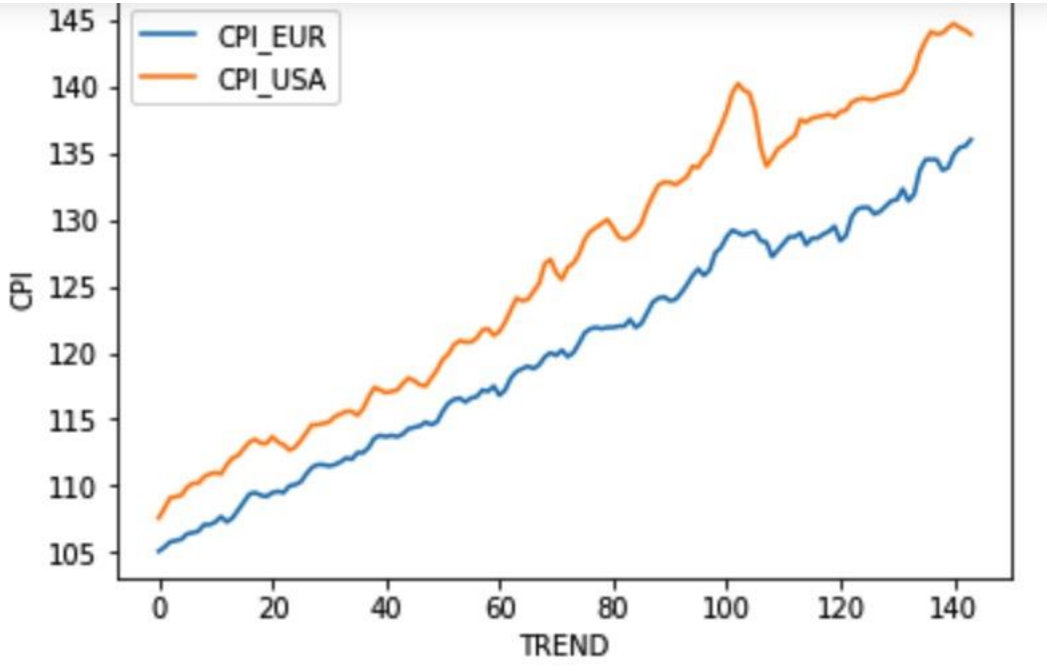
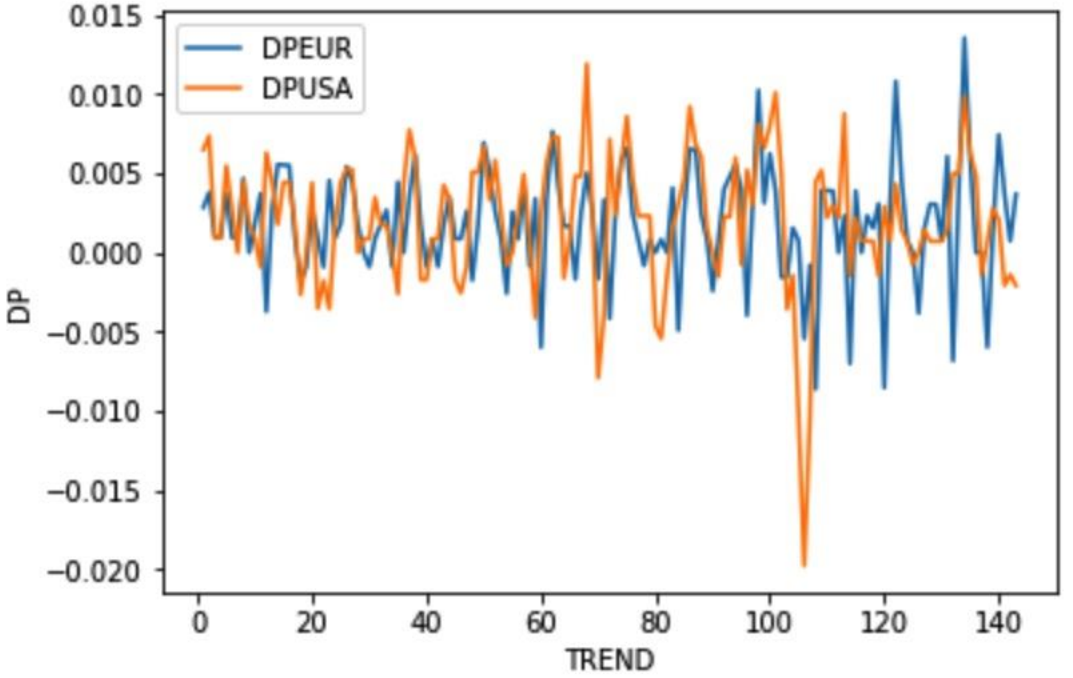
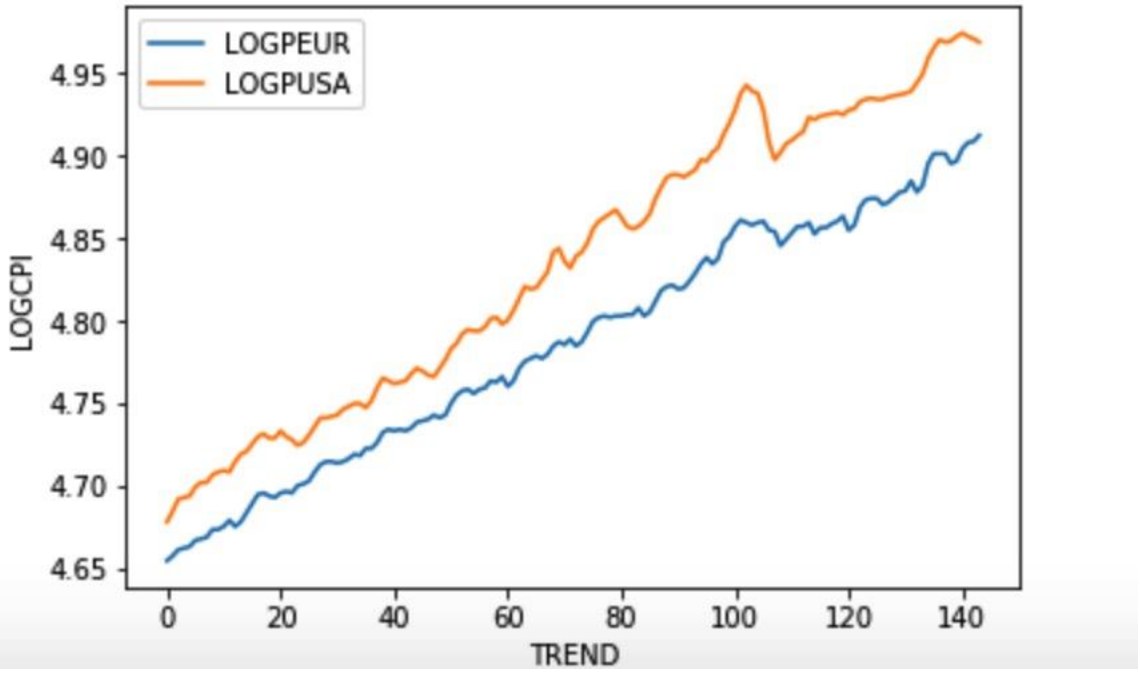
(a)




- CPI_EUR and CPI_USA seems to be cointegrated.
- DPEUR and DPUSA seems rather stationary.

# (b)

- ADF test for LOGPEUR shows that the coefficient , standard error and t-value of $LOGPEUR_{t-1}$ is -0.1195, 0.049, and -2.455 respectively. Since -2.455>-3.5, we do not reject $H_0$ of non-stationarity and LOGPEUR is not stationary.

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.5589 | 0.227 | 2.466 | 0.015 | 0.110 | 1.008 |
| t | 0.0002 | 8.62e-05 | 2.380 | 0.019 | 3.45e-05 | 0.000 |
| lag1logpeur1 | -0.1195 | 0.049 | -2.455 | 0.016 | -0.216 | -0.023 |
| lag1dpeur1 | 0.1343 | 0.092 | 1.465 | 0.146 | -0.047 | 0.316 |
| lag2dpeur1 | -0.0410 | 0.091 | -0.452 | 0.652 | -0.221 | 0.139 |
| lag3dpeur1 | -0.1270 | 0.091 | -1.392 | 0.166 | -0.308 | 0.054 |

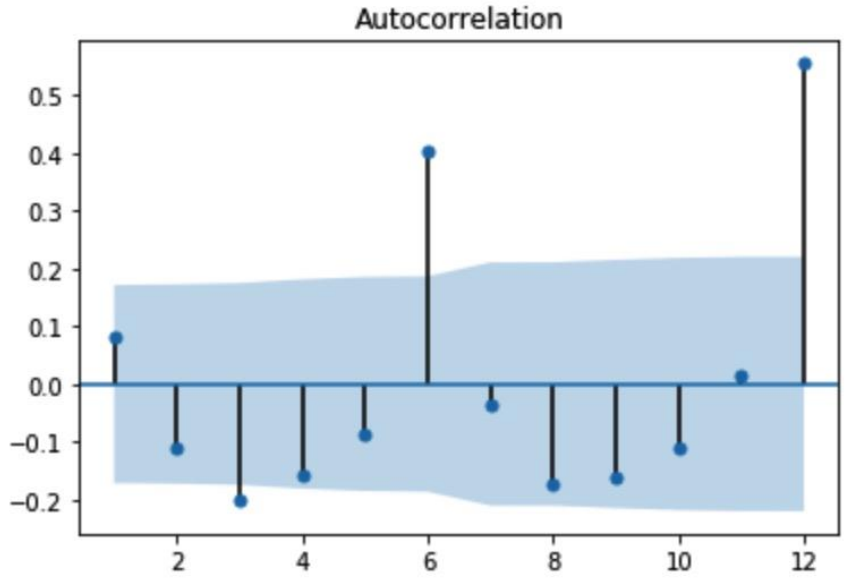
# (b)

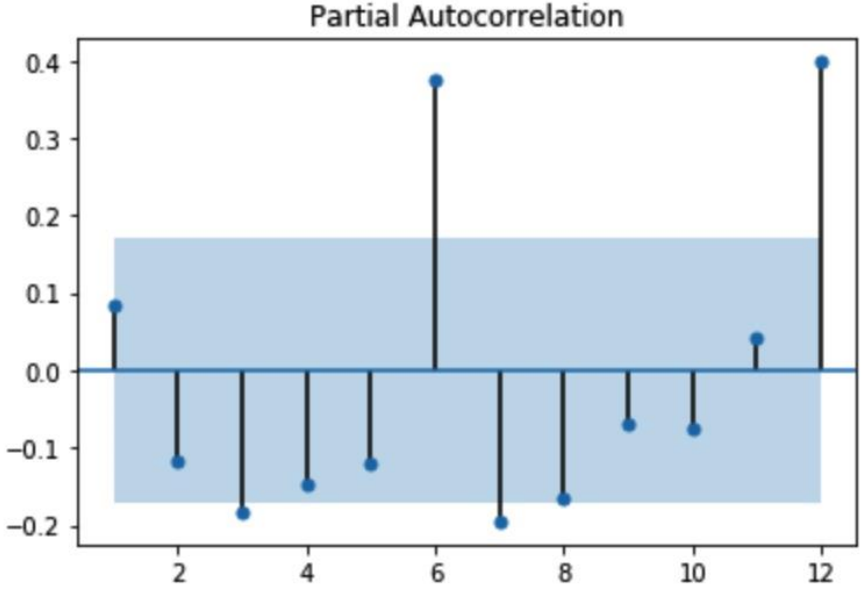
- ADF test for LOGPUSA shows that the coefficient , standard error and t-value of $LOGPUSA_{t-1}$ is -0.0710, 0.030, and -2.403 respectively. Since -2.403>-3.5, we do not reject $H_0$ of non-stationarity and LOGPUSA is not stationary.

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.3337 | 0.138 | 2.416 | 0.017 | 0.060 | 0.607 |
| t | 0.0001 | 6.37e-05 | 2.288 | 0.024 | 1.96e-05 | 0.000 |
| lag1logpusa1 | -0.0710 | 0.030 | -2.403 | 0.018 | -0.129 | -0.013 |
| lag1dpusa1 | 0.6077 | 0.089 | 6.863 | 0.000 | 0.432 | 0.783 |
| lag2dpusa1 | -0.1684 | 0.101 | -1.668 | 0.098 | -0.368 | 0.031 |
| lag3dpusa1 | 0.0080 | 0.091 | 0.088 | 0.930 | -0.172 | 0.188 |

(c)

- ACF and PACF results shown below motivate the use of the following AR model: DPEUR$t$ = α + β1DPEUR$t$−6 + β2DPEUR$t$−12 + ε$t$ .




```
AC:
lag 1 0.0838912402592
lag 2 -0.110851228692
lag 3 -0.203754518896
lag 4 -0.163966677839
lag 5 -0.0919521421017
lag 6 0.422255401876
lag 7 -0.0370241040946
lag 8 -0.1845256395
lag 9 -0.174014762253
lag 10 -0.1206203565
lag 11 0.0159160502092
lag 12 0.610391736592
```

```
PAC
lag 1 0.0838912402592
lag 2 -0.118724521219
lag 3 -0.187331390228
lag 4 -0.153366970227
lag 5 -0.125079768797
lag 6 0.393047341221
lag 7 -0.209869979593
lag 8 -0.18066762509
lag 9 -0.0736537902527
lag 10 -0.0821357958809
lag 11 0.0500397629005
lag 12 0.455910002382
```

# (c)

- AR model is estimated as DPEUR$t$ = 0.0004 + 0.1887DPEUR$t$−6 + 0.5980DPEUR$t$−12 + $\varepsilon t$ .

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.0004 | 0.000 | 1.365 | 0.175 | -0.000 | 0.001 |
| lag6dpeur1 | 0.1887 | 0.077 | 2.442 | 0.016 | 0.036 | 0.342 |
| lag12dpeur1 | 0.5980 | 0.084 | 7.157 | 0.000 | 0.432 | 0.763 |

# (d)

- After extending the AR model, the estimation shows that the t-value of $DPUSA_{t-6}$ is -1.024>-2, so $H_0$ of insignificance is not rejected and $DPUSA_{t-6}$ is not significant.

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.0004 | 0.000 | 1.545 | 0.125 | -0.000 | 0.001 |
| lag6dpeur1 | 0.2030 | 0.079 | 2.584 | 0.011 | 0.047 | 0.359 |
| lag12dpeur1 | 0.6367 | 0.087 | 7.279 | 0.000 | 0.463 | 0.810 |
| lag1dpusa1 | 0.2264 | 0.051 | 4.429 | 0.000 | 0.125 | 0.328 |
| lag6dpusa1 | -0.0561 | 0.055 | -1.024 | 0.308 | -0.165 | 0.052 |
| lag12dpusa1 | -0.2300 | 0.054 | -4.247 | 0.000 | -0.337 | -0.123 |

# (d)

- ADL model is estimated as $DPEUR_t = 0.0003 + 0.1687DPEUR_{t-6} + 0.6552DPEUR_{t-12} + 0.2326DPUSA_{t-1} - 0.2265DPUSA_{t-12} + \varepsilon_t$

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.0003 | 0.000 | 1.267 | 0.208 | -0.000 | 0.001 |
| lag6dpeur1 | 0.1687 | 0.071 | 2.374 | 0.019 | 0.028 | 0.310 |
| lag12dpeur1 | 0.6552 | 0.086 | 7.651 | 0.000 | 0.486 | 0.825 |
| lag1dpusa1 | 0.2326 | 0.051 | 4.582 | 0.000 | 0.132 | 0.333 |
| lag12dpusa1 | -0.2265 | 0.054 | -4.189 | 0.000 | -0.334 | -0.119 |

# (e)

```
AR
RMSE 0.0023213742217662 79
MAE 0.0016953175
SUM 0.004871538
```

```
ADL
RMSE 0.0020801928971084225
MAE 0.00137636683333
SUM 0.000735182
```

- We can conclude that ADL model performs better than the AR model since its RMSE ,MAE, and SUM are all lower than those of the AR model.
- Thus, inflation in the US has predictive power for inflation in the Euro area.