3-白噪声检验

|  |  |  |
| --- | --- | --- |
| LB | Pvalue | lags |
| 6.587534 | 0.010270 | 1 |
| 6.877207 | 0.032109 | 2 |
| 7.590798 | 0.055271 | 3 |
| 7.592361 | 0.107705 | 4 |
| 7.592376 | 0.180178 | 5 |
| 13.043891 | 0.042344 | 6 |
| 22.209596 | 0.002337 | 7 |
| 23.594389 | 0.002679 | 8 |
| 24.330564 | 0.003808 | 9 |
| 24.330943 | 0.006769 | 10 |
| 24.976291 | 0.009190 | 11 |
| 25.780571 | 0.011528 | 12 |
| 26.394731 | 0.015040 | 13 |
| 26.553483 | 0.021993 | 14 |
| 27.799707 | 0.022857 | 15 |
| 27.845764 | 0.032987 | 16 |
| 31.553424 | 0.017089 | 17 |
| 31.554431 | 0.024812 | 18 |
| 34.829323 | 0.014643 | 19 |
| 34.857801 | 0.020875 | 20 |
| 34.895854 | 0.028987 | 21 |
| 35.054775 | 0.038238 | 22 |
| 35.061316 | 0.051291 | 23 |
| 35.061488 | 0.067494 | 24 |

4.1-模型定阶

parameters AIC BIC

0 SARIMA(2, 1, 2)x(0, 0, 0, 0) 264.762182 280.261514

1 SARIMA(3, 1, 2)x(0, 0, 0, 0) 265.989215 284.588414

2 SARIMA(1, 1, 1)x(0, 0, 0, 0) 276.775640 286.075240

3 SARIMA(2, 1, 1)x(0, 0, 0, 0) 274.686941 287.086407

4 SARIMA(3, 1, 3)x(0, 0, 0, 0) 266.594783 288.293848

5 SARIMA(1, 1, 2)x(0, 0, 0, 0) 277.458117 289.857582

6 SARIMA(1, 1, 3)x(0, 0, 0, 0) 276.056094 291.555426

7 SARIMA(3, 1, 1)x(0, 0, 0, 0) 279.710681 295.210013

8 SARIMA(2, 1, 3)x(0, 0, 0, 0) 277.789535 296.388733

4.2-使用 𝑆𝐴𝑅𝐼𝑀𝐴(𝑝,𝑑,𝑞)(𝑃,𝐷,𝑄)𝑚 建模

SARIMAX Results

==============================================================================

Dep. Variable: y No. Observations: 165

Model: ARIMA(2, 1, 1) Log Likelihood -133.343

Date: Thu, 02 Dec 2021 AIC 274.687

Time: 09:33:23 BIC 287.086

Sample: 0 HQIC 279.721

- 165

Covariance Type: opg

==============================================================================

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 0 | coef | stderr | z | P>|z| | [0.025 | 0.975] |
| ar.L1 | 1.1436 | 0.056 | 20.319 | 0.000 | 1.033 | 1.254 |
| ar.L2 | -0.2564 | 0.034 | -7.458 | 0.000 | -0.324 | -0.189 |
| ma.L1 | -0.9390 | 0.050 | -18.794 | 0.000 | -1.037 | -0.841 |
| sigma2 | 0.2972 | 0.010 | 30.163 | 0.000 | 0.278 | 0.316 |

===================================================================================

Ljung-Box (L1) (Q): 0.04 Jarque-Bera (JB): 4960.66

Prob(Q): 0.84 Prob(JB): 0.00

Heteroskedasticity (H): 36.04 Skew: -3.16

Prob(H) (two-sided): 0.00 Kurtosis: 29.19

===================================================================================

5-模型显著性检验（残差检验）

|  |  |  |
| --- | --- | --- |
| LB | Pvalue | lags |
| 0.010273 | 0.919269 | 1 |
| 0.021151 | 0.989480 | 2 |
| 0.041407 | 0.997787 | 3 |
| 0.087512 | 0.999070 | 4 |
| 0.111853 | 0.999786 | 5 |
| 0.112559 | 0.999972 | 6 |
| 0.331409 | 0.999860 | 7 |
| 0.355759 | 0.999964 | 8 |
| 0.361006 | 0.999993 | 9 |
| 0.393833 | 0.999998 | 10 |
| 0.406426 | 1.000000 | 11 |
| 0.480089 | 1.000000 | 12 |
| 0.515043 | 1.000000 | 13 |
| 0.523314 | 1.000000 | 14 |
| 0.599722 | 1.000000 | 15 |
| 0.701094 | 1.000000 | 16 |
| 0.913882 | 1.000000 | 17 |
| 0.974329 | 1.000000 | 18 |
| 1.087333 | 1.000000 | 19 |
| 1.172770 | 1.000000 | 20 |
| 1.223661 | 1.000000 | 21 |
| 1.229729 | 1.000000 | 22 |
| 1.240942 | 1.000000 | 23 |
| 1.247198 | 1.000000 | 24 |

6-拟合+7-预测

----fitted confidence interval: 95 %

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| y | mean | mean\_se | mean\_ci\_lower | mean\_ci\_upper |
| 0 | 684854.633220 | 0.565359 | 684853.525136 | 684855.741304 |
| 1 | 811488.459980 | 0.552103 | 811487.377878 | 811489.542081 |
| 2 | 802002.607606 | 0.551133 | 802001.527406 | 802003.687806 |
| 3 | 686253.454797 | 0.550315 | 686252.376199 | 686254.533394 |
| 4 | 752412.662322 | 0.549622 | 752411.585083 | 752413.739561 |
| .. | ... | ... | ... | ... |
| 172 | 25895.117392 | 1.641024 | 25891.901043 | 25898.333740 |
| 173 | 25689.467588 | 1.689885 | 25686.155475 | 25692.779701 |
| 174 | 25518.331606 | 1.733351 | 25514.934300 | 25521.728913 |
| 175 | 25375.840508 | 1.772597 | 25372.366281 | 25379.314734 |
| 176 | 25257.109496 | 1.808493 | 25253.564915 | 25260.654078 |