

Econometrics III

Assignment Part II

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```

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

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

dfAssign_p2 <- as.data.frame(read_csv("data/data_assign_p2.csv"))

# Encode quarters
dfAssign_p2 <-
  ↪ cbind(dfAssign_p2,c(seq(1,nrow(dfAssign_p2),length.out=nrow(dfAssign_p2))))
colnames(dfAssign_p2) <- c("obs", "GDP_QGR", "UN_RATE", "ind")

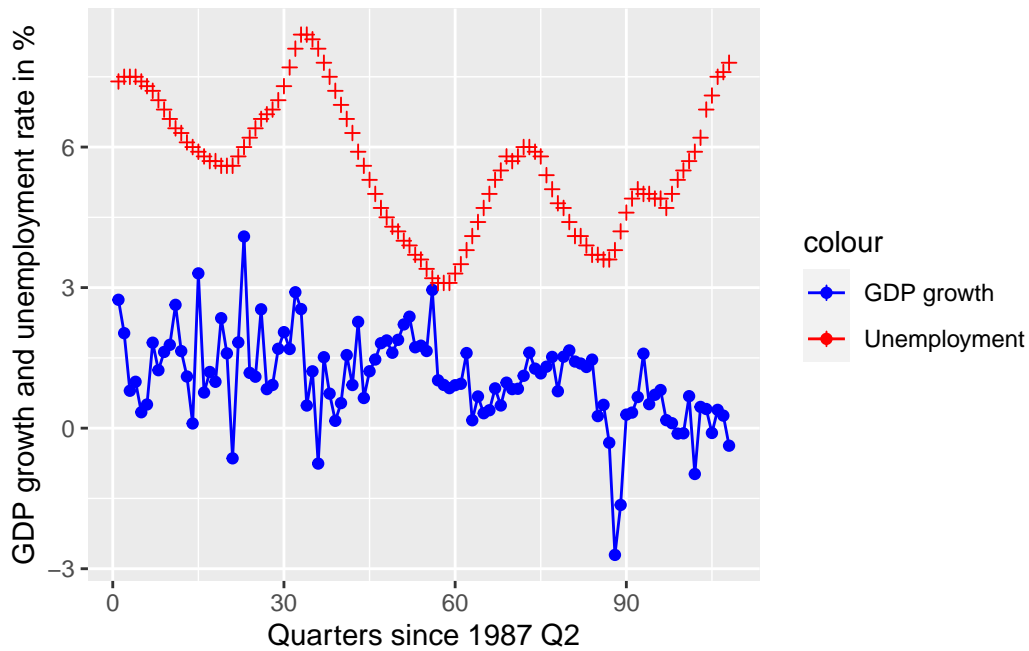
```

1 Question 1

```

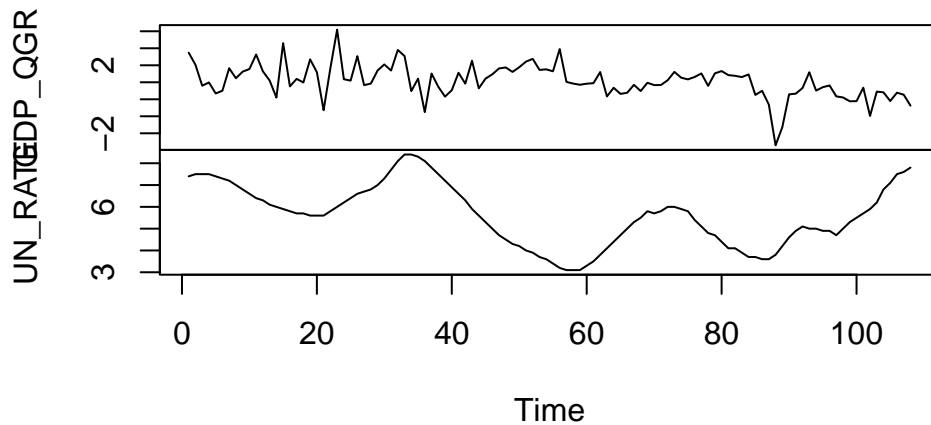
ggplot(dfAssign_p2) +
  geom_point(aes(x = ind, y = GDP_QGR, color="GDP growth")) +
  geom_line(aes(x = ind, y = GDP_QGR, color="GDP growth")) +
  geom_point(data=dfAssign_p2, aes(x=ind, y=UN_RATE,
  ↪ color="Unemployment"), shape=3) +
  ylab("GDP growth and unemployment rate in %") +
  xlab("Quarters since 1987 Q2") +
  scale_color_manual(values = c(
    "Unemployment" = "red",
    "GDP growth" = "blue"))

```



```
plot.ts(dfAssign_p2[,2:3], plot.type = c("multiple"), main="GDP
→ quarterly growth and unemployment rate since 1987 Q2")
```

GDP quarterly growth and unemployment rate since 1987



MAYBE SOME TEXT HERE? WE HAD NO QUESTIONS BUT JUST TO DESCRIBE THE PLOT?

```
# Creating the autoregression of GDP growth
ar4_gdp <- arima(dfAssign_p2$GDP_QGR, order=c(4,0,0))
coeftest(ar4_gdp)
```

z test of coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
ar1	0.332074	0.097217	3.4158	0.000636	***
ar2	0.056504	0.100260	0.5636	0.573047	
ar3	0.207863	0.100008	2.0785	0.037667	*
ar4	0.045652	0.097498	0.4682	0.639614	
intercept	1.064601	0.220502	4.8281	1.379e-06	***

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

```
ar3_gdp <- arima(dfAssign_p2$GDP_QGR, order=c(3,0,0))
coeftest(ar3_gdp)
```

z test of coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
ar1	0.342181	0.094883	3.6064	0.0003105	***
ar2	0.059545	0.100243	0.5940	0.5525106	
ar3	0.222430	0.095130	2.3382	0.0193792	*
intercept	1.066499	0.211070	5.0528	4.353e-07	***

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

```
# Stop here, 3rd lag coefficient is significant

dfAssign_p2$GDP_QGR <- ts(dfAssign_p2$GDP_QGR, start = c(1987, 2),
  ↪ frequency = 4)
dfAssign_p2$UN_RATE <- ts(dfAssign_p2$UN_RATE, start = c(1987, 2),
  ↪ frequency = 4)
```

```
adl_4_4 <- dynlm(UN_RATE ~ L(UN_RATE, 1) + L(UN_RATE, 2) + L(UN_RATE, 3)
  ↪ + L(UN_RATE, 4) + L(GDP_QGR, 1) + L(GDP_QGR, 2) + L(GDP_QGR, 3) +
  ↪ L(GDP_QGR, 4), data = dfAssign_p2)

coeftest(adl_4_4)
```

t test of coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.1689789	0.0572296	2.9527	0.00397	**
L(UN_RATE, 1)	1.5958562	0.1025897	15.5557	< 2e-16	***
L(UN_RATE, 2)	-0.3032125	0.1906828	-1.5901	0.11513	
L(UN_RATE, 3)	-0.4086458	0.1919958	-2.1284	0.03589	*
L(UN_RATE, 4)	0.0903634	0.1031079	0.8764	0.38302	
L(GDP_QGR, 1)	-0.0243677	0.0145049	-1.6800	0.09625	.
L(GDP_QGR, 2)	-0.0095159	0.0150293	-0.6332	0.52815	
L(GDP_QGR, 3)	0.0175242	0.0150231	1.1665	0.24634	
L(GDP_QGR, 4)	-0.0070625	0.0146231	-0.4830	0.63023	

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

```
adl_3_3 <- dynlm(UN_RATE ~ L(UN_RATE, 1) + L(UN_RATE, 2) + L(UN_RATE, 3)
  ↪ + L(GDP_QGR, 1) + L(GDP_QGR, 2) + L(GDP_QGR, 3), data = dfAssign_p2)

coeftest(adl_3_3)
```

t test of coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.180767	0.053479	3.3801	0.001041	**
L(UN_RATE, 1)	1.569051	0.097665	16.0656	< 2.2e-16	***
L(UN_RATE, 2)	-0.325147	0.182538	-1.7813	0.077968	.
L(UN_RATE, 3)	-0.272207	0.096427	-2.8229	0.005764	**
L(GDP_QGR, 1)	-0.025143	0.013964	-1.8006	0.074842	.
L(GDP_QGR, 2)	-0.010475	0.014801	-0.7077	0.480801	
L(GDP_QGR, 3)	0.015055	0.014036	1.0726	0.286066	

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

```
adl_3_2 <- dynlm(UN_RATE ~ L(UN_RATE, 1) + L(UN_RATE, 2) + L(UN_RATE, 3)
  ↪ + L(GDP_QGR, 1) + L(GDP_QGR, 2), data = dfAssign_p2)

coeftest(adl_3_2)
```

t test of coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.1882529	0.0530622	3.5478	0.0005957 ***
L(UN_RATE, 1)	1.5664194	0.0977086	16.0315	< 2.2e-16 ***
L(UN_RATE, 2)	-0.3332377	0.1825207	-1.8258	0.0709020 .
L(UN_RATE, 3)	-0.2610874	0.0959416	-2.7213	0.0076830 **
L(GDP_QGR, 1)	-0.0235740	0.0138974	-1.6963	0.0929742 .
L(GDP_QGR, 2)	-0.0056792	0.0141203	-0.4022	0.6884033

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

```
adl_3_1 <- dynlm(UN_RATE ~ L(UN_RATE, 1) + L(UN_RATE, 2) + L(UN_RATE, 3)
  ↪ + L(GDP_QGR, 1), data = dfAssign_p2)

coeftest(adl_3_1)
```

t test of coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.184821	0.052152	3.5439	0.0006011 ***
L(UN_RATE, 1)	1.572280	0.096210	16.3422	< 2.2e-16 ***
L(UN_RATE, 2)	-0.339772	0.181033	-1.8769	0.0634533 .
L(UN_RATE, 3)	-0.260515	0.095528	-2.7271	0.0075469 **
L(GDP_QGR, 1)	-0.025568	0.012929	-1.9776	0.0507287 .

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

IT IS YET UNCLEAR HOW TO PROGRESS WITH THE RESTRICTIONS. DOES ONE RESTRICT CO-JOINTLY, START WITH X OR START WITH Y ALONE?

2 Question 2

3 Question 3

4 Question 4

5 Question 5

6 Question 6

6.1 Question 6a

6.2 Question 6b