

Econometrics III

Assignment Part I

Thao Le (523716)
David Gyarakı (582340)

Contents

1	Question 1	2
2	Question 2	5
3	Question 3	6
4	Question 4	7
5	Question 5	8
6	Question 6	9
7	Question 7	9
8	Question 8	9

```
# load packages
if(!require(pacman)){install.packages("pacman")}

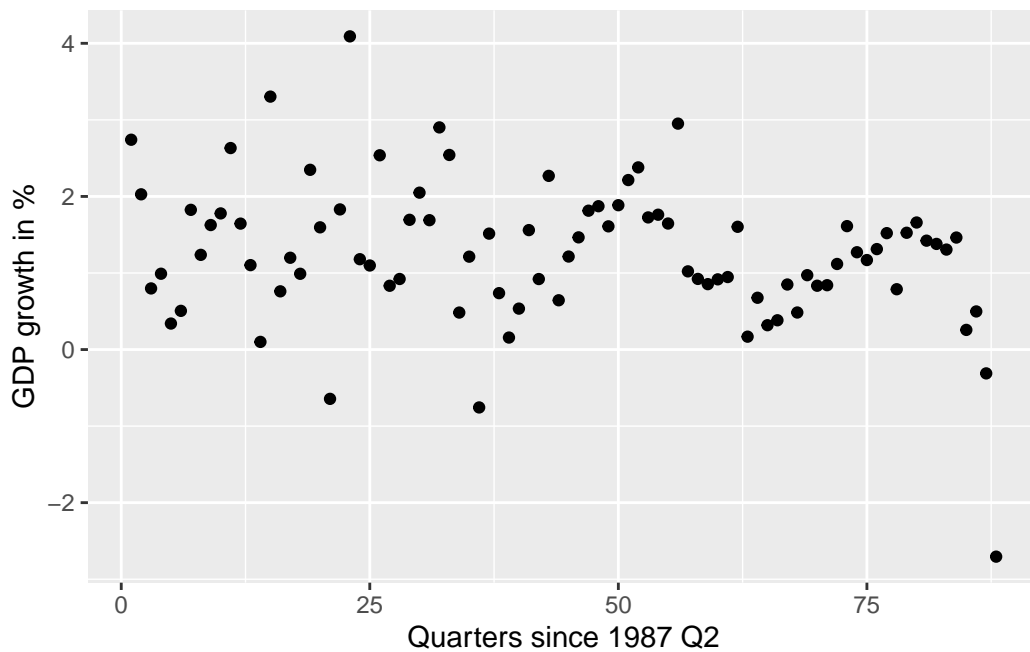
p_load(devtools,tidyverse,dplyr,ggplot2,latex2exp,stargazer, fixest,
  ↳ modelsummary, knitr, readr, tseries, lmtest, forecast)

dfAssign_p1 <- as.data.frame(read_csv("data_assign_p1.csv"))

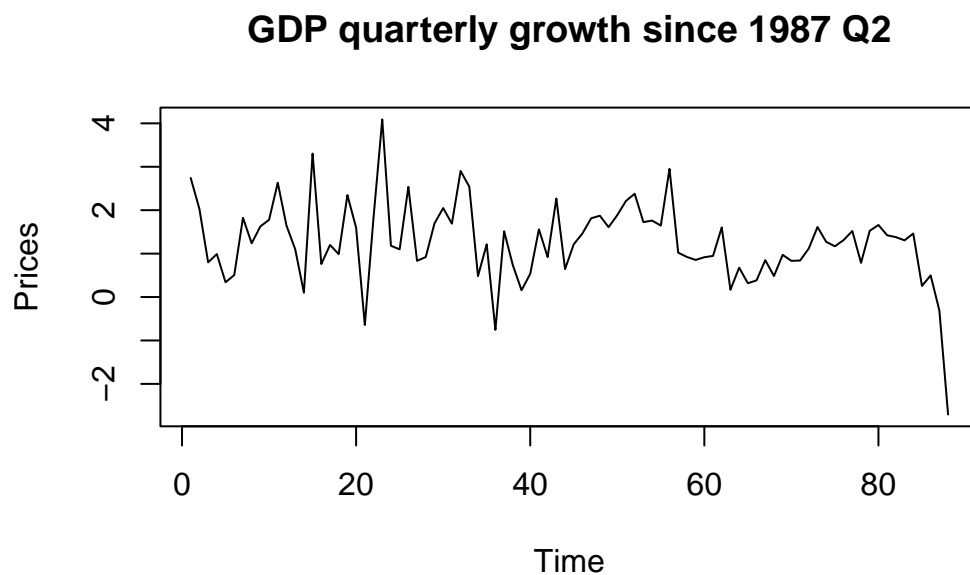
# Encode quarters
dfAssign_p1 <-
  ↳ cbind(dfAssign_p1,c(seq(1,nrow(dfAssign_p1),length.out=nrow(dfAssign_p1))))
colnames(dfAssign_p1) <- c("obs", "GDP_QGR", "ind")
```

1 Question 1

```
ggplot(dfAssign_p1, aes(x = ind, y = GDP_QGR)) + geom_point() +
  ↳ ylab("GDP growth in %") + xlab("Quarters since 1987 Q2")
```



```
plot.ts(dfAssign_p1$GDP_QGR, main="GDP quarterly growth since 1987 Q2",
  ↪ ylab="Prices")
```



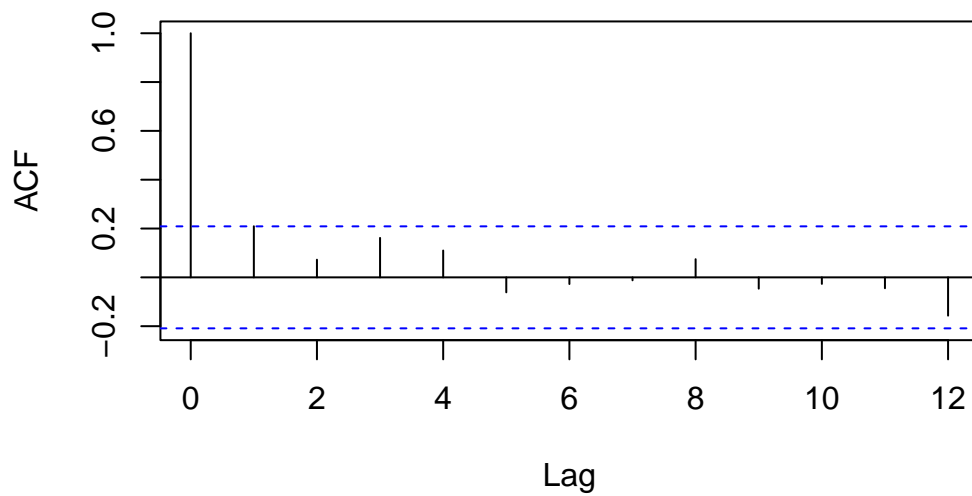
```
acf(dfAssign_p1$GDP_QGR,12,pl=F)
```

Autocorrelations of series 'dfAssign_p1\$GDP_QGR', by lag

0	1	2	3	4	5	6	7	8	9	10
1.000	0.209	0.072	0.162	0.110	-0.061	-0.027	-0.012	0.075	-0.046	-0.027
11	12									
-0.045	-0.157									

```
acf(dfAssign_p1$GDP_QGR,12,pl=T)
```

Series dfAssign_p1\$GDP_QGR

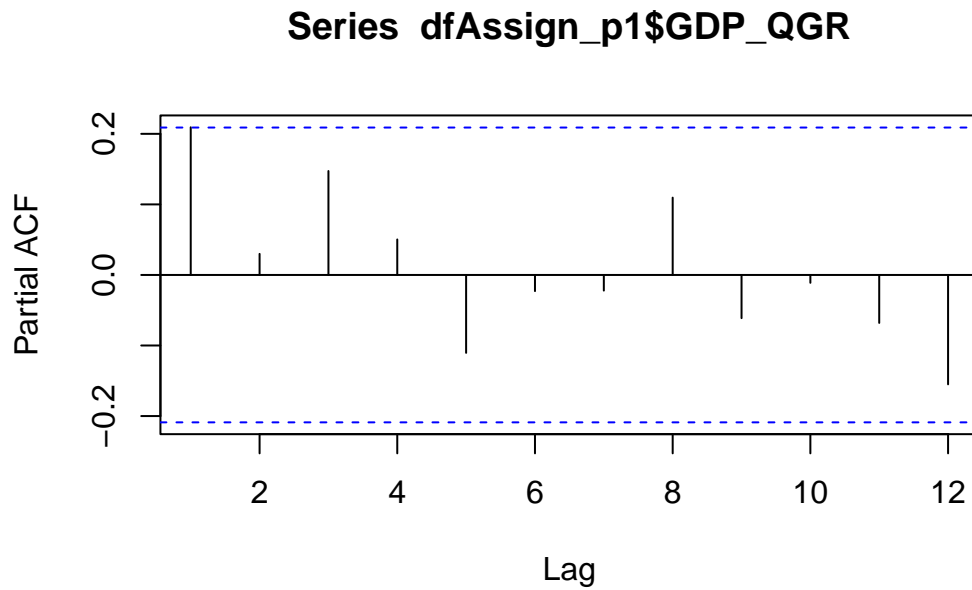


```
pacf(dfAssign_p1$GDP_QGR,12,p1=F)
```

Partial autocorrelations of series 'dfAssign_p1\$GDP_QGR', by lag

	1	2	3	4	5	6	7	8	9	10	11
	0.209	0.030	0.147	0.050	-0.110	-0.023	-0.022	0.110	-0.061	-0.011	-0.068
12											
	-0.155										

```
pacf(dfAssign_p1$GDP_QGR,12,p1=T)
```



2 Question 2

```
ar4 <- arima(dfAssign_p1$GDP_QGR, order=c(4,0,0))
#coeftest(ar4)

ar3 <- arima(dfAssign_p1$GDP_QGR, order=c(3,0,0))
#coeftest(ar3)

ar2 <- arima(dfAssign_p1$GDP_QGR, order=c(2,0,0))
#coeftest(ar2)

ar1 <- arima(dfAssign_p1$GDP_QGR, order=c(1,0,0))
#coeftest(ar1)
```

```
stargazer::stargazer(ar4,ar3,ar2,ar1, title="Estimating the AR(4) to
  ↪ AR(1) models on GDP data", align=TRUE, label = "tab_ar4",
  ↪ table.placement="H", out = "tab_ar4.tex")
```

Table 1: Estimating the AR(4) to AR(1) models on GDP data

<i>Dependent variable:</i>				
	(1)	(2)	(3)	(4)
ar1	0.242** (0.118)	0.256** (0.117)	0.263** (0.119)	0.272** (0.118)
ar2	0.030 (0.120)	0.030 (0.120)	0.058 (0.121)	
ar3	0.189 (0.119)	0.200* (0.119)		
ar4	0.086 (0.120)			
intercept	1.214*** (0.204)	1.228*** (0.180)	1.249*** (0.140)	1.253*** (0.130)
Observations	88	88	88	88
Log Likelihood	-113.211	-113.468	-114.849	-114.963
σ^2	0.765	0.770	0.796	0.798
Akaike Inf. Crit.	238.421	236.936	237.698	235.925
<i>Note:</i>			*p<0.1; **p<0.05; ***p<0.01	

3 Question 3

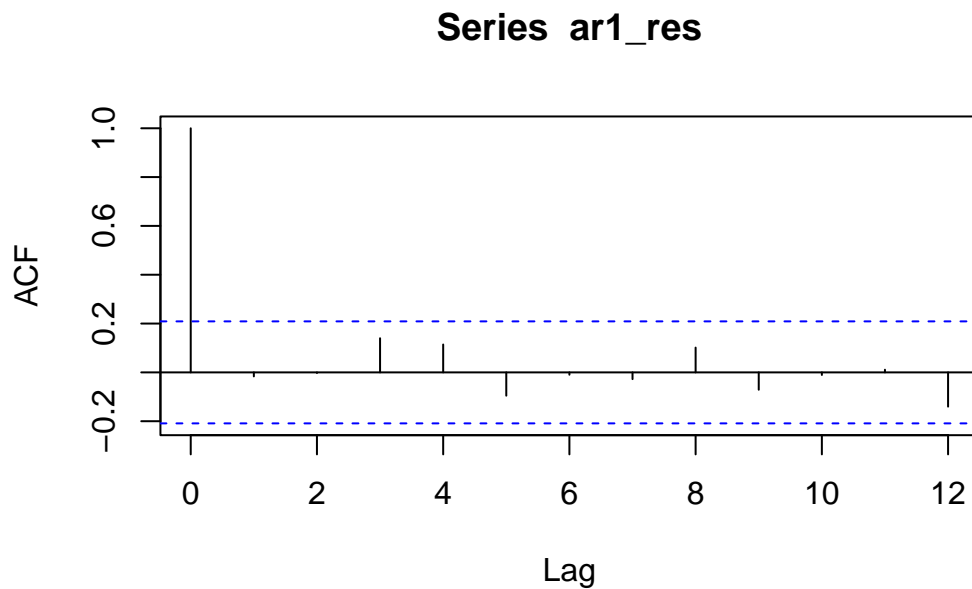
```
ar1_res <- as.numeric(ar1[["residuals"]])
acf(ar1_res,12,pl=F)
```

Autocorrelations of series 'ar1_res', by lag

```

    0      1      2      3      4      5      6      7      8      9     10
1.000 -0.017 -0.003  0.140  0.114 -0.096 -0.010 -0.028  0.102 -0.071 -0.011
    11     12
0.011 -0.140
```

```
acf(ar1_res,12,pl=T)
```



4 Question 4

```
forecast8 <- forecast(ar1, 8, level = c(95))
predlbl1 <- c("2009Q2", "2009Q3", "2009Q4", "2010Q1", "2010Q2", "2010Q3",
  ↪ "2010Q4", "2011Q1")
forecast_q4 <- cbind(predlbl1, as.data.frame(forecast8))

kable(forecast_q4[,1:2], caption="The predicted quarterly GDP growth
  ↪ rates using ARIMA(1,0,0)", col.names = c("Quarter", "Predicted
  ↪ growth %"), digits = 3, row.names = F)
```

Table 2: The predicted quarterly GDP growth rates using ARIMA(1,0,0)

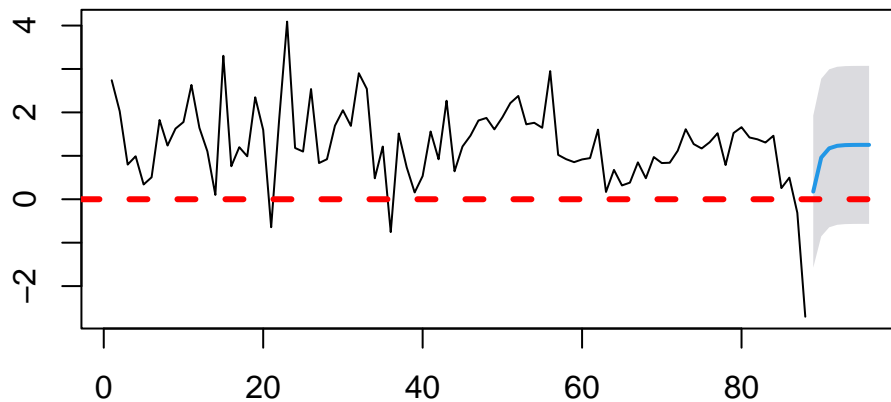
Quarter	Predicted growth %
2009Q2	0.177
2009Q3	0.960

Quarter	Predicted growth %
2009Q4	1.173
2010Q1	1.231
2010Q2	1.247
2010Q3	1.251
2010Q4	1.252
2011Q1	1.253

5 Question 5

```
plot(forecast8) %>%
  abline(h=0, col="red", lwd=3, lty=2)
```

Forecasts from ARIMA(1,0,0) with non-zero mean



6 Question 6

7 Question 7

8 Question 8

```
ar4_10 <- arima(dfAssign_p1$GDP_QGR, order=c(4,0,0))
coeftest(ar4_10)
```

z test of coefficients:

	Estimate	Std. Error	z value	Pr(> z)
ar1	0.241960	0.117749	2.0549	0.03989 *
ar2	0.029955	0.119538	0.2506	0.80213
ar3	0.189023	0.119463	1.5823	0.11359
ar4	0.086413	0.120151	0.7192	0.47201
intercept	1.214421	0.203636	5.9637	2.466e-09 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```
ar3_10 <- arima(dfAssign_p1$GDP_QGR, order=c(3,0,0))
coeftest(ar3_10)
```

z test of coefficients:

	Estimate	Std. Error	z value	Pr(> z)
ar1	0.255536	0.116737	2.1890	0.02860 *
ar2	0.029868	0.120377	0.2481	0.80404
ar3	0.200007	0.119049	1.6800	0.09295 .
intercept	1.228330	0.179893	6.8281	8.605e-12 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```
forecast_10 <- forecast(ar3_10, 8, level = c(90))
forecast_10db <- cbind(predlbl, as.data.frame(forecast_10))
```

```
kable(forecast_10db[,1:2], caption="The predicted quarterly GDP growth
↪ rates using ARIMA(1,0,0) and 90% CI", col.names = c("Quarter",
↪ "Predicted growth %"), digits = 3, row.names = F)
```

Table 3: The predicted quarterly GDP growth rates using ARIMA(1,0,0) and 90% CI

Quarter	Predicted growth %
2009Q2	0.031
2009Q3	0.497
2009Q4	0.219
2010Q1	0.709
2010Q2	0.919
2010Q3	0.932
2010Q4	1.040
2011Q1	1.109

```
plot(forecast_10) %>%
abline(h=0, col="red", lwd=3, lty=2)
```

Forecasts from ARIMA(3,0,0) with non-zero mean

