MGMT 237E:
Empirical Methods in Finance

Homework 5

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1.a. The null hypothesis is: $\beta_1^{n+1} = 1$ for all n.

1.b. OLS and HAC test results shows that the coefficient is significantly different from 1. The HAC result is more meaningful, as the time series data demonstrate heteroscedasticity.

Table 1: Classic OLS assumes homoscedasticity.

β	OLS SE	T-stat
0.2736	0.086388	2.6178
0.53016	0.083435	5.2238
0.71412	0.076759	9.7909
0.78976	0.074268	11.773

Table 2: Variance covariance estimation is heteroscedastic robust.

β	OLS White SE	T-stat
0.2736	0.090767	2.6178
0.53016	0.10149	5.2238
0.71412	0.072937	9.7909
0.78976	0.067082	11.773

Table 3: HAC regression result.

β	HAC SE	T-stat
0.2736	0.20735	1.1459
0.53016	0.26637	1.9903
0.71412	0.18802	3.798
0.78976	0.17014	4.6419

2.a. The null hypothesis is: $\gamma_1^{n+1} = 0$ for all n.

2.b. OLS and HAC test results shows that the coefficient is significantly different from 0.

Table 4: Classic OLS assumes homoscedasticity.

γ	OLS SE	T-stat
0.7624	0.086388	8.3995
1.0118	0.10801	8.5929
1.2821	0.11977	9.8876
1.0561	0.13546	6.9011

Table 5: Variance covariance estimation is heteroscedastic robust.

γ	OLS White SE	T-stat
0.7624	0.090767	8.3995
1.0118	0.11775	8.5929
1.2821	0.12966	9.8876
1.0561	0.15304	6.9011

Table 6: HAC regression result.

γ	HAC SE	T-stat
0.7624	0.20735	3.6769
1.0118	0.26474	3.8218
1.2821	0.30213	4.2435
1.0561	0.34352	3.0745

```
%% MGMT237E HW5
% Zhaofang Shi
clear; clc; close all;
% this part is subject to changes
addpath('C:\Users\SallyShi\Desktop\MGMT237E-Empirical Methods in Finance\MFEToolbox\timeseries')
addpath('C:\Users\SallyShi\Desktop\MGMT237E-Empirical Methods in Finance\MFEToolbox\crosssection')
addpath('C:\Users\SallyShi\Desktop\MGMT237E-Empirical Methods in Finance\MFEToolbox\utility')
addpath('C:\Users\SallyShi\Desktop\MGMT237E-Empirical Methods in Finance\HW5')
%% question 1
prices = xlsread('Fama_bond_prices.xlsx');
% get annually price based on 1 dollar face value
yrprices = prices(1:length(prices(:,1)),2:6)/100;
% generate matrix for log price based on 1 dollar face value
logprices = log(yrprices);
% generate matrix for yields
yields = zeros(length(logprices(:,1)),5);
for n=1:5
    yields(:,n)= -logprices(:,n)/n;
end
% generate matrix for forward rate
fwd = zeros(length(logprices(:,1)),4);
for n=1:4
    fwd(:,n)= logprices(:,n)-logprices(:,n+1);
end
% generate matrix for dependent variables for regression 1
yieldchanges=NaN(length(logprices(:,1)),4);
for n=1:4
    yieldchanges(1:end-n*12,n)= yields(1+n*12:end,1)-yields(1:end-n*12,1);
end
% gernerate matrix for independent variables
fwdspread=NaN(length(logprices(:,1)),4);
for n=1:4
    fwdspread(:,n)=fwd(:,n)-yields(:,1);
end

% figure(1)
% plot(fwdspread)
%
% figure(2)
% plot(yieldchanges)

% compute OLS standard error
B = NaN(4,2);
TSTAT = NaN(4,2);
S2 = NaN(4,1);
SE = NaN(4,2);
SEWHITE = NaN(4,2);
VCV= NaN(2,2);
VCVWHITE = NaN(2,2);
for i=1:4
   [B(i,:),TSTAT(i,:),S2(i,1),VCV,VCVWHITE] = ols(yieldchanges(1:end-i*12,i),fwdspread(1:end-i*12,i));
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```
    SE(i,:)=sqrt(diag(VCV));
    SEWHITE(i,:)=sqrt(diag(VCVWHITE));
end

OLS = table(B(:,2),SE(:,2),TSTAT(:,2));
OLS.Properties.VariableNames = {'Beta' 'OLS_SE' 'T_stat' };
disp(OLS);

OLSWHITE = table(B(:,2),SEWHITE(:,2),TSTAT(:,2));
OLSWHITE.Properties.VariableNames = {'Beta' 'OLS_SEWHITE' 'T_stat'
    };
disp(OLSWHITE);

% compute HAC standard erros
B_hac = NaN(4,2);
TSTAT_hac = NaN(4,2);
S2_hac = NaN(4,1);
SE_hac = NaN(4,2);
VCVNW_hac = NaN(2,2);

for i=1:4
    [B_hac(i,:),TSTAT_hac(i,:),S2_hac(i,1),VCVNW_hac] = olsnw(
     yieldchanges(1:end-i*12,i),fwdspread(1:end-i*12,i));
    SE_hac(i,:)=sqrt(diag(VCVNW_hac));
end

HAC = table(B_hac(:,2),SE_hac(:,2),TSTAT_hac(:,2));
HAC.Properties.VariableNames = {'Beta_hac' 'Hac_SE' 'T_stat' };
disp(HAC);

%% question 2
% generate matrix for holding period returns
hpr = NaN(length(logprices(:,1)),4);
for n=1:4
     hpr(1:end-12,n)= logprices(13:end,n)-logprices(1:end-12,n+1);
end
% generate matrix for dependent variables for regression 2
hprchanges= NaN(length(logprices(:,1)),4);
for n=1:4
     hprchanges(:,n)=hpr(:,n)-yields(:,1);
end

% figure(1)
% plot(fwdspread)
%
% figure(3)
% plot(hprchanges)


% compute OLS standard error
B2 = NaN(4,2);
TSTAT2 = NaN(4,2);
S22 = NaN(4,1);
SE22 = NaN(4,2);
SEWHITE2 = NaN(4,2);
VCV2= NaN(2,2);
VCVWHITE2 = NaN(2,2);
```

```
for i=1:4
    [B2(i,:),TSTAT2(i,:),S22(i,1),VCV2,VCVWHITE2] = ols(hprchanges(1:end-12,i),fwdspread(1:end-12,i));
    SE2(i,:)=sqrt(diag(VCV2));
    SEWHITE2(i,:)=sqrt(diag(VCVWHITE2));
end

OLS2 = table(B2(:,2),SE2(:,2),TSTAT2(:,2));
OLS2.Properties.VariableNames = {'Gamma' 'OLS_SE' 'T_stat' };
disp(OLS2);

OLSWHITE2 = table(B2(:,2),SEWHITE2(:,2),TSTAT2(:,2));
OLSWHITE2.Properties.VariableNames = {'Gamma' 'OLS_SEWHITE' 'T_stat' };
disp(OLSWHITE2);

% compute HAC standard erros
B2_hac = NaN(4,2);
TSTAT2_hac = NaN(4,2);
S22_hac = NaN(4,1);
SE2_hac = NaN(4,2);
VCVNW2_hac = NaN(2,2);

for i=1:4
    [B2_hac(i,:),TSTAT2_hac(i,:),S22_hac(i,1),VCVNW2_hac] = olsnw(hprchanges(1:end-12,i),fwdspread(1:end-12,i));
    SE2_hac(i,:)=sqrt(diag(VCVNW2_hac));
end

HAC2 = table(B2_hac(:,2),SE2_hac(:,2),TSTAT2_hac(:,2));
HAC2.Properties.VariableNames = {'Gamma_hac' 'Hac_SE' 'T_stat' };
disp(HAC2);
```