func\_lcpfchoice = function life-cycle portfolio choice model

func\_pol = function policy function

func\_fwdsolve = function fwdsolve

rho = discount rate

tetta = RRA

rf = risk-free return

mu = mean risky return

sig = standard deviation of stock returns

ns = number of stochastic simulations

coh0 = starting value of cash at hand

inc0 = net labor income during working period

rplr = net replacement rate at retirement

nj = maximum age

jr = retirement age

betta = discount factor

inc = income

mpc = marginal propensity to consume

hatalph = estimated portfolio share

hk = human capital

jc = year count variable

agevec = age vector

mret = mean simple return

mhatpfret = mean estimated portfolio share

mpfret = mean portfolio return

mcons = mean consumption

malph = mean portfolio share

mass = mean assets1

mtotwealth = mean total wealth

mcoh = mean cash on hands

mtotsav = mean total savings

mfinsav = mean financial savings

sc = simulation count

lnR = log gross return (standardized)

R = gross return

ret simple return

cons = consumption

consgr = consumption growth

coh = cash on hands

ass = assets

totwealth = total wealth

totsav = total savings

finsav = financial savings

alph = portfolio share

hatpfret = estimated portfolio return

pfret = portfolio return

lnmu = log mean risky return

mup = ?

sigp = ?

b = ?

------------------------------------------------------------------------------------------------------------------------------------

% Main function for the life-cycle portfolio choice model:

begin function: life-cycle portfolio choice model

close all

% Set parameter values:

discount rate = 0.02;

RRA = 150.0;

risk-free return = 0.02;

mean risky return = 0.05;

standard deviation of stock returns = 0.15;

number of stochastic simulations = 10000;

starting value cash at hands = 1.0;

net labour income during working period = 1.0;

net replacement rate at retirement = 0.6;

maximum age = 61;

retirement age = 46;

% Transformation:

discount factor = 1 / (1+discount rate);

income = column vector of length maximum age filled with zeros;

change income(for year = 1 to year = retirement age) = net labour income during working period;

change income (for year = retirement age to year = maximum age) = net replacement rate at retirement \* net labour income during working period;

% Policy functions:

function policy function output[marginal propensity to consume, estimated portfolio share] = input[maximum age, discount factor, RRA, risk-free return, mean risky return, standard deviation of stock returns];

% Human capital:

human capital = column vector of length maximum age filled with zeros;

for year = (maximum age - 1) until year = 1 {

change human capital(year) = [human capital (year + 1) + income (year + 1)] / (1 + risk-free return)

change year = year - 1;

}

% Plot policy functions:

% Remark: year = 1 is the first year an individual works, year = maximum age is the last year an individual works:

age vector = column vector of values 20 to (maximum age + 19);

plot(age vector on x-axis, marginal propensity to consume on y-axis);

plot(age vector on x-axis, estimated portfolio share on y-axis);

% Simulation:

initial state of random number generator = 0;

% Make space for simulated draws:

mean return = column vector of length maximum age filled with zeros;

mean estimated portfolio return = column vector of length maximum age filled with zeros;

mean portfolio return = column vector of length maximum age filled with zeros;

mean consumption = column vector of length maximum age filled with zeros;

mean portfolio share = column vector of length maximum age filled with zeros;

mean assets = column vector of length maximum age filled with zeros;

mean total wealth = column vector of length maximum age filled with zeros;

mean cash on hand = column vector of length maximum age filled with zeros;

mean total savings = column vector of length maximum age filled with zeros;

mean financial savings = column vector of length maximum age filled with zeros;

Rlong = empty array;

for simulation count = 1 until simulation count = number of stochastic simulations, {

log gross return = column vector of length maximum age filled with random numbers;

change log gross return = log gross return \* standard deviation of stock returns + log(1.0+ mean risky return);

gross return = exp(log gross return + 0.5 \* (standard deviation of stock returns) ^ 2);

simple return = gross return - 1.0;

Rlong = Vector[Rlong;R];

Function fwdsolve output[consumption, consumption growth, cash on hands, assets, total wealth, total savings, financial savings, share invested in risky asset, estimated portfolio return, portfolio return]=input[starting value of cash at hand, human capital, income, maximum age, marginal propensity to consume, portfolio share, risk-free return, simple return];

plot(age vector on x-axis, simple return on y-axis) if simulation count = 1;

plot(age vector on x-axis, consumption on y-axis) if simulation count = 1;

plot(age vector on x-axis, assets on y-axis) if simulation count = 1;

plot(age vector on x-axis, share invested in risky asset on y-axis) if simulation count = 1;

% Remark: Return only from period 2 onwards:

plot(age vector(2:maximum age) on x-axis, portfolio return on y-axis) if simulation count = 1;

% Calculate means (over simulations):

mean return = mean return + 1.0 / number of stochastic simulations \* return;

mean portfolio return = mean portfolio return + 1.0 / number of stochastic simulations \* portfolio return;

mean consumption = mean consumption + 1.0 / number of stochastic simulations \* consumption;

mean assets = mean assets + 1.0 / number of stochastic simulations \* assets;

mean total wealth = mean total wealth + 1.0 / number of stochastic simulations \* total wealth;

mean cash on hand = mean cash on hand + 1.0 / number of stochastic simulations \* cash on hand;

mean share invested in risky assets = mean share invested in risky assets + 1.0 / number of stochastic simulations \* share invested in risky assets;

mean total savings = mean total savings + 1.0 / number of stochastic simulations \* total savings;

mean financial savings = mean financial savings + 1.0 / number of stochastic simulations \* financial savings;

}

plot(age vector on x-axis, mean consumption on y-axis);

plot(age vector on x-axis, mean assets on y-axis);

plot(age vector on x-axis, mean cash on hand on y-axis);

plot(age vector on x-axis, mean assets on y-axis);

% Remark: only (maximum age - 1) consumption growth values

pl=plot(agevec(1:nj-1),mcons(2:nj)./mcons(1:nj-1)-1.0,'b-');

plot(age vector on x-axis(1:(maximum age -1)), mean consumption(2:maximum age) divided elementwise by mean consumption (1:(maximum age - 1)) - 1.0 on y-axis);

plot(age vector on x-axis, mean share invested in risky asset on y-axis);

plot(age vector on x-axis, mean portfolio return on y-axis);

display ('THE END');

end function: life-cycle portfolio choice model

% Supplemental function for life-cycle portfolio choice model

begin function: policy function output[marginal propensity to consume; portfolio share] = input[maximum age, discount factor, discount rate, risk-free return, mean risky return, standard deviation of stock returns]

log mean risky return = log(1.0 + mean risky return);

marginal propensity to consume = column vector of length maximum age filled with ones;

estimated portfolio share = (log mean risky return-log(1.0+ risk-free return)+ standard deviation of stock returns ^2/2)/( RRA \* standard deviation of stock returns ^2);

mup = estimated portfolio share \* log mean risky return + (1-estimated portfolio share) \* log(1+risk-free return) + 0.5 \* estimated portfolio share \* ( 1.0 - portfolio share) \* variance of stock returns;

sigp = estimated portfolio share ^2 \* standard deviation of stock returns ^2;

for year = (maximum age - 1) until year = 1{

% Calculate the marginal propensity to consume:

b = marginal propensity to consume(year+1) ^(-1) \* (discount factor \* exp ((1.0-RRA) \* (mup + (1.0 - RRA) \* sigp ^2/2))) ^(1/RRA);

marginal propensity to consume(year) = 1.0 / ( 1.0 + b);

change year = year - 1

}

end function: policy function

% Supplemental function for life-cycle portfolio choice model

begin function: fwdsolve output[consumption, consumption growth, cash on hands, assets, total wealth, total savings, financial savings, share invested in risky asset, estimated portfolio return, portfolio return]=input[starting value cash at hand, human capital, income, maximum age, marginal propensity to consume, portfolio share, risk-free return, simple return];

% Make space for variable values:

total savings = column vector of length maximum age filled with zeros;

financial savings = column vector of length maximum age filled with zeros;

cash on hands = column vector of length maximum age filled with zeros;

consumption = column vector of length maximum age filled with zeros;

assets = column vector of length maximum age filled with zeros;

total wealth = column vector of length maximum age filled with zeros;

portfolio share = column vector of length maximum age filled with zeros;

portfolio return = column vector of length maximum age filled with zeros;

estimated portfolio return = column vector of length maximum age filled with zeros;

cash on hands(year=1) = starting value of cash on hands;

total wealth (year=1) = starting value of cash on hands + human capital(year=1);

for year = 1 until year = maximum age, {

consumption(year) = marginal propensity to consume(year) \* total wealth(year);

cash on hands(year)= total wealth(year)-human capital(year);

if year == 1, {

estimated portfolio return (year) = risk-free return + estimated portfolio share \* (simple return(year)-risk-free return);

}

assets (year) = cash on hands (year) - income (year);

total savings(year) = total wealth (year) - consumption(year);

financial savings(year) = cash on hands (year) - consumption(year);

if year < maximum age, {

portfolio share (year) = estimated portfolio share \* total savings(year)/financial savings(year);

estimated portfolio return (year + 1) = risk-free return + estimated portfolio share \* ( simple return(year+1)-risk-free return);

portfolio return(year + 1) = risk-free return + portfolio share(year + 1) \* (simple return(year + 1) - risk-free return);

total wealth (year + 1) = total savings (year) \* ( 1+ estimated portfolio return (year + 1));

}

}

consumption growth = consumption(2:end) divided elementwise consumption (1:(end-1));

end function: fwdsolve