# Matlab Project

目的：

利用主成分分析法对六年零息债卷数据降维度处理，找出收益率曲线的特点

主成分分析法：利用正交变换，把一系列可能线性相关的变量转换一组不相关的新变量

数据：

zero coupon bond（零息债卷）,六年，每半年共 25 年的即期利率

为（2022x50）的矩阵

收益率曲线改变有三个特点：

Level, Slope, Curvature

将 2022 维度降到三维

步骤：

1.找到 cov,求 evactor（特征向量）,evlaue（特征值）

2.找到前三 evalue,对应前三个 evactor

3.算出最大十个 evalue 所占总值比例

4. 画出三个特点所占比例图形

5. 原始数据*（前三个 evactor）T，画图（Level, Slope, Curvature）与 DAY 的关系

## Table of Contents



```
clear all
clc
% M606 Term Structure HW 3
```

# Q1 Part a

```
r=xlsread('HW3Q1-SpotRates','B:AY'); %IMPORT DATA TO MATLAB

for i=1:2020 %calculate dr=r(t)-r(t-1) by using loop
    r1(i,:)=r(i+1,:)-r(i,:);
end
c=cov(r1); % covariance matrix of the dr series

fprintf('Find cov')
```

```
Find cov
```

# Q1 Part b

```
[eig_vactor,eig_value]=eig(c); %eigenvactor,eigenvalues of square
 matrix c
eig_vactor;
eig_value;
diag_eig_value=diag(eig_value);
diag_eig_value;
[eig_value_sort,originalpos2]=sort(diag_eig_value(:),'descend');%Find
 the biggest 10 evalue
fprintf('Question 1 part b : first 10(largest) eigenvalues is : ')
largest10_evalue=eig_value_sort(1:10);

fprintf('Question 1 part b : first 10(largest) eigenvalues is : ')
evactor_of_l10evactor=[eig_vactor(:,originalpos2(1:10))];
evactor_of_l10evactor ;
fprintf('Find Largest 10 evactor')
```

```
Question 1 part b : first 10(largest) eigenvalues is : Question 1 part
 b : first 10(largest) eigenvalues is : Find Largest 10 evactor
```

# Q1 Part c

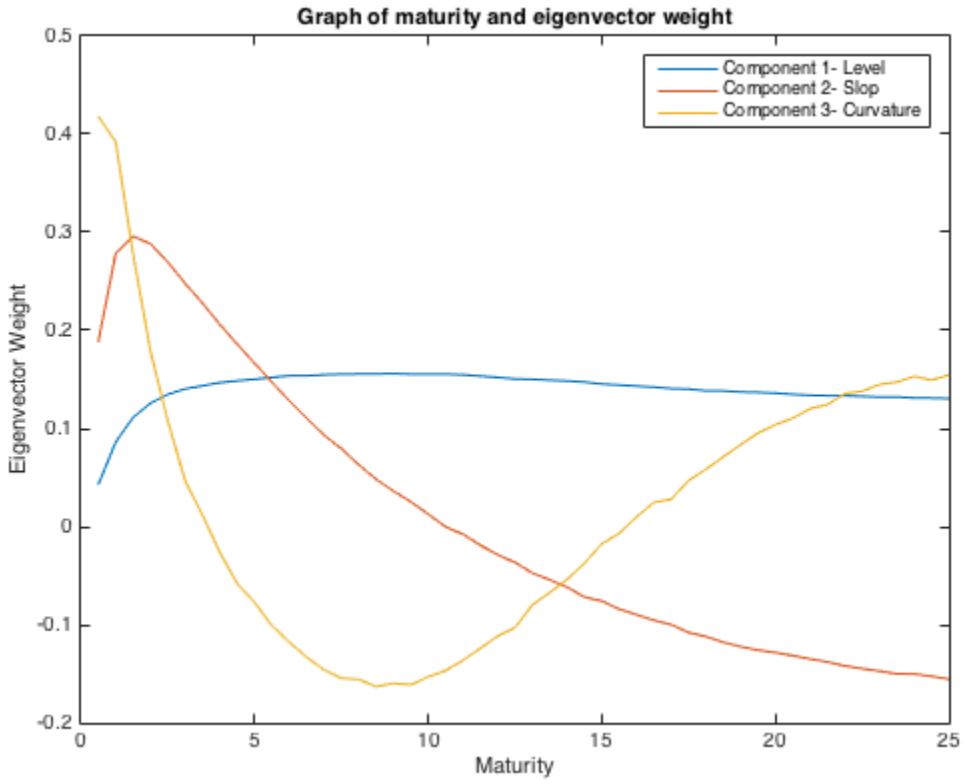
```
%Percentage Variation
```

```
fprintf('Question 1 part C :  Percentage Table : ')
percentage_variation=largest10_evalue/sum(eig_value_sort);
fprintf('Question 1 part c : Percentage Variation Table : ')
table(largest10_evalue,percentage_variation)


%Cumulative Percentage
sum_of_largest_10_evalue=sum(largest10_evalue);
cumulative_sum_largest_10_evalue=cumsum(largest10_evalue);
cumulative_percentage=cumulative_sum_largest_10_evalue/
sum_of_largest_10_evalue;
fprintf('Question 1 part C : Cumulative Percentage Table : ')
table(largest10_evalue,cumulative_percentage)
fprintf('About 88.8% of the variation is explained by this first
 eigenvalue,ect.')
```

```
Question 1 part C :  Percentage Table : Question 1 part c : Percentage
 Variation Table :
ans =

    largest10_evalue    percentage_variation
    ________________    ____________________

      0.066938              0.88087
     0.0062186             0.081834
     0.0012756             0.016787
    0.00061343            0.0080724
    0.00013698            0.0018025
    6.4888e-05           0.00085389
    3.1603e-05           0.00041587
    2.2941e-05           0.00030189
    2.2183e-05           0.00029192
     2.198e-05           0.00028925

Question 1 part C : Cumulative Percentage Table :
ans =

    largest10_evalue    cumulative_percentage
    ________________    _____________________

      0.066938              0.8884
     0.0062186             0.97094
     0.0012756             0.98787
    0.00061343             0.99601
    0.00013698             0.99783
    6.4888e-05             0.99869
    3.1603e-05             0.99911
    2.2941e-05             0.99941
    2.2183e-05             0.99971
     2.198e-05                   1

About 88.8
```

# Q1 Part d

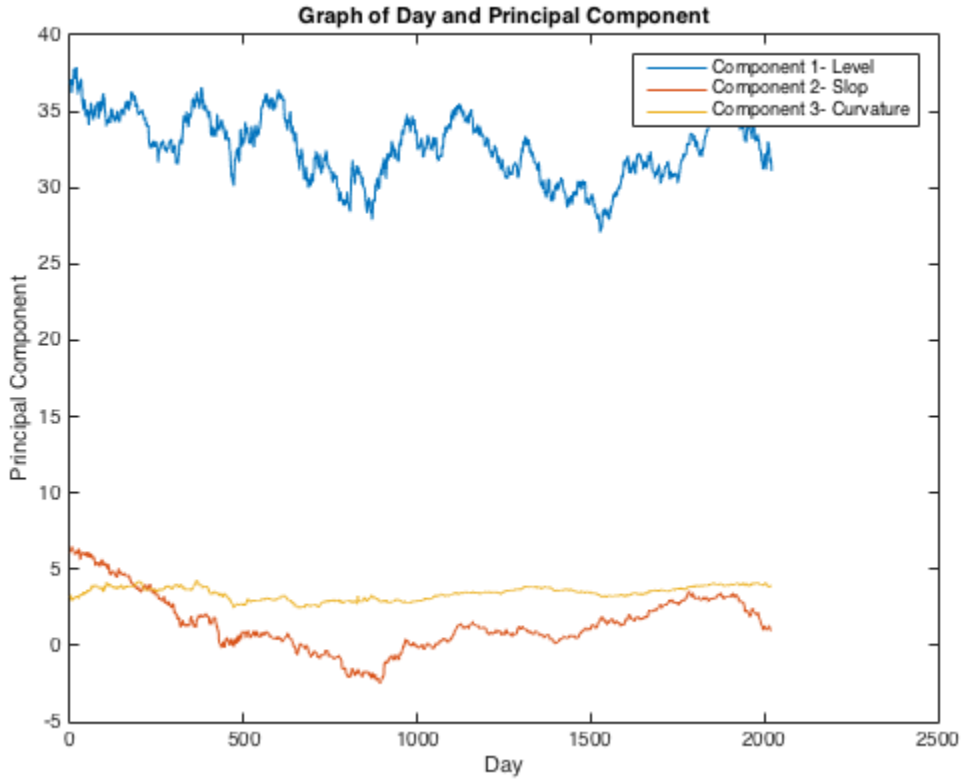
```
largest3_evactor=largest10_evalue(1:3,:);        %Find the biggest 3
 evactor
largest3_evactor_weight=percentage_variation(1:3);%Find the weight of
 biggest 3 evactor
evactor_of_l3evactor=[eig_vactor(:,originalpos2(1:3))];%Find evector
 to the biggest 3 evalue

figure (1);
plot([0.5:0.5:25],evactor_of_l3evactor)
legend('Component 1- Level','Component 2- Slop','Component 3-
 Curvature')
title('Graph of maturity and eigenvector weight');
xlabel('Maturity');
ylabel('Eigenvector Weight');
```




# Q1 Part e

```
%Transpose daily rates and evactor first, then multiple
trans_r=r';
trans_l3_evactor=evactor_of_l3evactor';
PC=trans_l3_evactor*trans_r;
figure (2);
plot([1:1:2021],PC)
```

```
legend('Component 1- Level','Component 2- Slop','Component 3-
 Curvature')
title('Graph of Day and Principal Component');
xlabel('Day');
ylabel('Principal Component')
```

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