

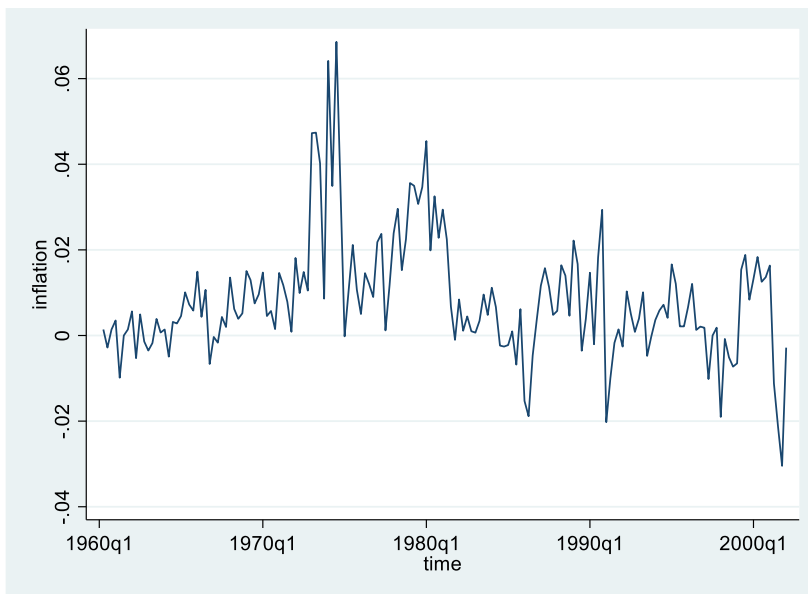
Miguel Alejandro García Navarro

1919323

Homework 1

Inflation is generated and plotted.

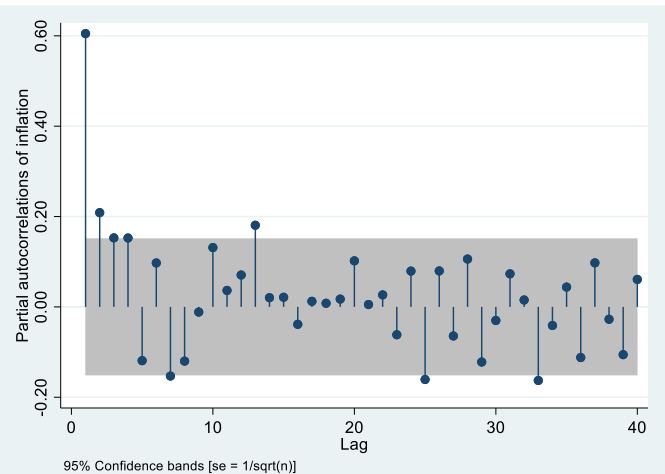
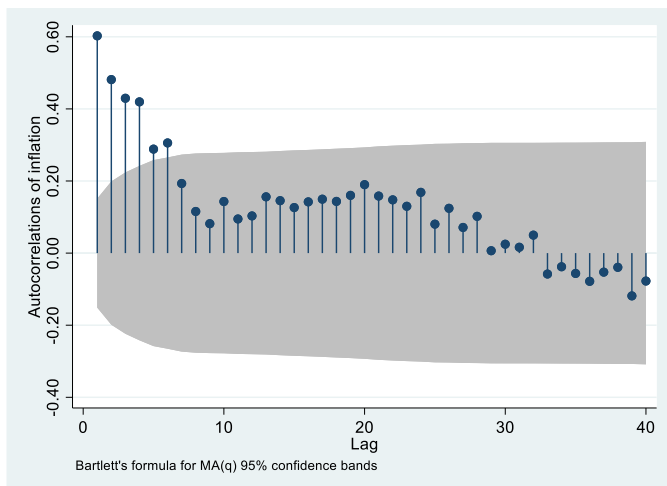
```
.  
. use ppi  
  
. generate lppi=log(ppi)  
(1 missing value generated)  
  
. generate inflation=d.lppi  
  
. tsline inflation  
  
. ac inflation  
  
. pac inflation  
  
. corrgram inflation
```



From the plot one cannot say if it is stationary or not.

LAG	AC	PAC	Q	Prob>Q	-1 0 1 [Autocorrelation]	-1 0 1 [Partial autocor]
1	0.6027	0.6050	62.119	0.0000		
2	0.4813	0.2087	101.98	0.0000		
3	0.4295	0.1528	133.91	0.0000		
4	0.4196	0.1525	164.58	0.0000		
5	0.2885	-0.1189	179.16	0.0000		
6	0.3056	0.0973	195.63	0.0000		
7	0.1931	-0.1530	202.25	0.0000		
8	0.1155	-0.1200	204.63	0.0000		
9	0.0817	-0.0114	205.83	0.0000		
10	0.1431	0.1314	209.53	0.0000		
11	0.0947	0.0365	211.16	0.0000		
12	0.1031	0.0706	213.11	0.0000		
13	0.1561	0.1808	217.6	0.0000		
14	0.1455	0.0204	221.52	0.0000		
15	0.1264	0.0213	224.51	0.0000		
16	0.1421	-0.0386	228.3	0.0000		
17	0.1496	0.0124	232.54	0.0000		
18	0.1434	0.0080	236.45	0.0000		
19	0.1602	0.0173	241.37	0.0000		
20	0.1899	0.1020	248.33	0.0000		

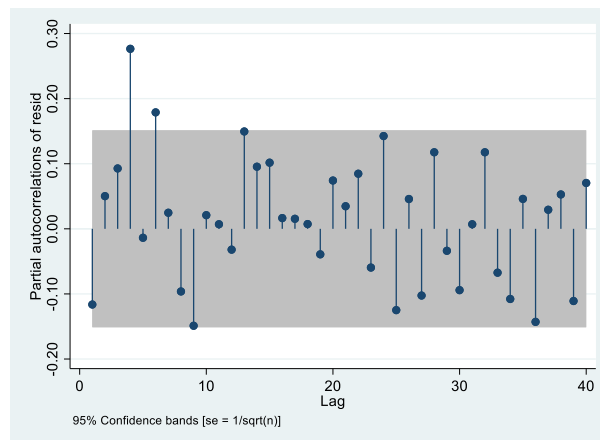
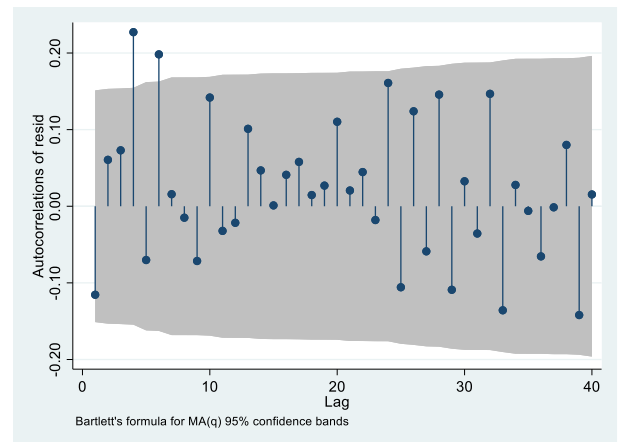
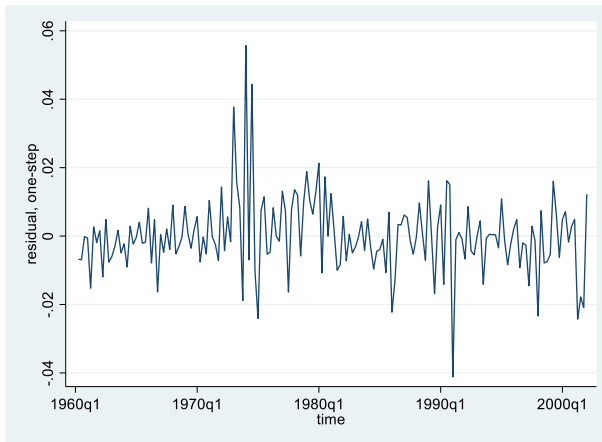
Correlogram indicates that there is autocorrelation



From the AC and PAC it seems like it is a stationary process, it slowly goes to zero in the AC, and in the PAC it has one big spike, but 4 in total at the beginning. I propose the next models:

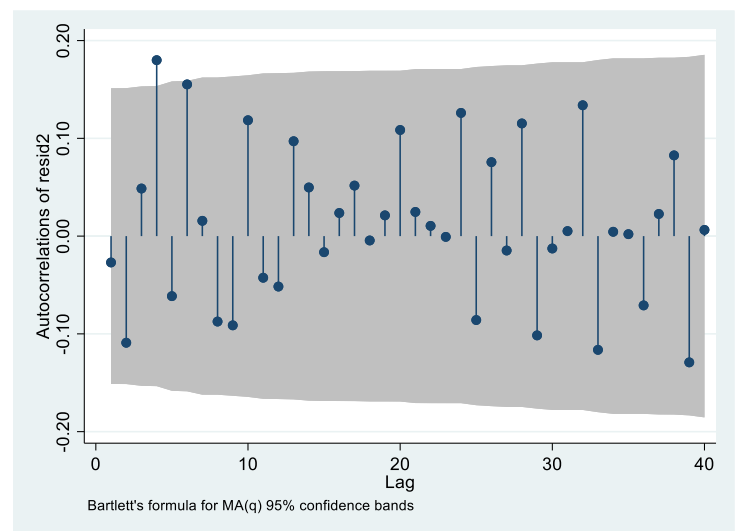
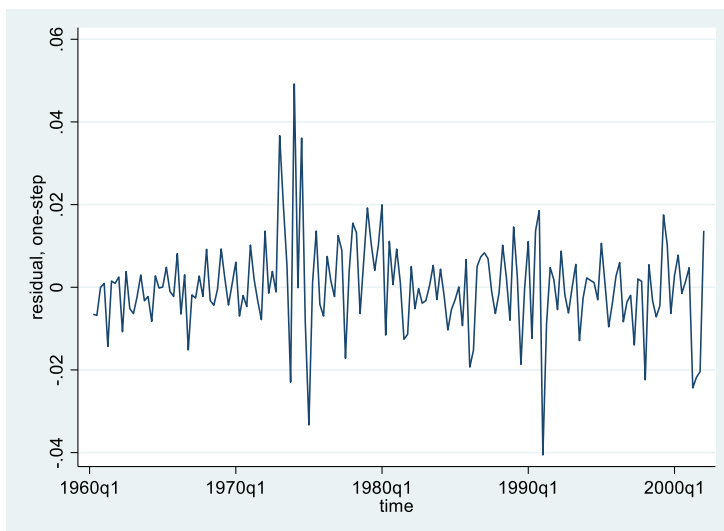
AR(1), AR(2), MA(4), MA(5), MA(6), ARMA(1,1)

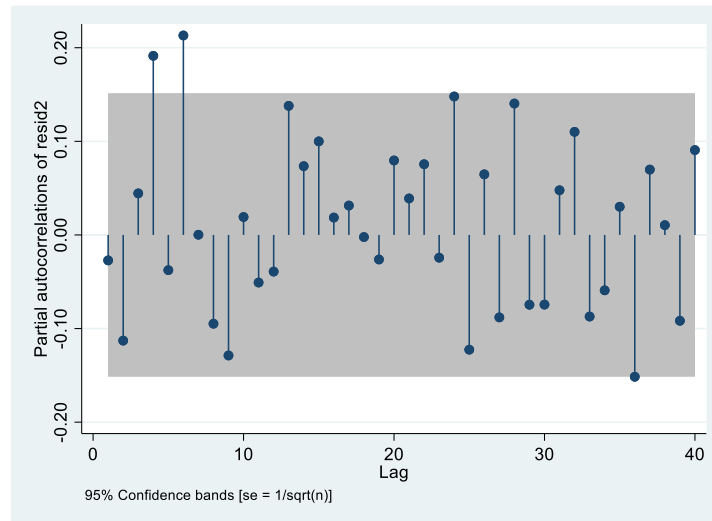
AR(1)



The residuals of the AR(1) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

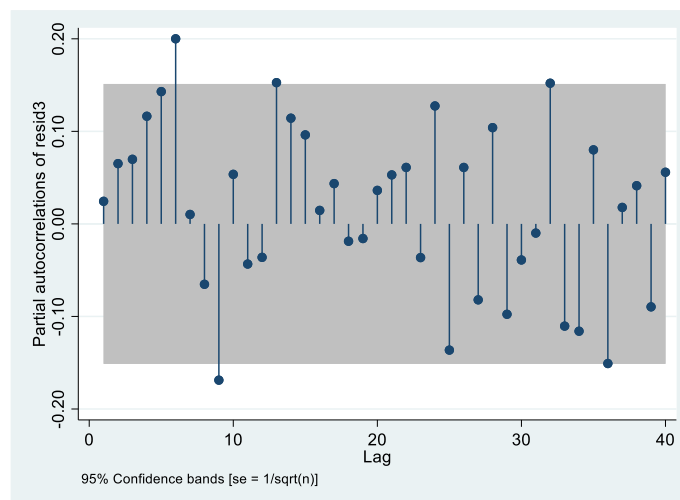
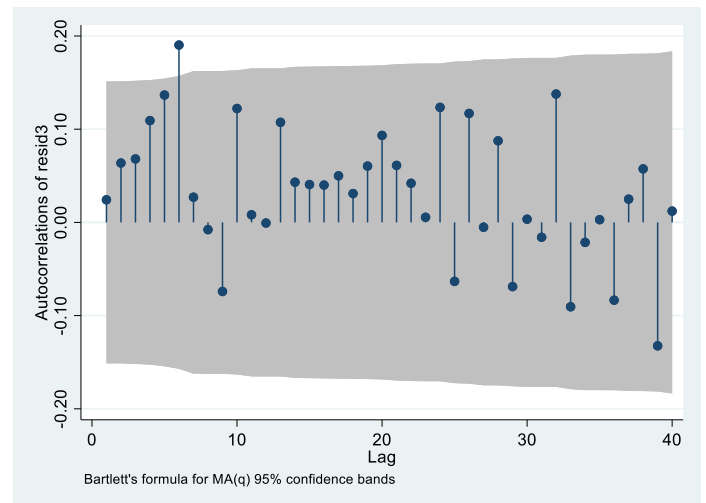
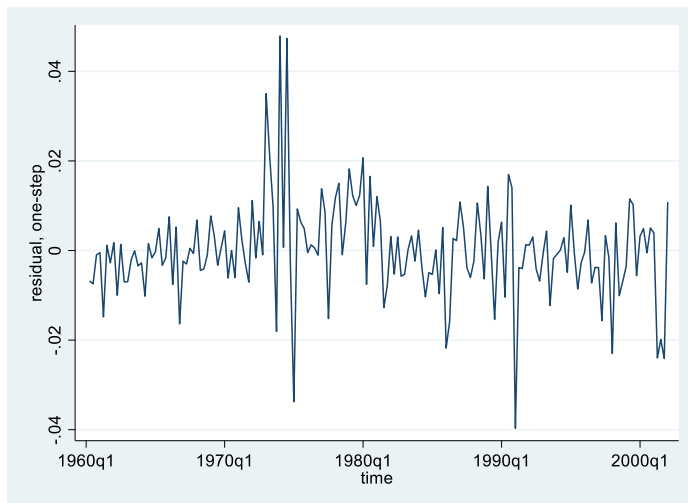
AR(2)





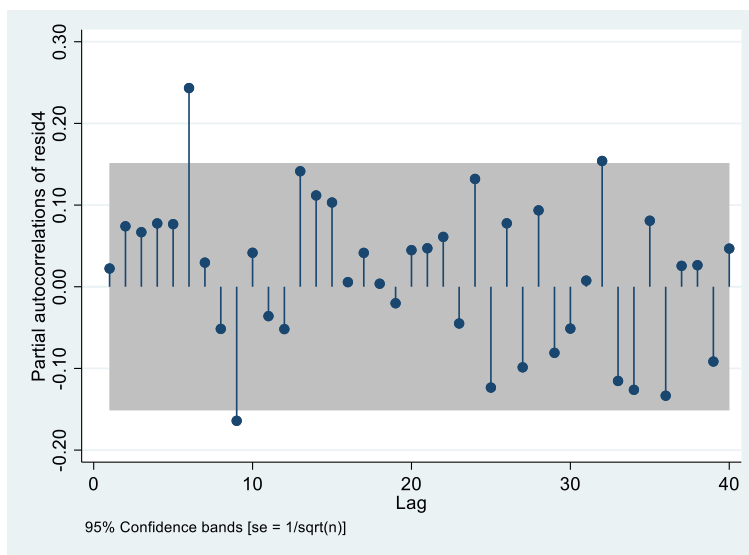
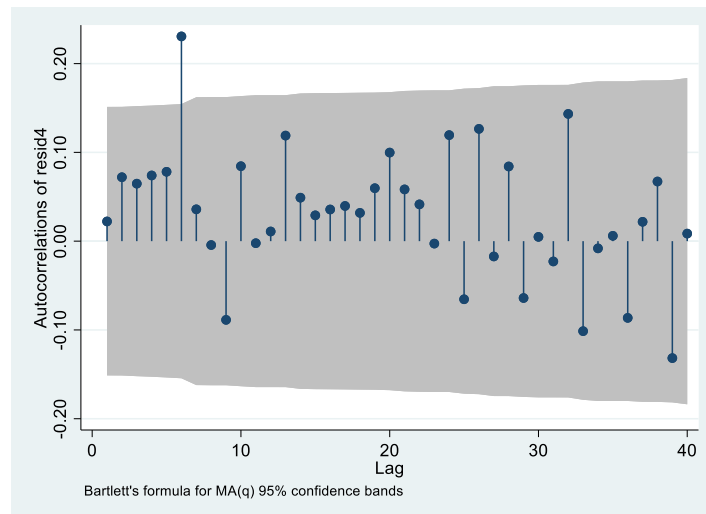
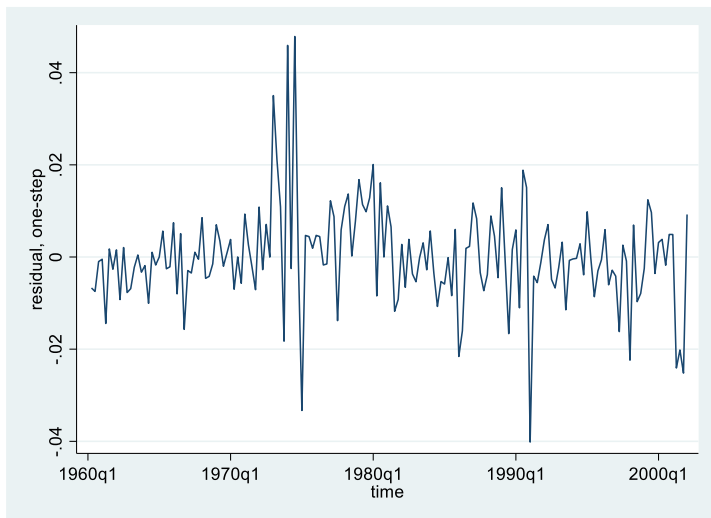
The residuals of the AR(2) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

MA(4)



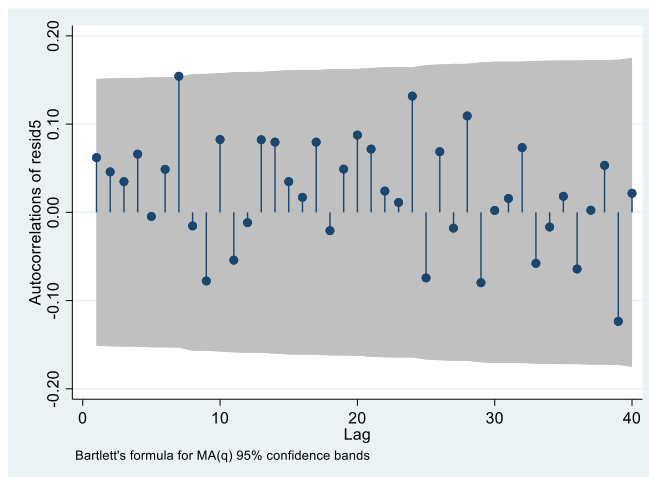
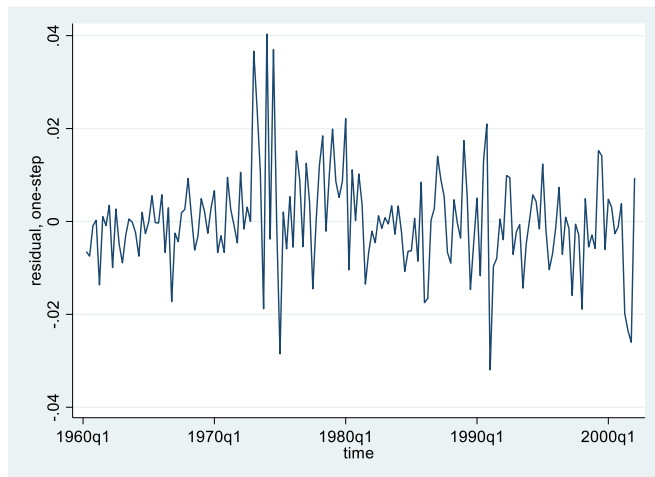
The residuals of the MA(4) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

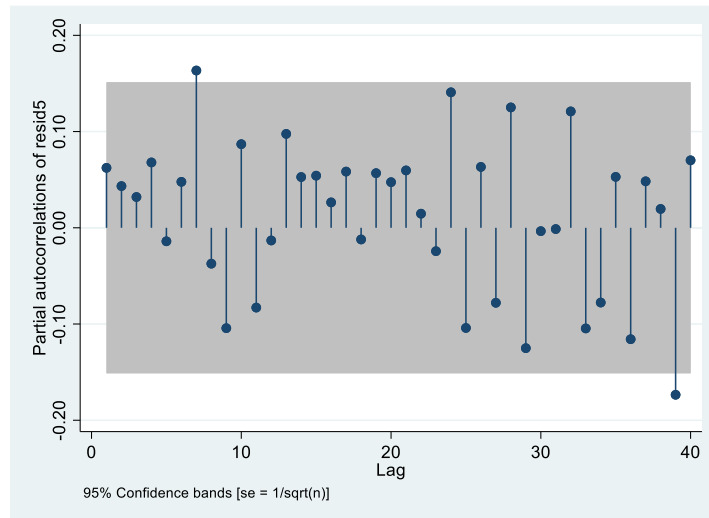
MA(5)



The residuals of the MA(5) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

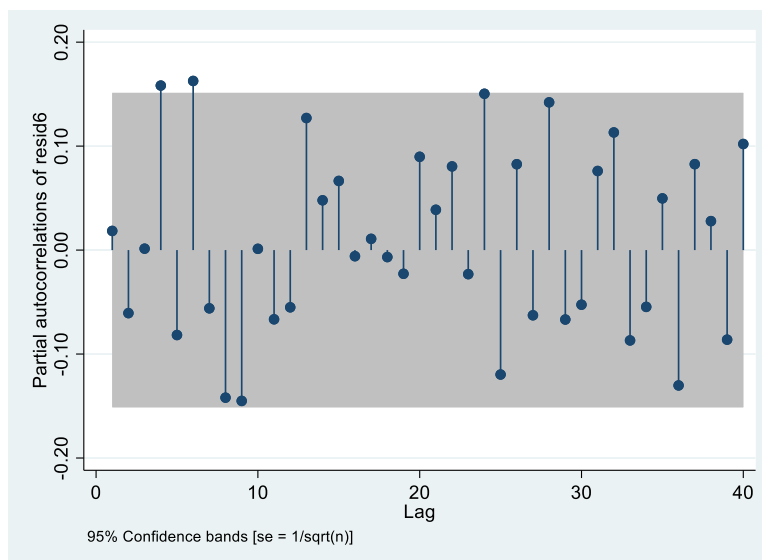
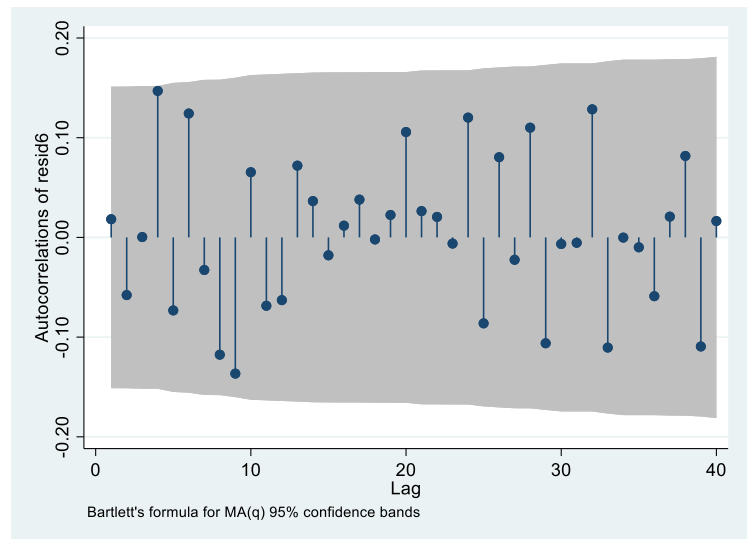
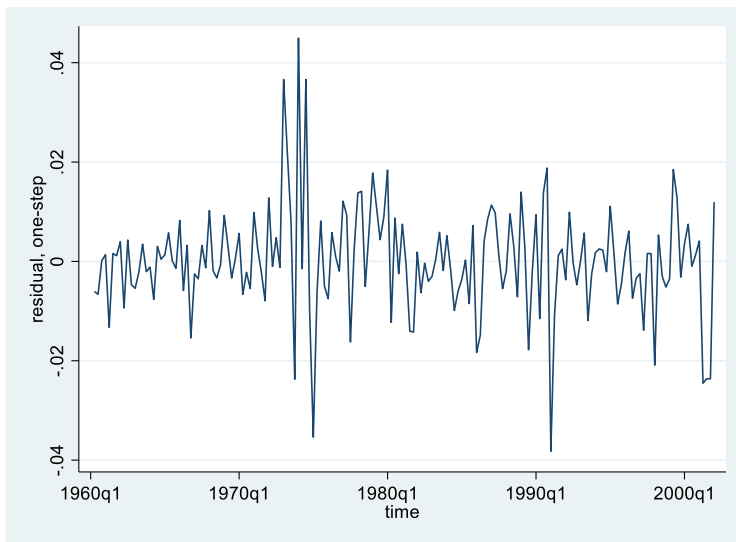
MA(6)





The residuals of the MA(6) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

ARMA(1,1)



The residuals of the ARMA(1,1) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

The next two tables summarize some of the properties of each model tested.

Yellow-shaded are the ones that can be compared. The others are rejected either because of the significance of their coefficients or because they do not imply stationarity and/or invertibility

	AR(1)	AR(2)	MA(4)
Coefficients			
Are they all individually significant? (t-test)	Yes	Yes	Yes
Are they all jointly significant (F-test or chi-squared test)	Yes	Yes	Yes
Do they imply stationarity (AR coefficients) and invertibility (MA coefficients)	Yes	Yes	No
Information criterion			
AIC	-1025.94	-1030.975	-1026.423
BIC	-1016.57	-1018.48	-1007.679
Diagnostic checks – residuals			
Plot the residuals – do they exhibit any remaining pattern?	No	No	Yes
ACFs and PACFs of residuals – do they indicate white noise?	No	No	No
Ljung-Box Q-Test (p-values in brackets)			
Q_lag4	12.826 (0.0122)	8.221 (0.0838)	3.6792 (0.4512)
Q_lag 8	20.7 (0.0080)	14.534 (0.0689)	13.474 (0.0965)
Q_lag 12	25.53 (0.0125)	19.386 (0.0796)	17.173 (0.1432)

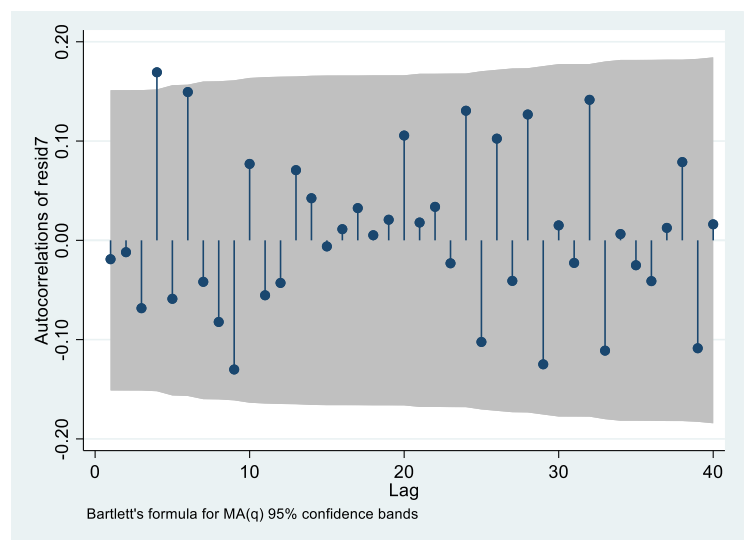
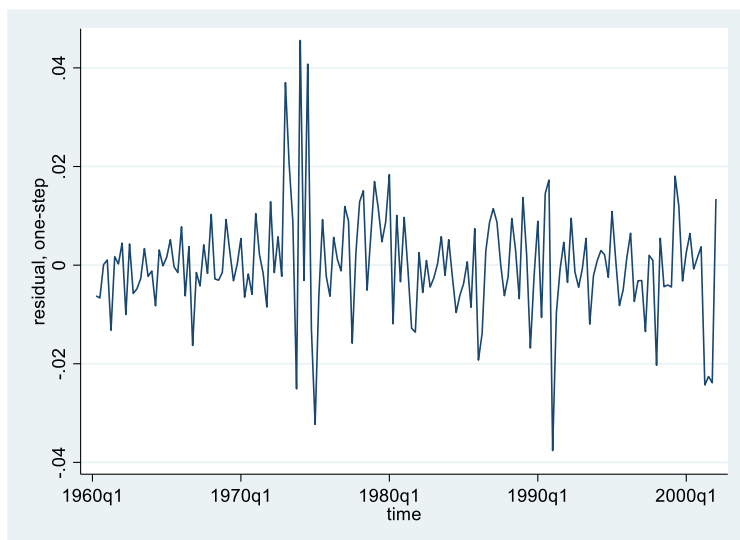
	MA(5)	MA(6)	ARMA(1,1)
Coefficients			
Are they all individually significant? (t-test)	No	Yes	Yes

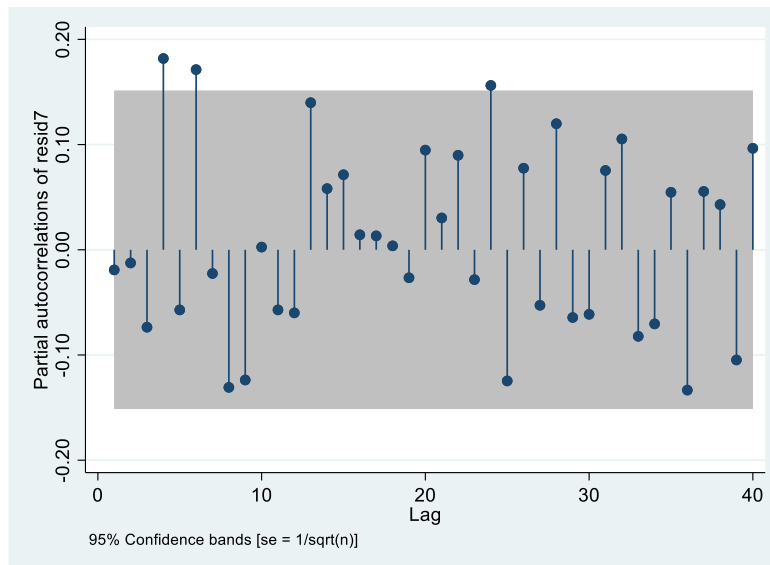
Are they all jointly significant (F-test or chi-squared test)	Yes	Yes	Yes
Do they imply stationarity (AR coefficients) and invertibility (MA coefficients)	No	No	Yes
Information criterion			
AIC	-1025.692	-1034.996	-1035.257
BIC	-1003.824	-1010.004	-1022.761
Diagnostic checks – residuals			
Plot the residuals – do they exhibit any remaining pattern?	No	No	No
ACFs and PACFs of residuals – do they indicate white noise?	No	No	No
Ljung-Box Q-Test (p-values in brackets)			
Q_lag4	2.6576 (0.6166)	1.9866 (0.7382)	4.3911 (0.3557)
Q_lag 8	13.339 (0.1007)	6.6712 (0.5725)	10.711 (0.2186)
Q_lag 12	16.063 (0.1884)	9.5473 (0.6556)	16.416 (0.1729)

Based on these results, I propose these other models to test:

AR(3), AR(4), MA(3) and ARMA(2,1)

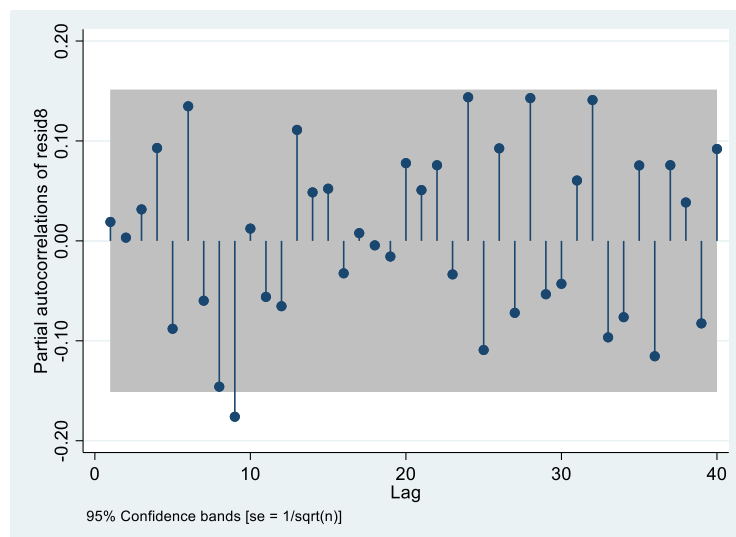
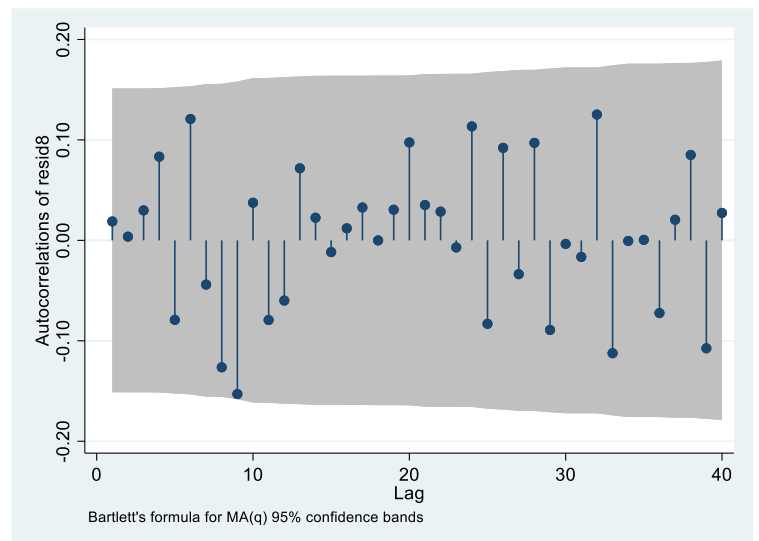
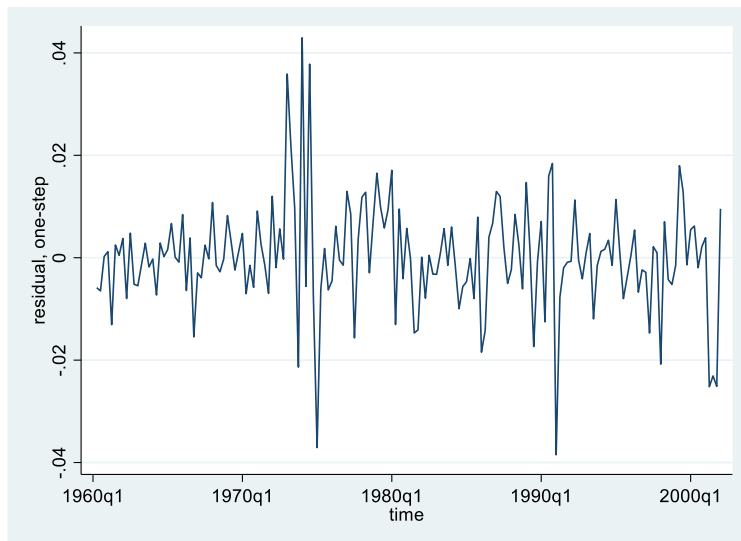
AR(3)





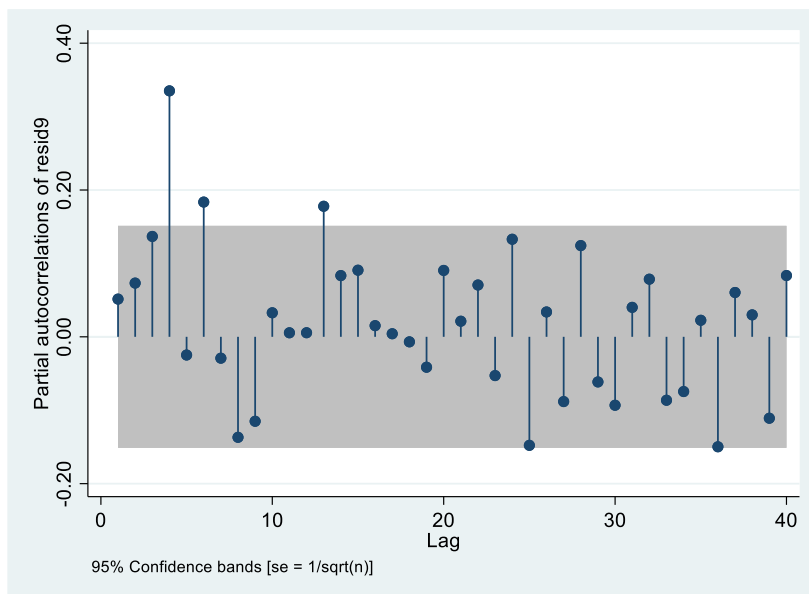
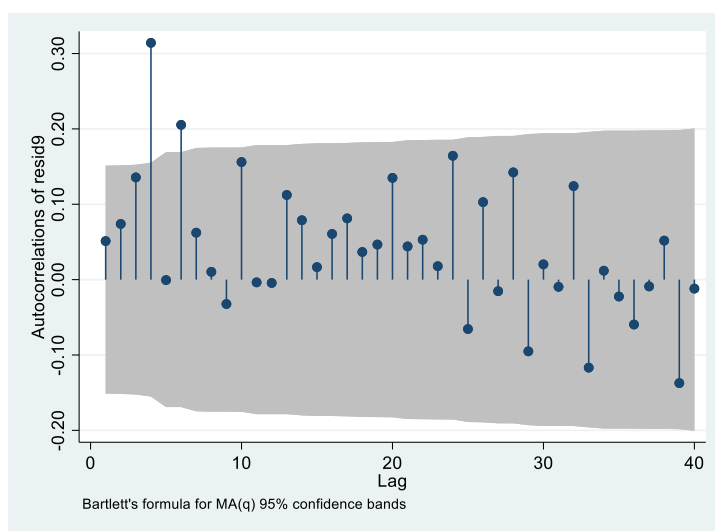
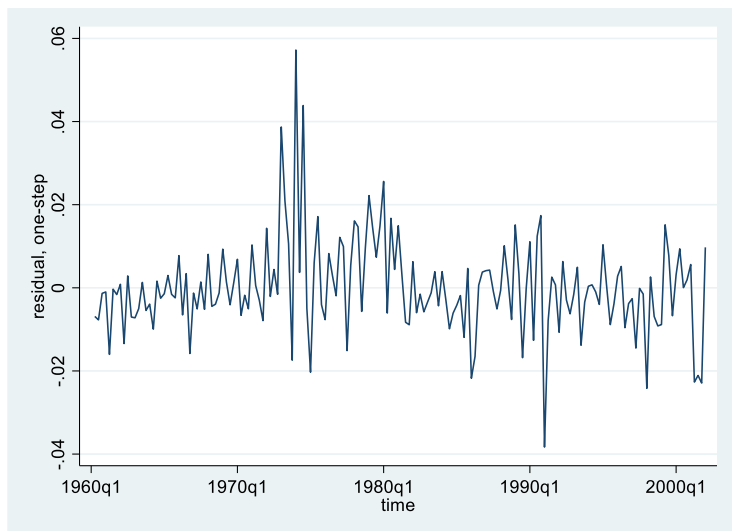
The residuals of the AR(3) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

AR(4)



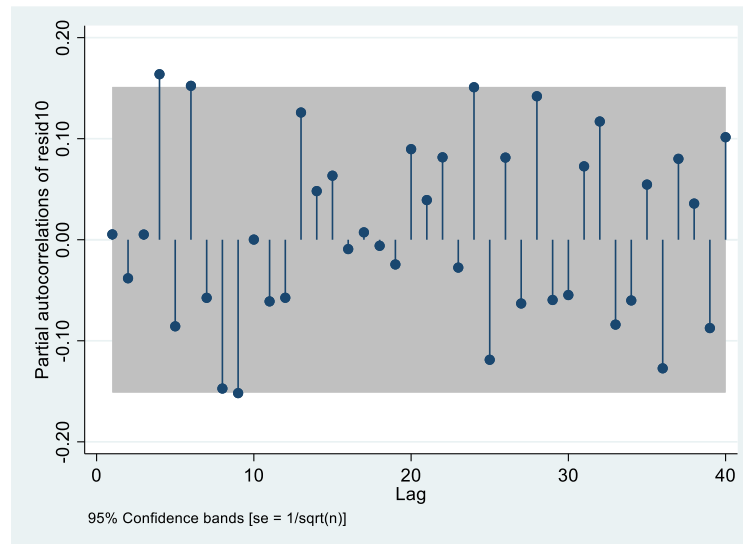
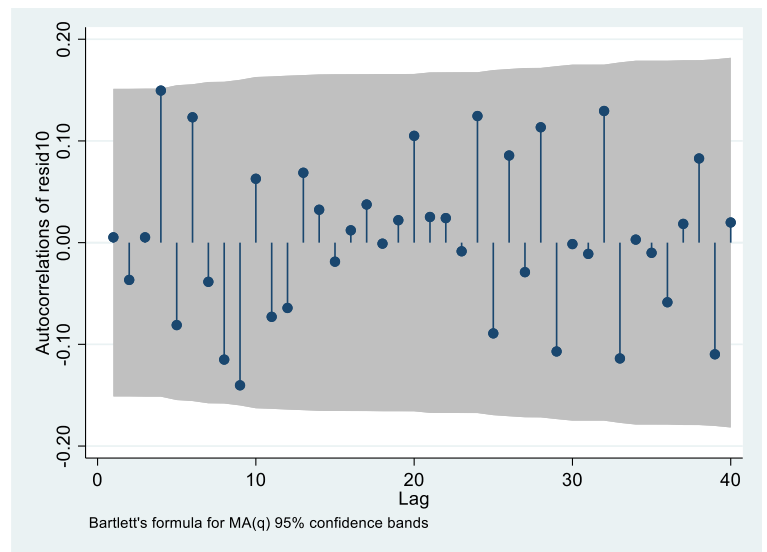
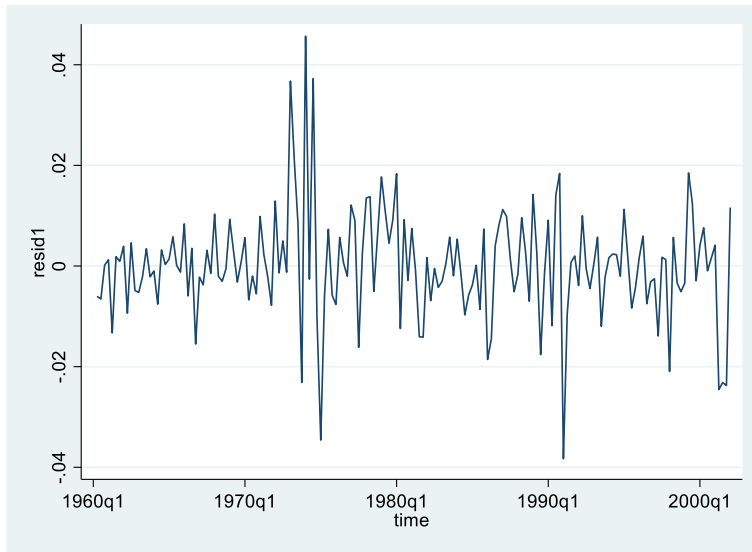
The residuals of the AR(4) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

MA(3)



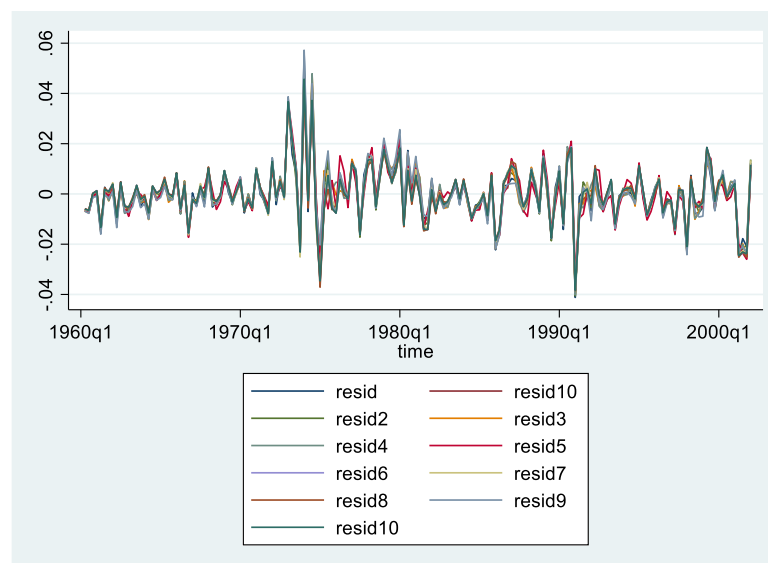
The residuals of the MA(3) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

ARMA(2,1)



The residuals of the ARMA(2,1) plotted seem to be white-noise, but it can be seen that autocorrelation cannot be said to be zero.

One thing to be noted is that, from all the models tested here, the residuals look almost the same:



The next two tables summarize the properties of each model. Again, the yellow-shaded is the only one that was not rejected based on the significance of its coefficients and on stationarity and invertibility.

	AR(3)	AR(4)	MA(3)
Coefficients			
Are they all individually significant? (t-test)	Yes	No	No
Are they all jointly significant (F-test or chi-squared test)	Yes	Yes	Yes
Do they imply stationarity (AR coefficients) and invertibility (MA coefficients)	Yes	Yes	Yes
Information criterion			
AIC	-1032.677	-1034.347	-1014.393
BIC	-1017.057	-1015.603	-998.7736
Diagnostic checks – residuals			
Plot the residuals – do they exhibit any remaining pattern?	No	No	No
ACFs and PACFs of residuals – do they indicate white noise?	No	No	No
Ljung-Box Q-Test (p-values in brackets)			
Q_lag4	5.8852 (0.2079)	1.4257 (0.8397)	21.769 (0.0002)
Q_lag 8	11.943 (0.1538)	8.2913 (0.4055)	29.911 (0.0002)
Q_lag 12	16.947 (0.1516)	14.55 (0.2670)	34.505 (0.0006)

	ARMA(2,1)
Coefficients	
Are they all individually significant? (t-test)	No
Are they all jointly significant (F-test or chi-squared test)	Yes
Do they imply stationarity (AR coefficients) and	No

invertibility (MA coefficients)	
Information criterion	
AIC	-1033.434
BIC	-1017.814
Diagnostic checks – residuals	
Plot the residuals – do they exhibit any remaining pattern?	No
ACFs and PACFs of residuals – do they indicate white noise?	No
Ljung-Box Q-Test (p-values in brackets)	
Q_lag4	4.1339 (0.3882)
Q_lag 8	10.587 (0.2262)
Q_lag 12	16.558 (0.1670)

From the accepted models, we have the next:

Information criterion	AR(1)	AR(2)	ARMA(1,1)	AR(3)
AIC	-1025.94	-1030.975	-1035.257	-1032.677
BIC	-1016.57	-1018.48	-1022.761	-1017.057

From these four models, the one with the lowest AIC and BIC is the ARMA(1,1), so this is considered to be the best model.