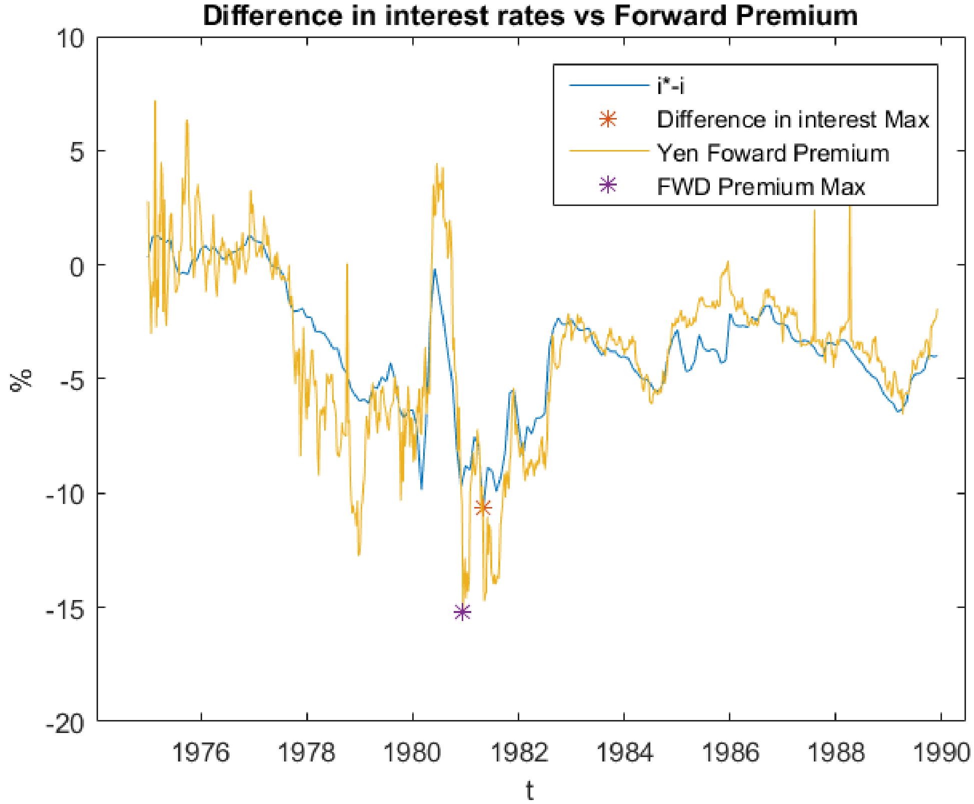
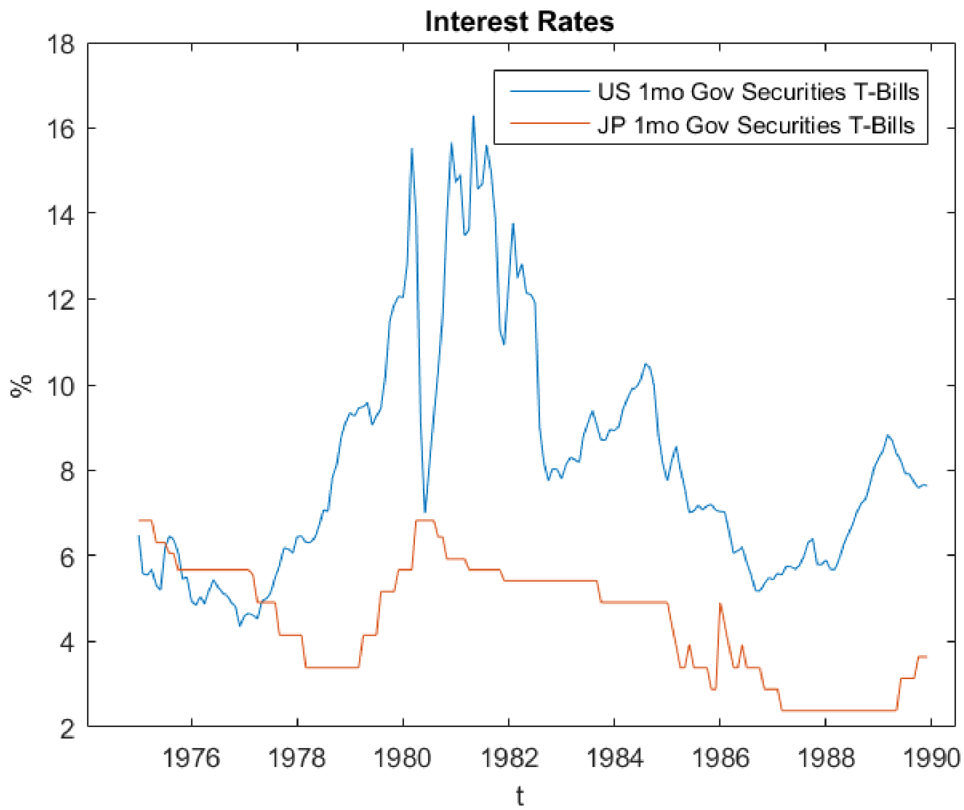
```
%Chapter 6 - HAYASHI - EXERCISE 1: a,b,c,d,e,f,g
%dm, yen, pound has been included in this folder
%John Daniel Paletto
%Last modified 11/28/15




%!@#$%^&*()PLEASE REFRAIN FROM CLICKING "RUN", PLEASE USE "RUN
 SECTION"!@#$%^&*()

%%%%% THIS WILL RUN PART BY PART and avoid DEATH-BY-POP-UPS




clear        %delete/clear memory
clc          %clear output screen
close all    %close e.g. figures

load('yen.mat'); %Jap Yen
%Notes from [currency].mat - Column 1,2,3,4: Date, Ask price S(t) in
 spot, 30-day
%forward F(t), bid price in delivery date for forward contract in spot
%ALL IN UNITS OF FOREIGN CURRENCY

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART A%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Identify the week where forward premium is largest
%For that week find a 1-mo measure of the interst rate (US and
 Foreign)
%Verify Forward premium

%initialize
n=length(yen);
st=log(yen(:,2));
ft=log(yen(:,3));
s30t=log(yen(:,4));

%Calculate Forward Premium
fwd_premium=ft-st;
%annualize
fwd_premium=fwd_premium*12;

%From Federal Reserve Baqnk of St. Louis:
%INTGSTJPM193N Interest Rates, Government Securities, Government Bonds
 for Japan
%INTGSTUSM193N Interest Rates, Government Securities, Treasury Bills
 for United States
load('fred.mat');
```

```
%Calculate difference in Interest rates
dif=fredgraph.INTGSTJPM193N-fredgraph.INTGSTUSM193N;

%Find max
fwdmax=max(abs(fwd_premium));
[row,column] = find(fwd_premium==fwdmax);
if length(row)==0
    [row,column] = find(fwd_premium==-fwdmax);
    fwdmax=-fwdmax;
end;

difmax=max(abs(dif));
[difrow,difcolumn] = find(dif==difmax);

if length(difrow)==0
    [difrow,difcolumn] = find(dif==-difmax);
    difmax=-difmax;
end;

%Plots
startDate = datenum('01-01-1975');
endDate = datenum('12-01-1989');
xData = linspace(startDate,endDate,180);
xxData = linspace(startDate,endDate,778);

figure
plot(xData, dif);
hold on;
plot(xData(difrow),difmax,'*');
hold on;
plot(xxData,100*fwd_premium);
hold on;
plot(xxData(row),100*fwdmax,'*');
datetick('x','yyyy','keeplimits')
title('Difference in interest rates vs Forward Premium')
legend('i*-i','Difference in interest Max','Yen Foward Premium','FWD
 Premium Max')
ylabel('%')
xlabel('t')
datetick('x','yyyy','keeplimits')
hold off;

figure
plot(xData, fredgraph.INTGSTUSM193N);
hold on;
plot(xData, fredgraph.INTGSTJPM193N);
legend('US 1mo Gov Securities T-Bills','JP 1mo Gov Securities T-
Bills')
datetick('x','yyyy','keeplimits')
title('Interest Rates')
ylabel('%')
xlabel('t')
hold off;
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART A%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
```



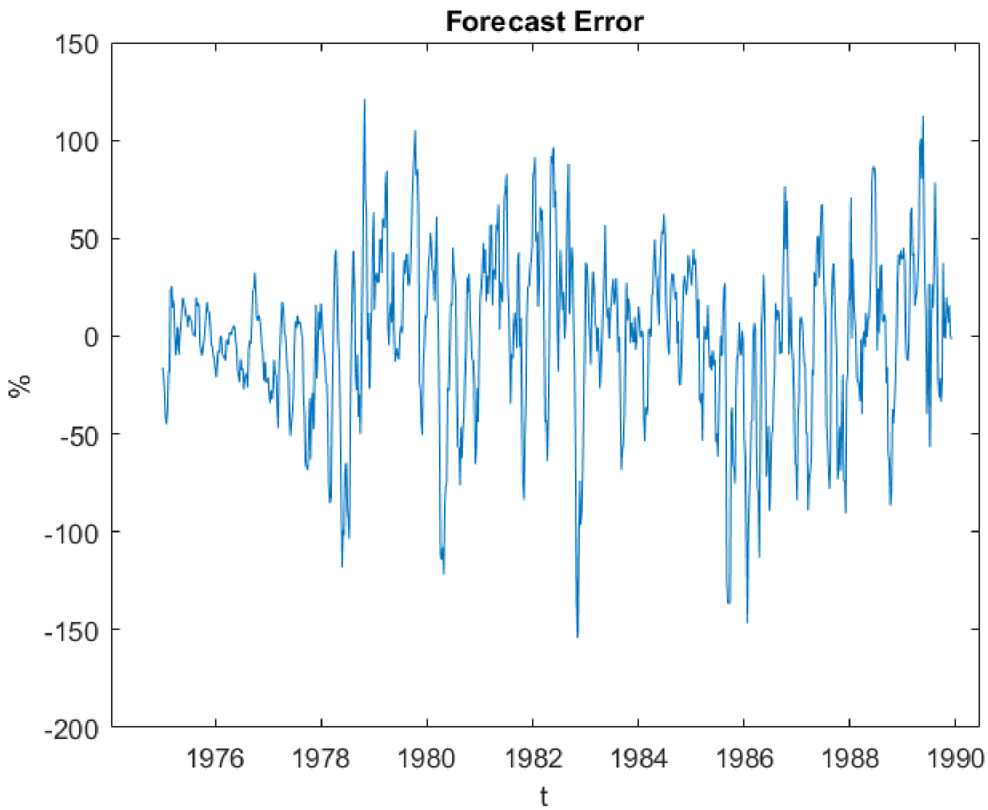
Difference in interest rates vs Forward Premium
i*-i
Difference in interest Max
Yen Foward Premium
FWD Premium Max
%
t
10
5
0
-5
-10
-15
-20
1976
1978
1980
1982
1984
1986
1988
1990

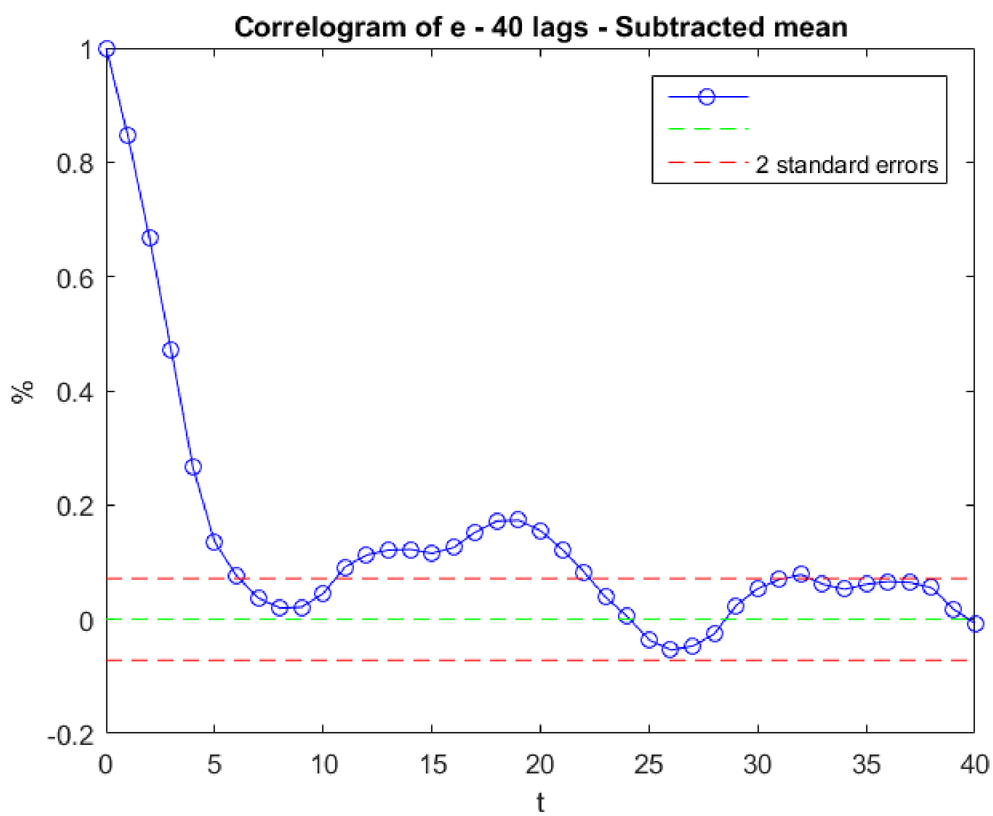



```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART B%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Draw sample correlogram of eps with 40 lags
%Significance of four lags?
%Check mean, and verify the assumption: Mean zero
%Subtract observed mean

%Calculate error
e = (s30t - ft);
%Annualize
e = 12*100*e;

%Autocovariance and auto correlation
rho_e=autocorrel(e,40);
gamma_e=autocov(e,40);

%standard error
std_e=1/sqrt(n);

%PLOT of forcast error
figure
plot(xxData,e)
datetick('x','yyyy','keeplimits')
title('Forecast Error')
ylabel('%')
xlabel('t')
```

```
hold off;

%PLOT correlogram
x=0:40;
zero=zeros(1,41);
up_errorband=zeros(1,41)+std_e*2;
low_errorband=zeros(1,41)-std_e*2;

figure
plot(x,rho_e,'b-o',x,zero,'g--')
hold on;
plot(x,up_errorband,'r--',x,low_errorband,'r--')
title('Correlogram of e - 40 lags - Subtracted mean')
legend('','','2 standard errors')
ylabel('%')
xlabel('t')
hold off;

%OUTPUT
MEAN_OF_e=mean(e)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART B%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
```

```
MEAN_OF_e =

   -1.2488
```


Forecast Error
150
100
50
0
-50
-100
-150
-200
%
1976
1978
1980
1982
1984
1986
1988
1990
t


Correlogram of e - 40 lags - Subtracted mean
2 standard errors
1
0.8
0.6
0.4
0.2
0
-0.2
%
0
5
10
15
20
25
30
35
40
t

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART C%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Verify if currency is a random walk with drift
%Correlogram S(t+1)-S(t) with 40 lags
%Box-Ljung Q hypothesis for S(t) is a random walk with drift

%Calculate s(t+1) - s(t) for 4o observations
s1=st(2:41)-st(1:40);

%Autocovariance and auto correlation
rho_s1=autocorrel(s1,40);
gamma_s1=autocov(s1,40);

%Correlogram
x=0:40;
zero=zeros(1,41);
up_errorband=zeros(1,41)+std_e*2;
low_errorband=zeros(1,41)-std_e*2;

figure
plot(x,rho_s1,'b-o',x,zero,'g--')
hold on;
plot(x,up_errorband,'r--',x,low_errorband,'r--')
legend('','','2 standard errors')
title('Correlogram of s(t+1)-s(t) - 40 lags')
ylabel('%')
xlabel('t')
hold off;

%LJUNG Q test
q_s1 = LjungQ( s1, 40 );

for lag=1:40
critical_value_Ljung = icdf('chi2',0.95,lag);
if q_s1(lag)>critical_value_Ljung
    'based on Ljung´s test for conditional heteroskedasticity, we fail
 to reject the assumption of The data are independently distributed'
    lag
else
    'based on Ljungs´s test for conditional heteroskedasticity, we
 reject the assumption of independently distributed data; they exhibit
 serial correlation'
    lag
    return
end;
end;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART C%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
```

ans =

```
based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     1


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     2


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     3


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     4


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     5


ans =
```

```
based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     6


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     7


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     8


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

     9


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    10
```

```
ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    11


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    12


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    13


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    14


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    15
```

```
ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    16


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    17


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    18


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    19


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    20
```

```
ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    21


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    22


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    23


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    24


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =
```

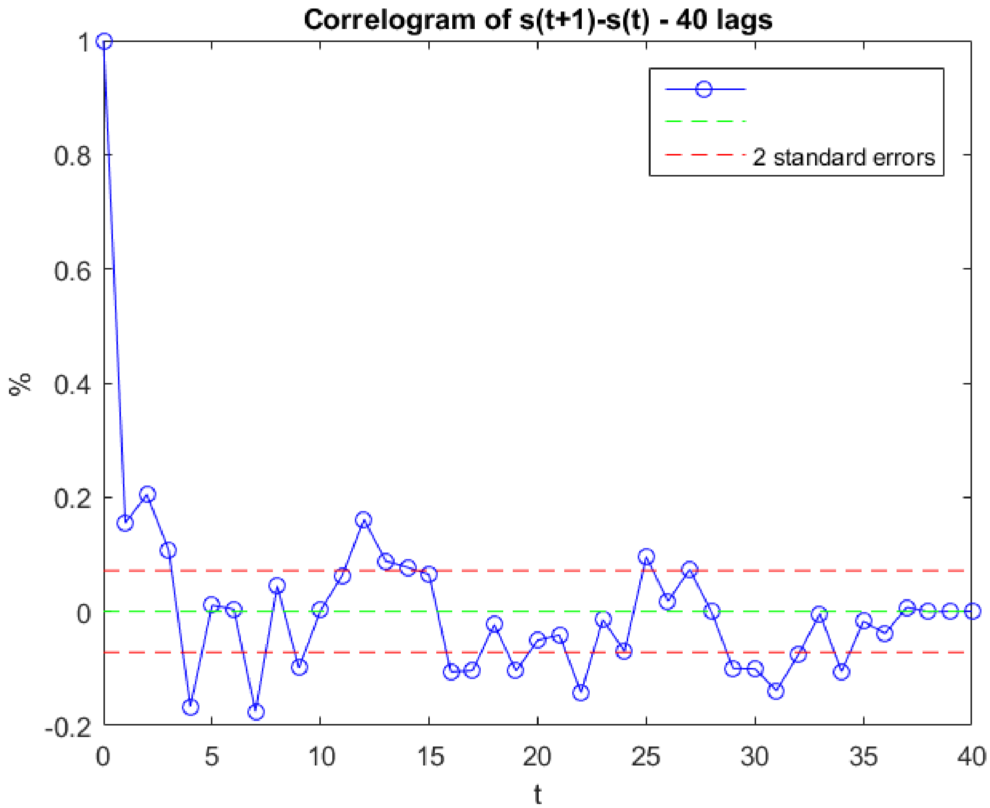
```
    25


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    26


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    27


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    28


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    29


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =
```

```
    30


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    31


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    32


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    33


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    34


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed
```

```
lag =

    35


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    36


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    37


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    38


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed


lag =

    39


ans =

based on Ljung´s test for conditional heteroskedasticity, we fail to
 reject the assumption of The data are independently distributed
```

lag =

40




```
%%%%%%%%%%%%%%%%%%%%%%%%%%%DICKEY FULLER UNIT ROOT%%%%%%%%%%%%%%%%%%
%%%%%%
%Test S(t) for a unit root using DF (with and without trend/intrcpt)
%Test S(t) for a unit root using Augmented DF (with and without trend/
intrcpt)


%%%%%%%%%%%%%%%%%%%%%%%%%%%%END DICKEY FULLER%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%

%%%%%%%%%%%%%%%%%%%%%%%%%%LAG LENGTH SELECTION%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%t-testing
%AIC
%BIC
%Verify choices, choose most appropriate



%%%%%%%%%%%%%%%%%%%%%%%%%%%END LAG LENGTH%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART D%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Unconditional test
%Replicate Table 6.1

%Exchange rates
actual_rate=(s30t-st)*12*100;
expected_rate=(ft-st)*12*100;
unexpected=e;

%Means
mean_actual=mean(actual_rate);
mean_expected=mean(expected_rate);
mean_e=MEAN_OF_e;


%Standard deviations
stdd_actual=std(actual_rate);
stdd_expected=std(expected_rate);
stdd_e=std(e);

%Standard error from proposition 6.10
std_e61=sqrt((gamma_e(1)+sum(gamma_e(2:5))*2))/n;

%Table 6.1
actual=[mean_actual,stdd_actual,0];
expected=[mean_expected,stdd_expected,0];
unex=[mean_e, stdd_e, std_e61];

Table61(:,1)=actual;
Table61(:,2)=expected;
Table61(:,3)=unex;
cnames = {'s30 - s','f - s','Difference'};
rnames = {'Mean','Std Deviation','Std Error'};
set(figure,'name', 'Table 6.1, Y/$ - Means and Standard
 Deviations','numbertitle','off');
uitable('Data',Table61,'ColumnName',cnames,'RowName',rnames,'Position',
[20 20 335 335])


%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART D%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%


ans =

  Table with properties:

                Data: [3x3 double]
         ColumnWidth: 'auto'
      ColumnEditable: []
    CellEditCallback: ''
            Position: [20 20 335 335]
               Units: 'pixels'
```

Use GET to show all properties

	s30 - s	f - s	Difference
Mean	-4.9836	-3.7348	-1.2488
Std Deviation	41.5584	3.6471	42.3819
Std Error	0	0	3.5616

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART E%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Regression test with truncated kernel
%Replicate Table 6.2

X(:,1)=ones(1,778);
X(:,2)=expected_rate;
[T,K]=size(X);

y=actual_rate;

%SHORT SOLUTION:
mdl = fitlm(expected_rate,y,'linear')
[EstCovtr,LSSe,coeff]=hac(mdl,'type','HAC','weights','TR','bandwidth',4,'smallT',f
[h,p,s,cv]=waldtest([coeff(1);coeff(2)-1],[1 0; 0 1],EstCovtr,.01)
```

```
mdl =


Linear regression model:
    y ~ 1 + x1
```

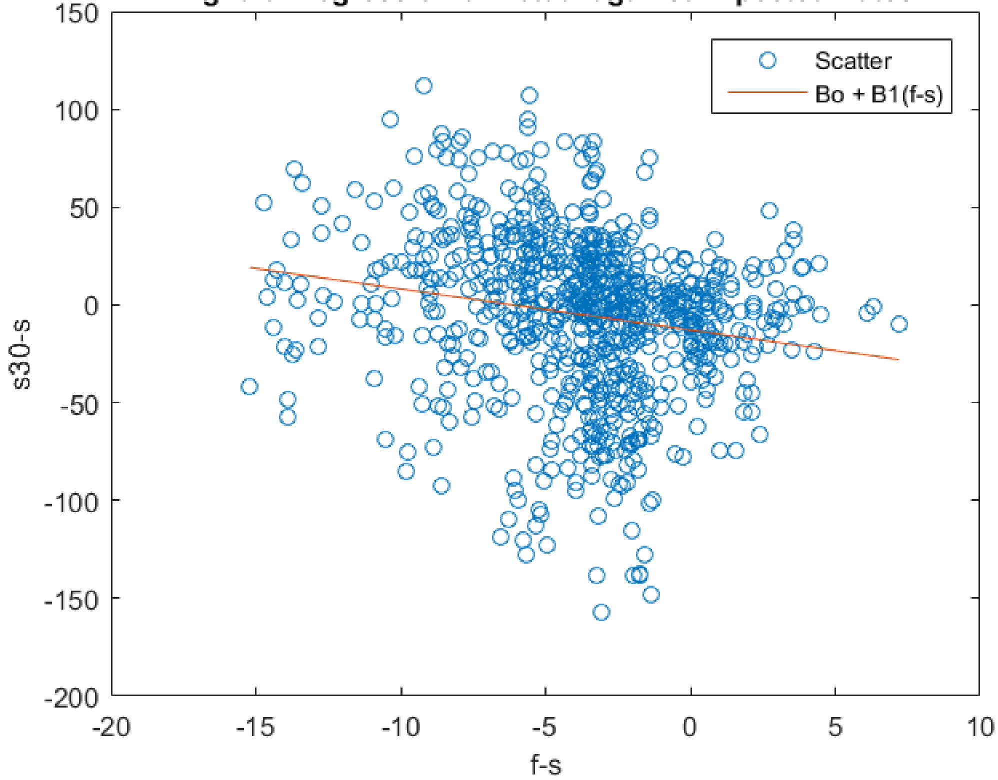
```
Estimated Coefficients:
                     Estimate      SE        tStat       pValue
                     ________    ________    ________    __________

    (Intercept)      -12.821       2.0981    -6.1105     1.5707e-09
    x1               -2.0984     0.40205     -5.2192     2.3091e-07


Number of observations: 778, Error degrees of freedom: 776
Root Mean Squared Error: 40.9
R-squared: 0.0339,  Adjusted R-Squared 0.0327
F-statistic vs. constant model: 27.2, p-value = 2.31e-07

Estimator type: HAC
Estimation method: TR
Bandwidth: 4.0000
Whitening order: 0
Effective sample size: 778
Small sample correction: off

Coefficient Covariances:

       |  Const     x1
-------------------------
 Const | 16.0895  1.6708
 x1    |  1.6708  0.5443

EstCovtr =

   16.0895    1.6708
    1.6708    0.5443


LSSe =

    4.0112
    0.7377


coeff =

  -12.8208
   -2.0984


h =

     1


p =

   8.9722e-05
```

```
s =

   18.6376


cv =

    9.2103


delta_hat_OLS=X\y;
epsilon_hat=y-X*delta_hat_OLS;
clear delta_hat_OLS

%define g (i.e. the multiplication of residuals*regressors - or
%residuals*instruments)
g_hat=X.*repmat(epsilon_hat,[1,K]);
clear epsilon_hat

hat_Gamma_j=NaN(K,K,2*(T-1)+1);
for j=0:1:(T-1)
    help=0; %auxiliary variable
    for t=j+1:1:T %summation index
        help=help+g_hat(t,:)'*g_hat(t-j,:);
    end;
    clear t
    hat_Gamma_j(:,:,T+j)=(1/T)*help; %compute Gamma_j for lags 0 to
 T-1
    if j>0
        hat_Gamma_j(:,:,T-j)=(reshape(hat_Gamma_j(:,:,T+j),
[K,K]))'; %compute remaining Gamma_j's for lags -1 to -(T-1)
    end;
    clear help
end;
clear j

%Given
q=4;

%For the sake of exhibition, take the same bandwidth/window size as
 above

Omega_hat_Truncated=zeros(K,K);
kernel_Truncated=NaN(2*(T-1)+1,1);
for j=-(T-1):1:(T-1)
    x=(j/q); %this is the kernel arguement j/q(T)
    if abs(x)<=1
        kernel_Truncated(T+j,1)=1;
    else
        kernel_Truncated(T+j,1)=0;
    end;
    Omega_hat_Truncated=Omega_hat_Truncated+kernel_Truncated(T
+j,1)*(reshape(hat_Gamma_j(:,:,T+j),[K,K]));
```

```
    clear x
end;
clear j

Sxx = X'*X/(n)
sxy = X'*y/(n)
delta_GMM=(Sxx^(-1))*sxy;
e_hat=y-X*delta_GMM;

Avar_GMM_robust=(Sxx'*(Omega_hat_Truncated^(-1))*Sxx)^(-1);
SE_GMM_robust=diag(((1/T)*Avar_GMM_robust).^(1/2));

R=[1, 0];
r=1;


R2=1-(e_hat'*e_hat)/((y-mean(y))'*(y-mean(y)));
SE_R = ((e_hat-mean(e_hat))'*(e_hat-mean(e_hat))/(n-2))^(1/2);

figure,
plot(expected_rate,actual_rate,'o')
hold on;
plot(expected_rate,delta_GMM(1)+delta_GMM(2)*expected_rate)
title('Fig. 6.5: Regression of Actual against Expected Rates')
legend('Scatter','Bo + B1(f-s)')
ylabel('s30-s')
xlabel('f-s')
hold off;

R_tbl(1,1:2)=delta_GMM;
R_tbl(2,1:2)=[SE_GMM_robust(1),SE_GMM_robust(2)];
R_tbl(3,3:5)=[R2,mean(y),s];

freg=figure('Position', [150 150 600 255]);
set(freg, 'name', 'TABLE 6.2: Regression Tests of Market Efficiency:
 1975-1989',...
    'numbertitle','off');

r2names={'Coefficients','Std Error','Statistics'};
c2names={,'B0','B1','R^2','Mean of y', 'Wald-stat'};
Regression_table = uitable('Data',R_tbl,...
    'RowName',r2names,'ColumnName',c2names,'Tag',...
    'Regression Tests of Market Efficiency: 1975-1989',...
    'Parent', freg,'Position',[40 40 550 155]);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%End Part E%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%


Sxx =

    1.0000   -3.7348
   -3.7348   27.2336
```

```
sxy =

   -4.9836
   -9.2629
```

Fig. 6.5: Regression of Actual against Expected Rates



	B0	B1	R^2	Mean of y	Wald-stat
Coefficients	-12.8208	-2.0984	0	0	0
Std Error	4.0112	0.7377	0	0	0
Statistics	0	0	0.0339	-4.9836	18.6376

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART F%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%Bartlett kernel based estimator of S for regression
%Newey-West data-dependent automatic bandwidth selection
```

```
%Assume lag length is 12 for YEN

%SHORT SOLUTION:
[EstCovbt,LSSe,coeff]=hac(mdl,'type','HAC','weights','BT','bandwidth',13,'smallT',
[h,p,s,cv]=waldtest([coeff(1);coeff(2)-1],[1 0; 0 1],EstCovbt,.01)


Estimator type: HAC
Estimation method: BT
Bandwidth: 13.0000
Whitening order: 0
Effective sample size: 778
Small sample correction: off

Coefficient Covariances:

       |  Const     x1
-------------------------
 Const | 13.8416  1.4187
 x1    |  1.4187  0.4645

EstCovbt =

   13.8416    1.4187
    1.4187    0.4645


LSSe =

    3.7204
    0.6815


coeff =

  -12.8208
   -2.0984


h =

     1


p =

   1.7964e-05


s =

   21.8543
```

```
cv =

    9.2103


%GIVEN
q=12+1;

Omega_hat_Bartlett=zeros(K,K);
kernel_Bartlett=NaN(2*(T-1)+1,1);
for j=-(T-1):1:(T-1)
    x=(j/q); %this is the kernel arguement j/q(T)
    if abs(x)<=1
        kernel_Bartlett(T+j,1)=1-abs(x);
    else
        kernel_Bartlett(T+j,1)=0;
    end;
    Omega_hat_Bartlett=Omega_hat_Bartlett+kernel_Bartlett(T
+j,1)*(reshape(hat_Gamma_j(:,:,T+j),[K,K]));
    clear x
end;
clear j


Avar_GMM_bartlett_robust=(Sxx'*(Omega_hat_Bartlett^(-1))*Sxx)^(-1);
SE_GMM_bartlett_robust=diag(((1/T)*Avar_GMM_bartlett_robust).^(1/2));

R_tbl(1,1:2)=delta_GMM;
R_tbl(2,1:2)=[SE_GMM_bartlett_robust(1),SE_GMM_bartlett_robust(2)];
R_tbl(3,3:5)=[R2,mean(y),s];

freg=figure('Position', [150 150 600 255]);
set(freg, 'name', '(Bartlett Kernel)Regression Tests of Market
 Efficiency: 1975-1989',...
    'numbertitle','off');

r2names={'Coefficients','Std Error','Statistics'};
c2names={,'B0','B1','R^2','Mean of y', 'Wald-stat'};
Regression_table = uitable('Data',R_tbl,...
    'RowName',r2names,'ColumnName',c2names,'Tag',...
    'BARTLETT Regression Tests of Market Efficiency: 1975-1989',...
    'Parent', freg,'Position',[40 40 550 155]);


%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART F%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
```

	B0	B1	R^2	Mean of y	Wald-stat
Coefficients	-12.8208	-2.0984	0	0	0
Std Error	3.7204	0.6815	0	0	0
Statistics	0	0	0.0339	-4.9836	21.8543

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%START PART G%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%
%VARHAC ESTIMATOR FOR S
%Justify p

p=int16(n^(1/3));%maximal number of lags in all equations


Phi_hat_temp=zeros(p*K,K); %temporary matrix of coefficients
residual=NaN(T,K); %residuals of VAR estimation
for k=1:K
    indep=[];
    dep=g_hat(p+1:end,k); %generate left-hand side variable
    for j=1:p
        indep=[indep g_hat(p+1-j:end-j,:)]; %generate set of
 regressors
    end;
    nn=length(indep); %notice: you lose observations as you increase
 the # of lags
    indep=[ones(nn,1) indep];

    reg=indep\dep; %OLS regression
    Phi_hat_temp(1:p*K,k)=reg(2:end,:); %we don't store the estimate
 for the intercept
    residual(T-nn+1:T,k)=dep-indep*reg; %OLS residuals
 clear indep dep j nn reg
end;
clear k

%now store the coefficients in the proper format (see slides)
Phi_hat=NaN(K,K,p);
for ii=1:p
    Phi_hat(:,:,ii)=Phi_hat_temp(ii*K-(K-1):ii*K,:)';
end;
clear ii Phi_hat_temp

%Now compute Sigma_epsilon_hat
Sigma_resid_hat=zeros(K,K);
```

```
for t=p+1:1:T
    Sigma_resid_hat=Sigma_resid_hat+residual(t,:)'*residual(t,:);
end;
Sigma_resid_hat=(1/T)*Sigma_resid_hat;
clear t residual

%Construct Omega_hat_VARHAC
temp=zeros(K,K);
for ii=1:p
    temp=temp+Phi_hat(:,:,ii);
end;
clear ii
Omega_hat_VARHAC=((eye(K,K)-temp)^(-1))*Sigma_resid_hat*((eye(K,K)-
temp)^(-1))';
clear temp

Avar_GMM_varhac_robust=(Sxx'*(Omega_hat_VARHAC^(-1))*Sxx)^(-1)
SE_GMM_varhac_robust=diag(((1/T)*Avar_GMM_varhac_robust).^(1/2))
EstCovv=Avar_GMM_varhac_robust/T;

[h,p,s,cv]=waldtest([coeff(1);coeff(2)-1],[1 0; 0 1],EstCovv,.01)

R_tbl(1,1:2)=delta_GMM;
R_tbl(2,1:2)=[SE_GMM_bartlett_robust(1),SE_GMM_bartlett_robust(2)];
R_tbl(3,3:5)=[R2,mean(y),s];

freg=figure('Position', [150 150 600 255]);
set(freg, 'name', '(VARHAC)Regression Tests of Market Efficiency:
 1975-1989',...
    'numbertitle','off');

r2names={'Coefficients','Std Error','Statistics'};
c2names={,'B0','B1','R^2','Mean of y', 'Wald-stat'};
Regression_table = uitable('Data',R_tbl,...
    'RowName',r2names,'ColumnName',c2names,'Tag',...
    'VARHAC Regression Tests of Market Efficiency: 1975-1989',...
    'Parent', freg,'Position',[40 40 550 155]);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%END PART G%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%


Avar_GMM_varhac_robust =

   1.0e+04 *

    1.1067    0.1234
    0.1234    0.0400


SE_GMM_varhac_robust =

    3.7716
    0.7172
```

```
h =

     1


p =

   5.0006e-05


s =

   19.8067


cv =

    9.2103
```

	B0	B1	R^2	Mean of y	Wald-stat
Coefficients	-12.8208	-2.0984	0	0	0
Std Error	3.7204	0.6815	0	0	0
Statistics	0	0	0.0339	-4.9836	19.8067

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