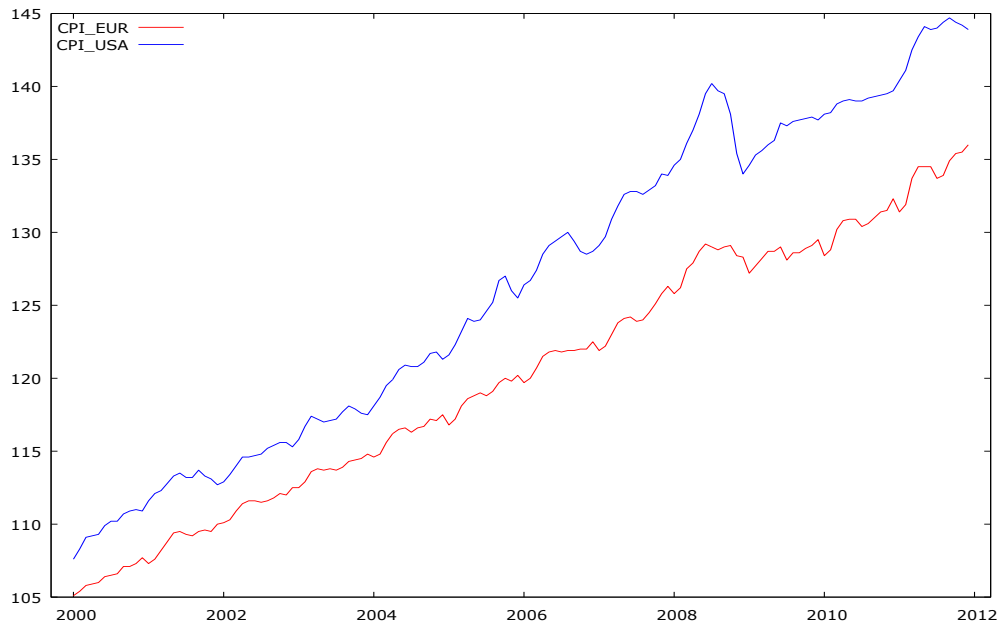


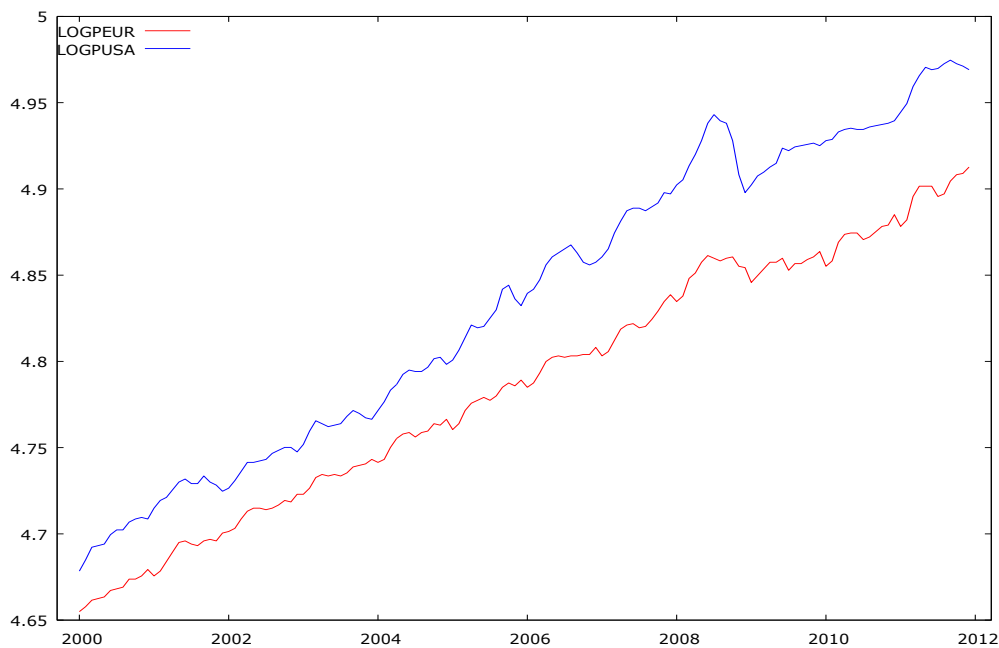
## Test Exercise 6 – Time Series – MOOC Econometrics

### Question A – Time Series Plots

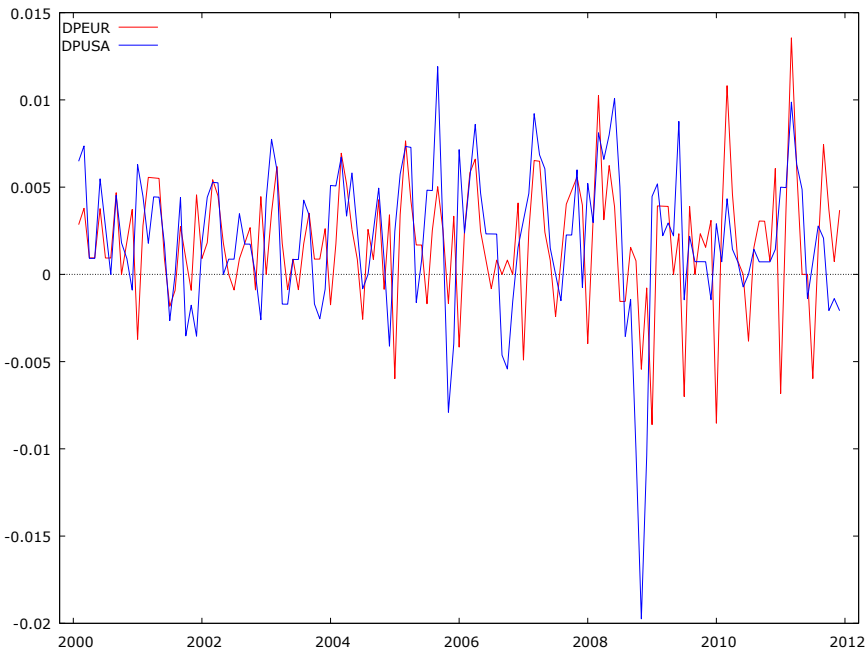
Below is a time series plot for the CPI's for the EUR area and the United States. It appears that both CPI plots have a similar pattern.



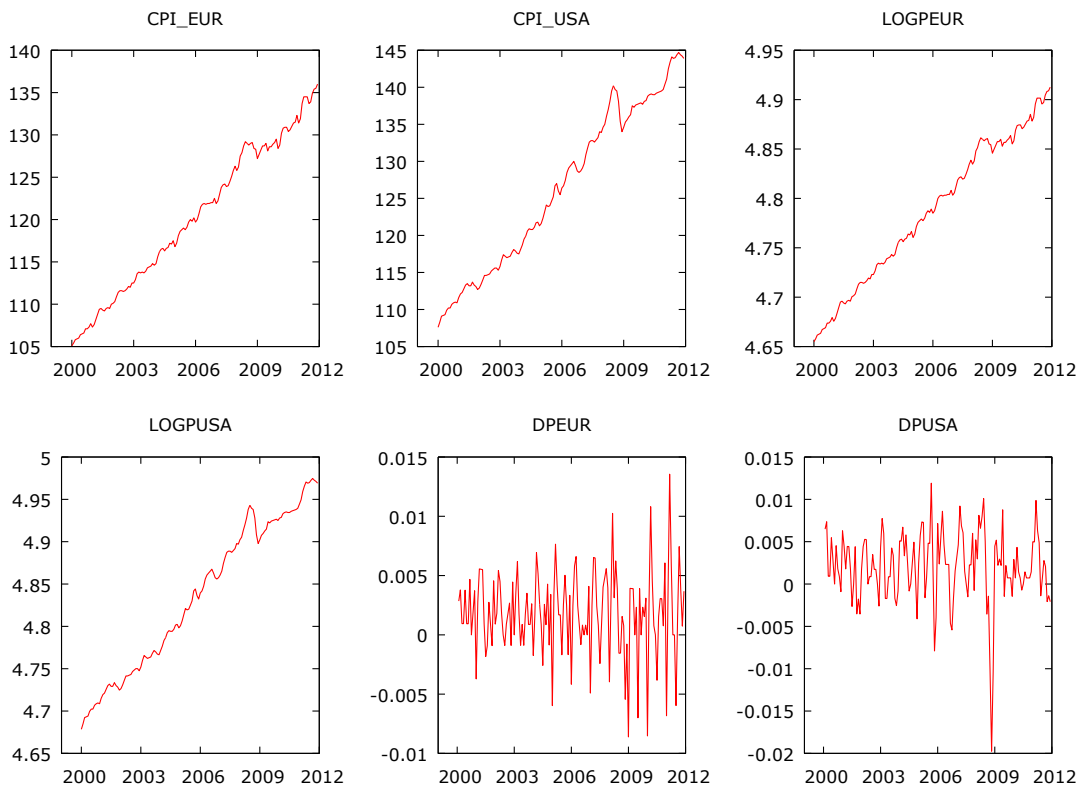
Below is a time-series plot for  $\log(\text{CPI})$  for Euro Area and the United States.



Below is the two monthly inflation series  $DP = \Delta \log(\text{CPI})$  for the Euro Area and the United States.



It appears that the DP United States series shows a greater degree of volatility compared to the Euro Zone series. This would suggest that the monthly changes in the Consumer Price Index for the United States are greater compared to that of the Euro Zone.



## Question 2 – Augmented Dickey-Fuller (ADF) Test

Here is the ADF test results for the log Euro CPI series.

Augmented Dickey-Fuller test for LOGPEUR  
including 3 lags of (1-L)LOGPEUR  
(max was 3, criterion t-statistic)  
sample size 140  
unit-root null hypothesis:  $a = 1$

test with constant  
model:  $(1-L)y = b_0 + (a-1)y(-1) + \dots + e$   
estimated value of  $(a - 1)$ : -0.00200597  
test statistic:  $\tau_c(1) = -0.486411$   
asymptotic p-value 0.8915  
1st-order autocorrelation coeff. for e: -0.034  
lagged differences:  $F(3, 135) = 3.258$  [0.0236]

Augmented Dickey-Fuller regression  
OLS, using observations 2000:05-2011:12 (T = 140)  
Dependent variable: d\_LOGPEUR

	coefficient	std. error	t-ratio	p-value	
const	0.0118565	0.0197522	0.6003	0.5493	
LOGPEUR_1	-0.00200597	0.00412402	-0.4864	0.8915	
d_LOGPEUR_1	0.0723468	0.0848070	0.8531	0.3951	
d_LOGPEUR_2	-0.156768	0.0838546	-1.870	0.0637	*
d_LOGPEUR_3	-0.174491	0.0848191	-2.057	0.0416	**

AIC: -1185.72    BIC: -1171.01    HQC: -1179.74

with constant and trend  
model:  $(1-L)y = b_0 + b_1*t + (a-1)y(-1) + \dots + e$   
estimated value of  $(a - 1)$ : -0.167946  
test statistic:  $\tau_{ct}(1) = -3.7764$   
asymptotic p-value 0.0177  
1st-order autocorrelation coeff. for e: 0.016

Augmented Dickey-Fuller regression  
OLS, using observations 2000:03-2011:12 (T = 142)  
Dependent variable: d\_LOGPEUR

	coefficient	std. error	t-ratio	p-value	
const	0.783998	0.207146	3.785	0.0002	***
LOGPEUR_1	-0.167946	0.0444724	-3.776	0.0177	**
d_LOGPEUR_1	0.168828	0.0836360	2.019	0.0455	**
time	0.000291494	7.78348e-05	3.745	0.0003	***

AIC: -1211.38    BIC: -1199.56    HQC: -1206.58

The coefficient of the  $\log(CPI_{t-1})$  is equal to 0.1688, and its standard error is equal to 0.0836, and its t-value is equal to 2.019. The strong t-value suggests that we can reject the null Hypothesis.

The ADF test result for the log United States CPI series are as follows.

Augmented Dickey-Fuller test for LOGPUSA  
including 2 lags of (1-L)LOGPUSA  
(max was 3, criterion t-statistic)  
sample size 141  
unit-root null hypothesis:  $a = 1$

test with constant  
model:  $(1-L)y = b_0 + (a-1)y(-1) + \dots + e$   
estimated value of  $(a - 1)$ : -0.00251882  
test statistic:  $\tau_c(1) = -0.715264$   
asymptotic p-value 0.8412  
1st-order autocorrelation coeff. for e: -0.009  
lagged differences:  $F(2, 137) = 26.622 [0.0000]$

Augmented Dickey-Fuller regression  
OLS, using observations 2000:04-2011:12 (T = 141)  
Dependent variable: d\_LOGPUSA

	coefficient	std. error	t-ratio	p-value	
const	0.0134052	0.0170386	0.7868	0.4328	
LOGPUSA_1	-0.00251882	0.00352153	-0.7153	0.8412	
d_LOGPUSA_1	0.600215	0.0829117	7.239	2.94e-011	***
d_LOGPUSA_2	-0.228720	0.0827652	-2.763	0.0065	***

AIC: -1184.46    BIC: -1172.66    HQC: -1179.66

with constant and trend  
model:  $(1-L)y = b_0 + b_1*t + (a-1)y(-1) + \dots + e$   
estimated value of  $(a - 1)$ : -0.0741869  
test statistic:  $\tau_{ct}(1) = -2.82498$   
asymptotic p-value 0.1881  
1st-order autocorrelation coeff. for e: 0.004  
lagged differences:  $F(2, 136) = 29.444 [0.0000]$

Augmented Dickey-Fuller regression  
OLS, using observations 2000:04-2011:12 (T = 141)  
Dependent variable: d\_LOGPUSA

	coefficient	std. error	t-ratio	p-value	
const	0.348638	0.122912	2.836	0.0053	***
LOGPUSA_1	-0.0741869	0.0262610	-2.825	0.1881	
d_LOGPUSA_1	0.604453	0.0810048	7.462	9.14e-012	***
d_LOGPUSA_2	-0.158518	0.0847739	-1.870	0.0636	*
time	0.000152177	5.52812e-05	2.753	0.0067	***

AIC: -1190.1    BIC: -1175.36    HQC: -1184.11

The results from the Dickey-Fuller regression gives a coefficient for the  $\log(\text{USA CPI}_{t-1})$  of 0.6045, with a standard error of 0.081 and a t-ratio of 7.462. Again, the high t-ratio value suggests that we can reject the null hypothesis.

### Question C – AR Model and Autocorrelations

Below is the AR model result for DPEUR =  $\Delta \log(\text{CPI EUR})$  model.

Model 1: AR, using observations 2000:05-2011:12 (T = 140)  
Dependent variable: DPEUR

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	0.00196487	0.0165356	0.1188	0.9056	
LOGPEUR	-3.72985e-05	0.00345206	-0.0108	0.9914	
u(-3)	-0.200537	0.0831604	-2.4114	0.0172	**

Statistics based on the rho-differenced data:

Mean dependent var	0.002144	S.D. dependent var	0.003446
Sum squared resid	0.001651	S.E. of regression	0.003458
R-squared	0.040139	Adjusted R-squared	0.033184
F(1, 138)	0.000117	P-value(F)	0.991395
rho	0.024238	Durbin-Watson	1.938428