3-白噪声检验

|  |  |  |
| --- | --- | --- |
| LB | Pvalue | lags |
| 14.660164 | 0.000129 | 1 |
| 15.078267 | 0.000532 | 2 |
| 15.097430 | 0.001735 | 3 |
| 15.994064 | 0.003027 | 4 |
| 16.220077 | 0.006243 | 5 |
| 16.375835 | 0.011873 | 6 |
| 16.466483 | 0.021180 | 7 |
| 17.697283 | 0.023614 | 8 |
| 17.994032 | 0.035243 | 9 |
| 19.665358 | 0.032582 | 10 |
| 19.869902 | 0.047157 | 11 |
| 44.424748 | 0.000013 | 12 |
| 51.690792 | 0.000002 | 13 |
| 51.693883 | 0.000003 | 14 |
| 52.568658 | 0.000005 | 15 |
| 52.657913 | 0.000009 | 16 |
| 52.863585 | 0.000015 | 17 |
| 52.890797 | 0.000027 | 18 |
| 53.409155 | 0.000041 | 19 |
| 58.664360 | 0.000011 | 20 |
| 60.241054 | 0.000012 | 21 |
| 62.034225 | 0.000011 | 22 |
| 65.597310 | 0.000006 | 23 |
| 69.160835 | 0.000003 | 24 |

4.1-模型定阶

parameters AIC BIC

0 SARIMA(1, 1, 1)x(0, 1, 1, 12) -273.257695 -261.756906

1 SARIMA(2, 1, 1)x(0, 1, 1, 12) -271.463670 -257.087684

2 SARIMA(1, 1, 2)x(0, 1, 1, 12) -271.257713 -256.881727

3 SARIMA(3, 1, 1)x(0, 1, 1, 12) -270.584854 -253.333670

4 SARIMA(1, 1, 3)x(0, 1, 1, 12) -269.460408 -252.209224

5 SARIMA(2, 1, 2)x(0, 1, 1, 12) -269.411967 -252.160783

6 SARIMA(3, 1, 2)x(0, 1, 1, 12) -269.859558 -249.733176

7 SARIMA(2, 1, 3)x(0, 1, 1, 12) -268.629169 -248.502787

8 SARIMA(3, 1, 3)x(0, 1, 1, 12) -266.489296 -243.487717

4.2-使用 𝑆𝐴𝑅𝐼𝑀𝐴(𝑝,𝑑,𝑞)(𝑃,𝐷,𝑄)𝑚 建模

SARIMAX Results

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

Dep. Variable: y No. Observations: 144

Model: ARIMA(3, 1, 1)x(0, 1, 1, 12) Log Likelihood 141.292

Date: Thu, 02 Dec 2021 AIC -270.585

Time: 00:09:54 BIC -253.334

Sample: 0 HQIC -263.575

- 144

Covariance Type: opg

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | coef | std err | z | P>|z| | [0.025 | 0.975] |
| ar.L1 | -1.0467 | 0.382 | -2.740 | 0.006 | -1.796 | -0.298 |
| ar.L2 | -0.3965 | 0.156 | -2.539 | 0.011 | -0.703 | -0.090 |
| ar.L3 | -0.1686 | 0.108 | -1.559 | 0.119 | -0.381 | 0.043 |
| ma.L1 | 0.7029 | 0.396 | 1.773 | 0.076 | -0.074 | 1.480 |
| ma.S.L12 | -0.7905 | 0.126 | -6.278 | 0.000 | -1.037 | -0.544 |
| sigma2 | 0.0062 | 0.001 | 8.571 | 0.000 | 0.005 | 0.008 |

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

Ljung-Box (L1) (Q): 0.00 Jarque-Bera (JB): 11.99

Prob(Q): 0.97 Prob(JB): 0.00

Heteroskedasticity (H): 0.85 Skew: -0.65

Prob(H) (two-sided): 0.60 Kurtosis: 3.71

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

5-模型显著性检验（残差检验）

|  |  |  |
| --- | --- | --- |
| LB | Pvalue | lags |
| 0.032360 | 0.857240 | 1 |
| 0.032407 | 0.983927 | 2 |
| 0.057543 | 0.996392 | 3 |
| 0.124347 | 0.998146 | 4 |
| 0.124603 | 0.999721 | 5 |
| 0.148931 | 0.999935 | 6 |
| 0.155292 | 0.999989 | 7 |
| 0.207094 | 0.999996 | 8 |
| 0.230768 | 0.999999 | 9 |
| 0.232913 | 1.000000 | 10 |
| 0.234259 | 1.000000 | 11 |
| 25.987537 | 0.010778 | 12 |
| 26.046891 | 0.016756 | 13 |
| 26.051997 | 0.025496 | 14 |
| 26.052303 | 0.037477 | 15 |
| 26.127322 | 0.052263 | 16 |
| 26.129340 | 0.072136 | 17 |
| 26.131950 | 0.096779 | 18 |
| 26.170501 | 0.125508 | 19 |
| 26.177514 | 0.160029 | 20 |
| 26.178243 | 0.199734 | 21 |
| 26.179350 | 0.244061 | 22 |
| 26.179356 | 0.292472 | 23 |
| 26.185646 | 0.343813 | 24 |

6-拟合+7-预测

----fitted confidence interval: 95 %

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| y | mean | mean\_se | mean\_ci\_lower | mean\_ci\_upper |
| 0 | 684853.984891 | 1000.000006 | 682894.020896 | 686813.948887 |
| 1 | 787461.996974 | 1000.000006 | 785502.032979 | 789421.960970 |
| 2 | 804685.999766 | 1000.000006 | 802726.035771 | 806645.963762 |
| 3 | 711591.003768 | 1000.000006 | 709631.039773 | 713550.967764 |
| 4 | 745976.996921 | 1000.000006 | 744017.032926 | 747936.960917 |
| .. | ... | ... | ... | ... |
| 160 | 322909.153427 | 0.242449 | 322908.678236 | 322909.628618 |
| 161 | 366518.096401 | 0.250373 | 366517.605679 | 366518.587124 |
| 162 | 379961.651433 | 0.257890 | 379961.145978 | 379962.156887 |
| 163 | 302243.351020 | 0.265329 | 302242.830984 | 302243.871055 |
| 164 | 322445.784407 | 0.272452 | 322445.250410 | 322446.318403 |