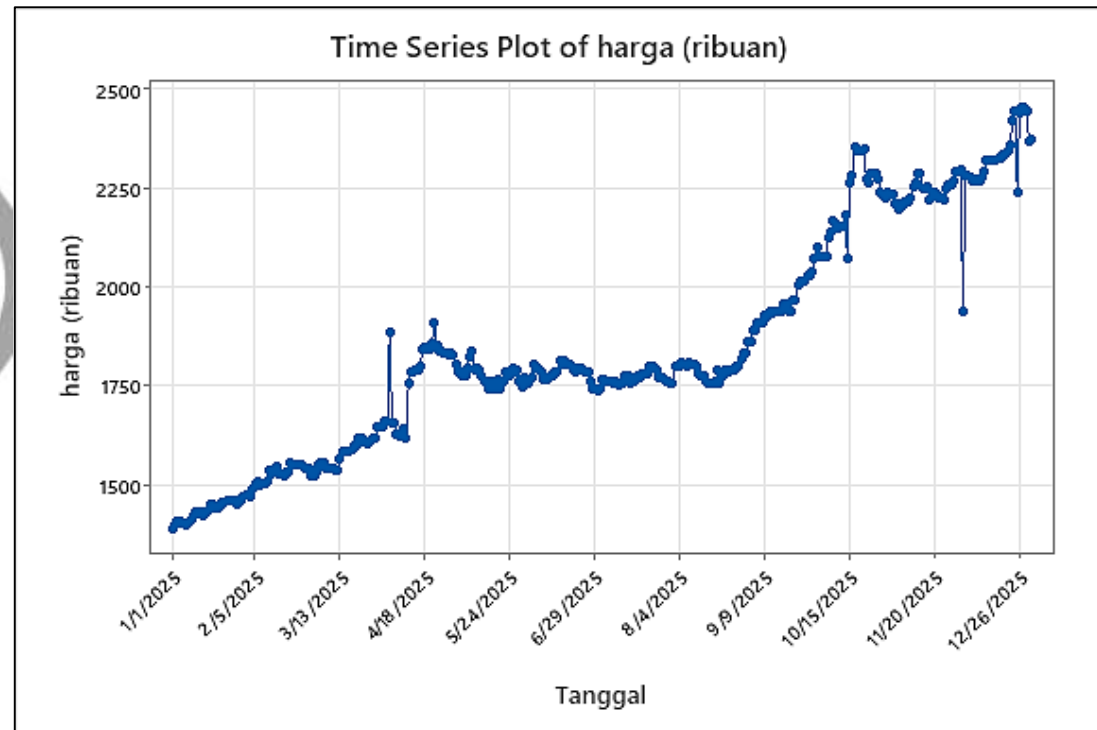
Ir. Tedjo Sukmono, ST., MT.

PROGRAM STUDI

Teknik Industri

Latar Belakang

Data Harga Emas Galeri24 per gram (Ribuan)



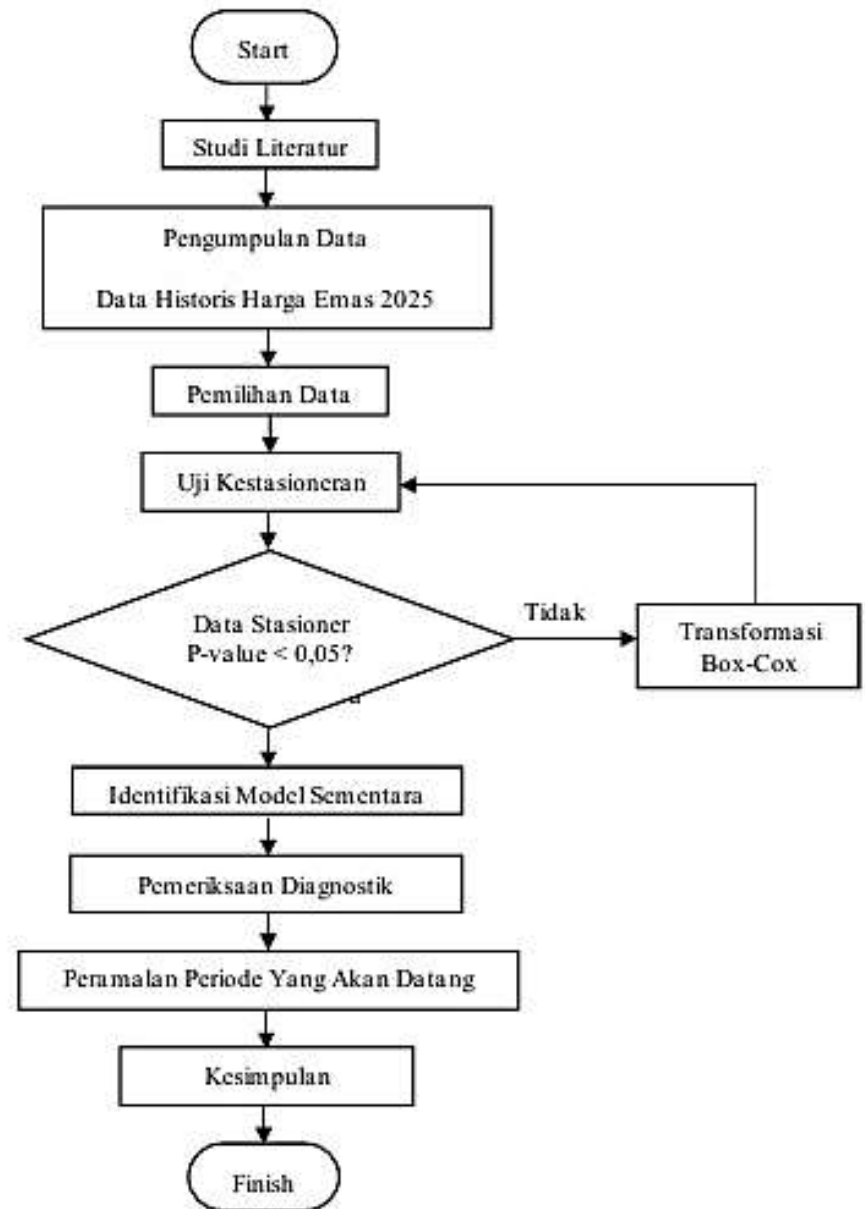
Pertanyaan Penelitian

Bagaimana mengetahui karakteristik pola data harga investasi emas menggunakan metode *Seasonal Autoregressive Integrated Moving Average* (SARIMA)

Tujuan Penelitian

Mengidentifikasi karakteristik pola data harga emas serta menyusun model prediktif harga penutupan harian emas menggunakan metode SARIMA.

Diagram Alir Penelitian



Metode

Uji kestasioneran:

- Box-Cox Transformation
- Uji Augmented Dickey Filler(ADF)

Pemeriksaan diagnostik:

- Uji Signifikansi Parameter
- Uji White Noise

Identifikasi model:

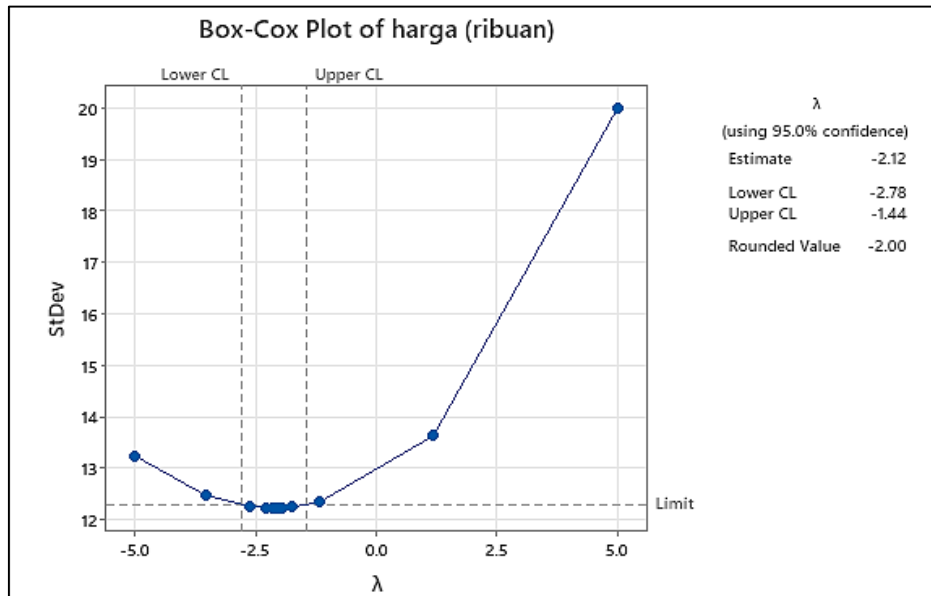
- Autocorrelation Function (ACF)
- Partial Autocorrelation Function (PACF)

Peramalan Yang Akan Datang:

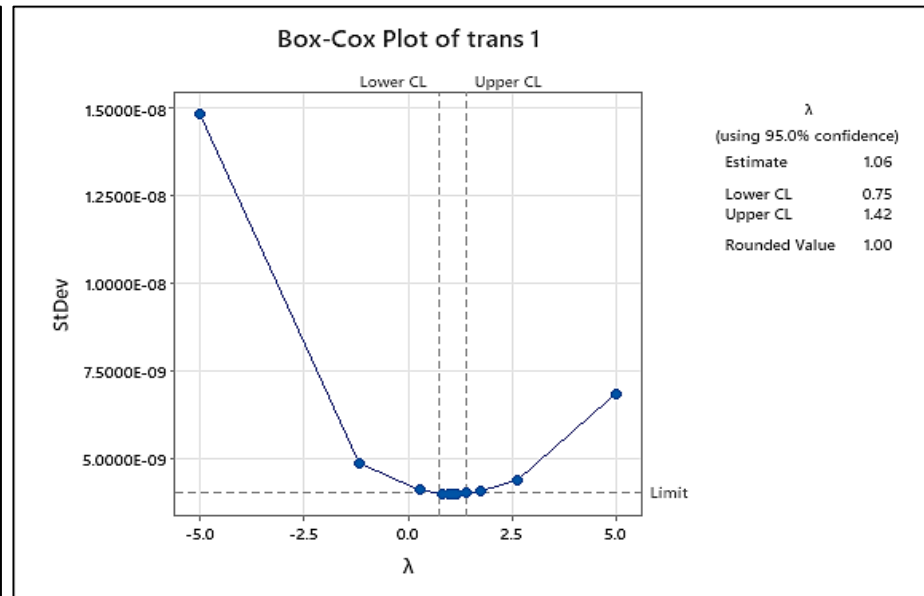
- Mean Square Error (MSE)
- Mean Absolute Percentage Error (MAPE)

Hasil Box-Cox Transformation

Gambar 1. belum stasioner



Gambar 2. telah stasioner



Apabila rounded value bernilai 1.00 Maka data dikatakan data telah stasioner dalam varians seperti ditunjukkan gambar 2.

Uji Augmented Dickey Fuller (ADF)

Augmented Dickey-Fuller Test

Null hypothesis: Data are non-stationary

Alternative hypothesis: Data are stationary

Test

Statistic P-Value Recommendation

-1.84465 0.359 Test statistic > critical value of -2.86967.

Significance level = 0.05

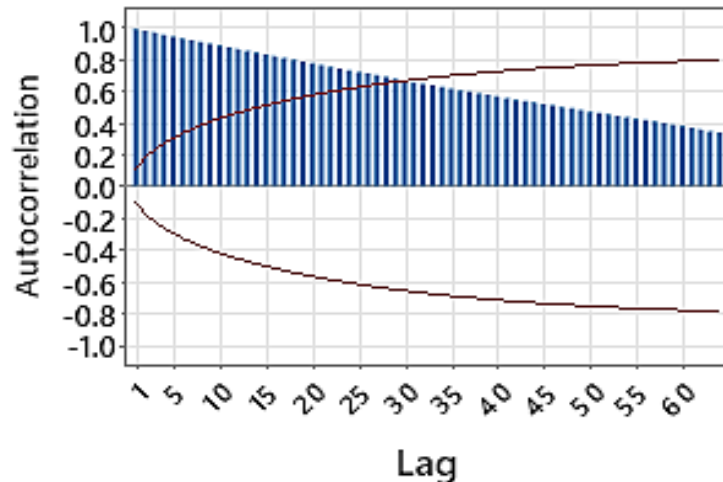
Fail to reject null hypothesis.

Consider differencing to make data stationary.

P-Value > 0.05 artinya data tidak stasioner pada rata-rata, maka perlu dilakukan differencing

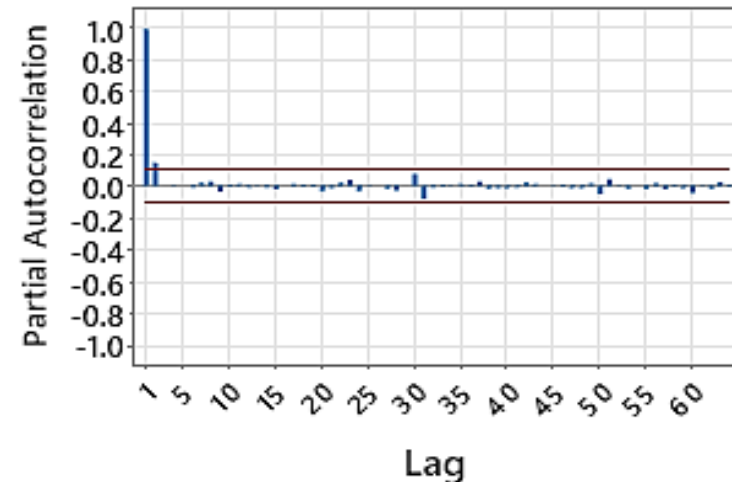
ACF for boxcox trans

(with 5% significance limits for the autocorrelations)



PACF for boxcox trans

(with 5% significance limits for the partial autocorrelations)



Uji Augmented Dickey Fuller (ADF) Setelah Differencing

Augmented Dickey-Fuller Test

Null hypothesis: Data are non-stationary

Alternative hypothesis: Data are stationary

Test

Statistic P-Value Recommendation

-12.4556 0.0000 Test statistic \leq critical value of -2.86960.

Significance level = 0.05

Reject null hypothesis.

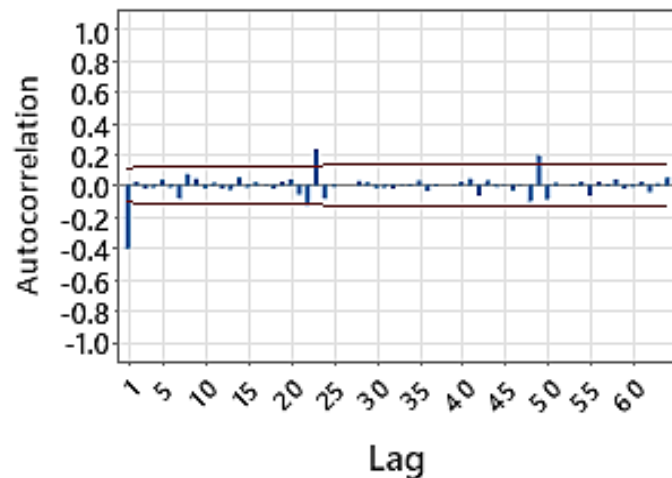
Data appears to be stationary, not supporting differencing.

P-Value < 0.05

artinya data stasioner pada rata-rata

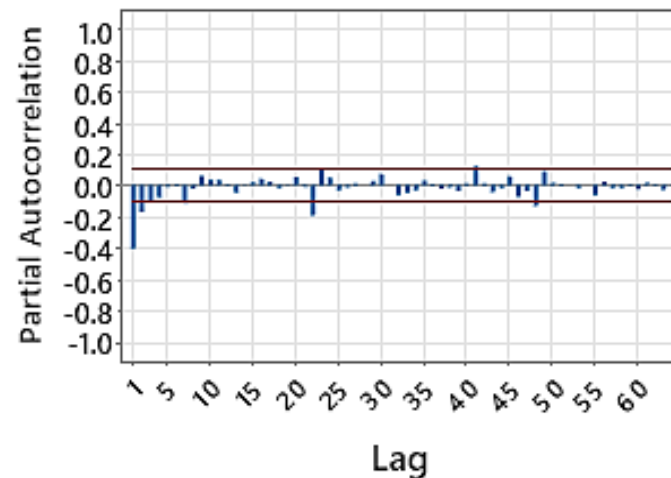
ACF for diff1

(with 5% significance limits for the autocorrelations)



PACF for diff1

(with 5% significance limits for the partial autocorrelations)



Pemilihan Model Peramalan

5 model peramalan dengan minimum AIC akan dilakukan pemeriksaan diagnostik terkait uji signifikansi parameter dan residual white noise.

Model Selection

Model (d = 1, D = 1)	LogLikelihood	AICc	AIC	BIC
p = 2, q = 0, P = 1, Q = 1*	6070.00	-12129.8	-12130.0	-12110.6
p = 1, q = 0, P = 1, Q = 1	6067.62	-12127.1	-12127.2	-12111.7
p = 2, q = 0, P = 0, Q = 1	6064.21	-12120.3	-12120.4	-12104.9
p = 1, q = 0, P = 0, Q = 1	6062.23	-12118.4	-12118.5	-12106.8
p = 0, q = 0, P = 1, Q = 1	6043.10	-12080.1	-12080.2	-12068.6
p = 0, q = 0, P = 0, Q = 1	6037.53	-12071.0	-12071.1	-12063.3
p = 0, q = 1, P = 1, Q = 0	6005.63	-12005.2	-12005.3	-11993.6
p = 1, q = 1, P = 1, Q = 0	6006.23	-12004.3	-12004.5	-11988.9
p = 0, q = 2, P = 1, Q = 0	6005.63	-12003.1	-12003.3	-11987.7
p = 0, q = 0, P = 1, Q = 0	5976.26	-11948.5	-11948.5	-11940.8
p = 2, q = 2, P = 0, Q = 0	5951.77	-11893.4	-11893.5	-11874.1
p = 1, q = 1, P = 0, Q = 0	5944.31	-11882.6	-11882.6	-11871.0
p = 0, q = 1, P = 0, Q = 0	5935.40	-11866.8	-11866.8	-11859.0
p = 0, q = 2, P = 0, Q = 0	5935.49	-11864.9	-11865.0	-11853.3
p = 2, q = 0, P = 0, Q = 0	5933.93	-11861.8	-11861.9	-11850.2
p = 1, q = 0, P = 0, Q = 0	5931.01	-11858.0	-11858.0	-11850.3
p = 2, q = 1, P = 0, Q = 0	5932.08	-11856.0	-11856.2	-11840.7
p = 0, q = 2, P = 1, Q = 1	5910.54	-11810.9	-11811.1	-11791.7
p = 0, q = 1, P = 1, Q = 1	5906.37	-11804.6	-11804.7	-11789.2
p = 0, q = 2, P = 0, Q = 1	5902.40	-11796.7	-11796.8	-11781.3
p = 1, q = 1, P = 1, Q = 1	5891.99	-11773.8	-11774.0	-11754.6
p = 0, q = 1, P = 0, Q = 1	5888.36	-11770.7	-11770.7	-11759.1
p = 2, q = 2, P = 1, Q = 1	5856.05	-11697.8	-11698.1	-11671.0
p = 1, q = 1, P = 0, Q = 1	5836.87	-11665.6	-11665.7	-11650.2
p = 2, q = 2, P = 0, Q = 1	5772.78	-11533.3	-11533.6	-11510.3
p = 1, q = 2, P = 0, Q = 1	5630.99	-11251.8	-11252.0	-11232.6
p = 1, q = 2, P = 1, Q = 1	5587.56	-11162.9	-11163.1	-11139.8

* Best model with minimum AICc.

Uji Signifikansi Parameter

Model	Parameter	Coef	T	P-Value	Hasil
(210)(111)7	AR 1	0.4702	-8.92	0.000	Signifikan
	AR 2	0.1719	-3.26	0.001	
	SAR 7	0.1241	-2.07	0.039	
	SMA 7	0.9638	34.41	0.000	
(110)(111)7	AR 1	0.4009	-8.20	0.000	Signifikan
	SAR 7	0.1392	-2.28	0.023	
	SMA 7	0.9579	32.38	0.000	
(210)(011)7	AR 1	0.4691	-8.91	0.000	Signifikan
	AR 2	0.1821	-3.46	0.001	
	SMA 7	0.9577	33.07	0.000	
(110)(011)7	AR 1	0.3964	-8.12	0.000	Signifikan
	SMA 7	0.9550	34.05	0.000	
(010)(111)7	SAR 7	0.1419	-2.30	0.022	Signifikan
	SMA 7	0.9504	30.73	0.000	

Contoh hasil uji parameter pada model (210)(111)7

Final Estimates of Parameters

Type	Coef	SE Coef	T-Value	P-Value
AR 1	-0.4702	0.0527	-8.92	0.000
AR 2	-0.1719	0.0528	-3.26	0.001
SAR 7	-0.1241	0.0600	-2.07	0.039
SMA 7	0.9638	0.0280	34.41	0.000
Constant	0.053	0.112	0.48	0.635

P-value < 0,05 maka signifikan

Uji White Noise

Model	Parameter	Uji Asumsi White Noise
(210)(111)7	Signifikan	Bersifat White Noise
(110)(111)7	Signifikan	Tidak Bersifat White Noise
(210)(011)7	Signifikan	Bersifat White Noise
(110)(011)7	Signifikan	Tidak Bersifat White Noise
(010)(111)7	Signifikan	Tidak Bersifat White Noise

Contoh hasil uji white noise pada model (210)(111)7

Modified Box-Pierce (Ljung-Box) Chi-Square Statistic

Lag	12	24	36	48
Chi-Square	10.78	36.48	40.22	47.00
DF	7	19	31	43
P-Value	0.148	0.009	0.124	0.312

P-value > 0,05 maka bersifat white noise

Contoh hasil uji white noise pada model (110)(111)7

Modified Box-Pierce (Ljung-Box) Chi-Square Statistic

Lag	12	24	36	48
Chi-Square	18.40	52.66	56.68	62.40
DF	8	20	32	44
P-Value	0.018	0.000	0.005	0.035

P-value < 0,05 maka tidak bersifat white noise

Pemilihan Model Terbaik

Model	MSE	MAPE
(210)(111)7	1333,89	16%
(110)(111)7	1373,39	18%
(210)(011)7	1352,66	19%
(110)(011)7	1395,66	19%
(010)(111)7	1630,27	21%

Pengecekan MSE dan MAPE terkecil yaitu ditemukan pada model (210)(111)7

Residual Sums of Squares

DF	SS	MS
352	469529	1333.89

Back forecasts excluded

Accuracy Measures

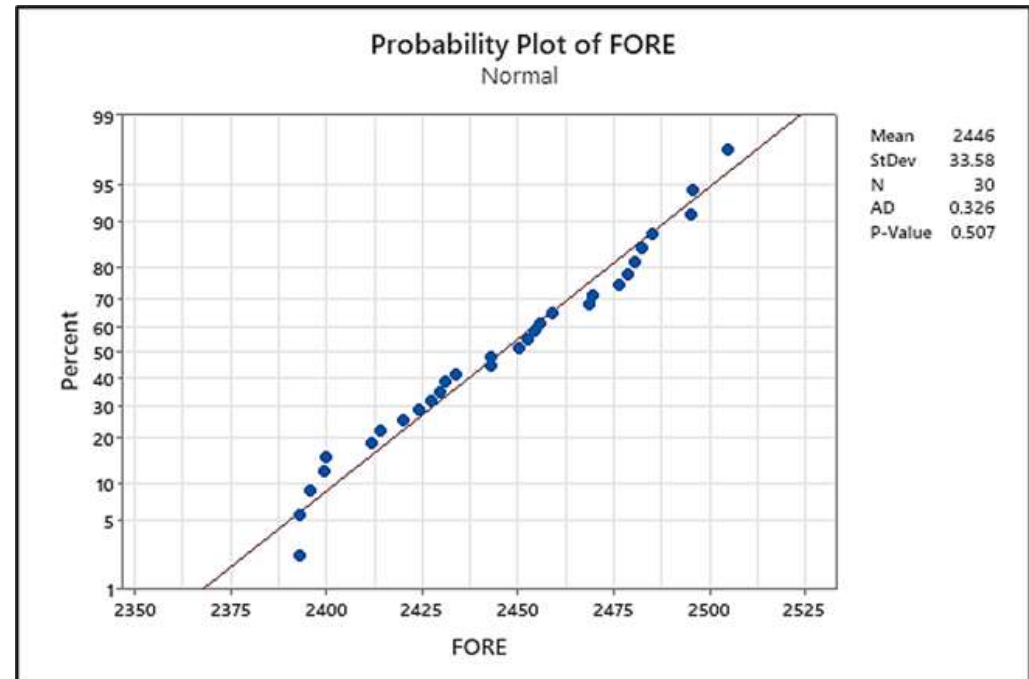
MAPE 0.1638
MAD 4.2678
MSD 36.1909

DF : Degree of Freedom
SS : Sum of Squares
MS : Mean Squared Error

Hasil Peramalan dalam ribuan

Hasil peramalan pada model (210)(111)7

Periode	Forecasting	Periode	Forecasting
1	2411,57	16	2452,44
2	2392,96	17	2454,24
3	2392,92	18	2456,01
4	2395,86	19	2458,94
5	2399,75	20	2450,39
6	2399,26	21	2469,38
7	2419,96	22	2468,79
8	2414,23	23	2478,73
9	2427,59	24	2480,59
10	2429,62	25	2482,36
11	2431,18	26	2485,30
12	2433,94	27	2476,64
13	2424,21	28	2495,63
14	2442,93	29	2495,15
15	2443,02	30	2505,06



P-value 0,507, maka berdistribusi normal

KESIMPULAN

Berdasarkan hasil analisis ditemukan bahwa model SARIMA (2,1,0)(1,1,1)₇ memenuhi seluruh kriteria uji kelayakan diagnostik, termasuk asumsi *white noise* dan normalitas residual dengan nilai MSE sebesar 1333,89 dan MAPE sebesar 16%. Hasil peramalan memberikan gambaran fluktuasi investasi emas untuk 30 periode mendatang dengan harga berkisar antara 2411,57 hingga 2505,06. Namun, perlu ditegaskan bahwa akurasi peramalan ini bergantung pada konsistensi harga historis dan memiliki keterbatasan memitigasi anomali harga yang disebabkan oleh dinamika geopolitik global yang tidak terduga.

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