Q3

1. The first order condition of the maximization problem gives:



Therefore, the optimal portfolio share for each agent i is the solution to



1. The code for question 2 can be found in the appendix.

When the degree of risk aversion equals to 15.535, we have optimal portfolio share is 1, and after that the share of optimal portfolio decreases with the increase of . That is to say, when the risk aversion degree is small enough, household will invest all in the risky asset.

1. With the method of splines, we first found the  that makes , then we approximated the evolution of the portfolio shares. This method of splines indeed made the graph look better.

And if increase the number of nodes large enough, the first graph will overlap with the second one.

Appendix

% problem3

clear

close all

clc

rf = 0.02;

er = 0.06;

r = [rf-er;rf+er];

p = 0.1;

n=15;

prob = [p; 1-p];

gam0=1;

gam1=50;

addpath(genpath('CEdemos'));

addpath(genpath('CEtools'));

%this is for using the Toolbox provided by Miranda & Facler

fspace=fundefn('cheb',n,gam0,gam1);

gamgrid=funnode(fspace);

alph=zeros(n,1);

alph0=alph(1);

for i=n:-1:1,

alph(i)=broyden(@alphres,alph0,gamgrid(i),prob,r,rf);

alph0=alph(i);

if alph0>1,

gam=gamgrid(i);

alph(1:i)=1;

break;

end;

end;

B=funbas(fspace,gamgrid);

coeff=B\alph;

figure;

plot(gamgrid,alph,'s-');

% smarter way:

gam0new=fzero(@resgam0,[gam0; gam1],[],prob,r,rf);

fspace=fundefn('cheb',n,gam0new,gam1);

gamgrid=funnode(fspace);

% coefficients:

alphgrid=broyden(@alphres,ones(n,1),gamgrid,prob,r,rf);

gamgrid=[gam0;gamgrid];

alphgrid=[1;alphgrid];

hold on;

plot(gamgrid,alphgrid,'y--');

function res=alphres(alph,gam,prob,r,rf)

res=0;

for i=1:length(prob),

res=res+prob(i)\*((1+rf+alph.\*(r(i)-rf)).^(-gam).\*(r(i)-rf));

end;

function res=resgam0(gam,prob,r,rf);

res=prob'\*((1+r).^(-gam).\*(r-rf));