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function CH6ans

% This function is designed to play around with simple AR1 process for g
% and tau and see what happens.

clc
clear all

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Part I: getting our shocks
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

T = 100; % length of time

TT = 10000; % number of random epsilon shocks we drew

EP = randn(TT,1);

% Let's choose some basic moments for our model

mean_tau = .1; % so mean inflation is 10%

mean_g = .02; % so mean growth is 2%

rho_tau = 0.7;

rho_g = 0.95;

beta = 0.98;

B_tau = mean_tau*(1 - rho_tau)

B_g = mean_g*(1 - rho_g)

C_tau = .007; % governs how volatile tau is

C_g = .007; % governs how volatile g is

vf = 1/ (1+.5); % setting gamma = .5 so Frisch elasticity is 2

% We need to initialize our matrices
% Generally good to use steady state values here

TAU = [mean_tau];

G = [mean_g];

Q = [beta/(1+mean_tau)];

L = [(beta/(1+mean_tau)) ^vf];

P = [1];

M = [1];

Z = [1];

Y_level = [Z(1)*L(1)];

infl = [(1+mean_tau)/(1+mean_g)];

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Y_gr = [1+mean_g];

for i=2:T,

    ep_tau = randn; % drawing a standard normal with mean 0 and std 1

    tau = rho_tau*TAU(i-1)+B_tau+C_tau*ep_tau;

    TAU(i) = tau;

    ep_g = randn;

    g = rho_g*G(i-1)+B_g+C_g*ep_g;

    G(i) = g;

    L(i) = (beta/(1+tau)) ^vf;

    M(i) = M(i-1)*(1+tau);

    Z(i) = Z(i-1)*(1+g);

    Y_level(i) = Z(i)*L(i);

    P(i) = M(i-1)/Y_level(i); % careful money at beginning of period here

    infl(i) = P(i)/P(i-1); % Gross growth rate of prices

    Y_gr(i) = Y_level(i)/Y_level(i-1); % Gross growth rate of output

    newTau = rho_tau*tau+B_tau+C_tau*EP; % vector reflecting distribution of tau_{t+1}

    newTerm = .98./(1+newTau);

    Q(i) = mean(newTerm);

end

figure(1)
plot([1:T]',TAU','-b','LineWidth',3)
title('Money Growth Rates')
xlabel('Time')
ylabel('Growth Rates')

figure(2)
plot([1:T]',G','-b','LineWidth',3)
title('Productivity Growth Rates')
xlabel('Time')
ylabel('Growth Rates')

figure(3)
yyaxis left
plot([2:T]',P(2:T)', 'LineWidth',3)
yyaxis right
plot([2:T]', Y_level(2:T)', 'LineWidth',3)
xlabel('Time')
ylabel('Levels')
legend('Prices', 'Output')

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figure(4)
yyaxis left
plot([2:T]',infl(2:T)', 'LineWidth',3)
yyaxis right
plot([2:T]',Y_gr(2:T)', 'LineWidth',3)
xlabel('Time')
ylabel('Growth Rates')
legend('Inflation', 'Output Growth')

figure(5)
plot([1:T]',Q', '-b', 'LineWidth',3)
title('Interest Rates')
xlabel('Time')
ylabel('Rates')

disp('Correlation between Money gr, Inflation, Y gr and Q')
corrcoef([1+TAU(2:T)' infl(2:T)' Y_gr(2:T)' Q(2:T)'])

% put everything here in gross growth terms so 1+tau
% dropped the first observation since not stochastic draw

disp('Correlation when we lag money growth')
corrcoef([1+TAU(1:T-1)' infl(2:T)' Y_gr(2:T)' Q(2:T)'])

% Note that the new money growth rate tau hits P_{t+1} through M so lag
% comes in too.

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% Part 2: Correlations and Long-Run Growth rates
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lrg_TAU = ((1+TAU(11:T))./(1+TAU(1:T-10))).^(1/10);

lrg_M = ((1+M(11:T))./(1+M(1:T-10))).^(1/10);

lrg_Y = (Y_level(11:T)./Y_level(1:T-10)).^(1/10);

lrg_P = (P(11:T)./P(1:T-10)).^(1/10);

disp('Correlation matrix for long-run money, output and inflation')

corrcoef([lrg_M' lrg_Y' lrg_P'])

% 10 year rolling windows

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Part 3: Simulation Panels
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TT = 30; % Using TT now for the length of data in each country

for i = 1:T, % Using T for the number of countries 100 is pretty large

    % using p for panel. initializing matrix must do that for each year 1

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pTAU(1,i) = mean_tau;

pG(1,i) = mean_g;

pLabor(1,i) = (beta/(1+mean_tau))^vf;

Prod(1,i) = 1;

pY(1,i) = Prod(1,i)*pLabor(1,i);

Money(1,i) = 1;

Prices(1,i) = Money(1,i)/pY(1,i);

for j = 2:TT,

    tau = rho_tau*pTAU(j-1,i)+B_tau+C_tau*randn;

    pTAU(j,i) = tau;

    pLabor(j,i) = (beta/(1+tau))^vf;

    g = rho_g*pG(j-1,i)+B_g+C_g*randn;

    pG(j,i) = g;

    Prod(j,i) = Prod(j-1,i)*(1+g);

    pY(j,i) = Prod(j,i)*pLabor(j,i);

    Money(j,i) = (1+tau)*Money(j-1,i);

    Prices(j,i) = Money(j-1,i)/pY(j,i); % again money at beginning of period

end

end

for i = 1:T,

    lrg_TAU = ((1+pTAU(11:TT,i))./(1+pTAU(1:TT-10,i))).^(1/10);

    lrg_Money = ((1+Money(11:TT,i))./(1+Money(1:TT-10,i))).^(1/10);

    lrg_Y = (pY(11:TT,i)./pY(1:TT-10,i)).^(1/10);

    lrg_P = (Prices(11:TT,i)./Prices(1:TT-10,i)).^(1/10);

    A = corrcoef([lrg_Money lrg_P lrg_Y]);

    PCORR_1(i) = A(1,2);

    PCORR_2(i) = A(1,3);

    PCORR_3(i) = A(2,3);

end

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figure(6)
histogram(PCORR_1)
title('Histogram LR money growth vs. inflation')

figure(7)
histogram(PCORR_2)
title('Histogram LR money growth vs. output growth')

figure(8)
histogram(PCORR_3)
title('Histogram LR inflation vs. output growth')

end
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B_tau =
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0.0300
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B_g =
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0.0010
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Correlation between Money gr, Inflation, Y gr and Q
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ans =
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1.0000	0.1741	0.0949	-1.0000
0.1741	1.0000	-0.8990	-0.1750
0.0949	-0.8990	1.0000	-0.0940
-1.0000	-0.1750	-0.0940	1.0000

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Correlation when we lag money growth
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ans =
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1.0000	0.0916	0.3398	-0.5648
0.0916	1.0000	-0.8990	-0.1750
0.3398	-0.8990	1.0000	-0.0940
-0.5648	-0.1750	-0.0940	1.0000

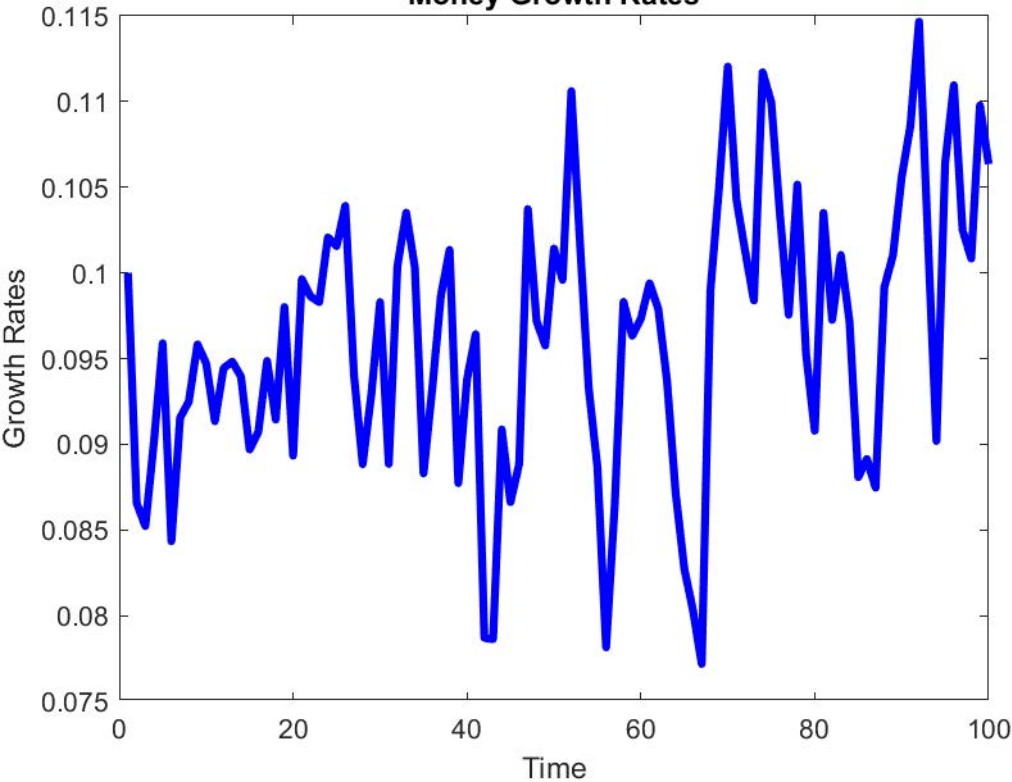
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Correlation matrix for long-run money, output and inflation
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ans =
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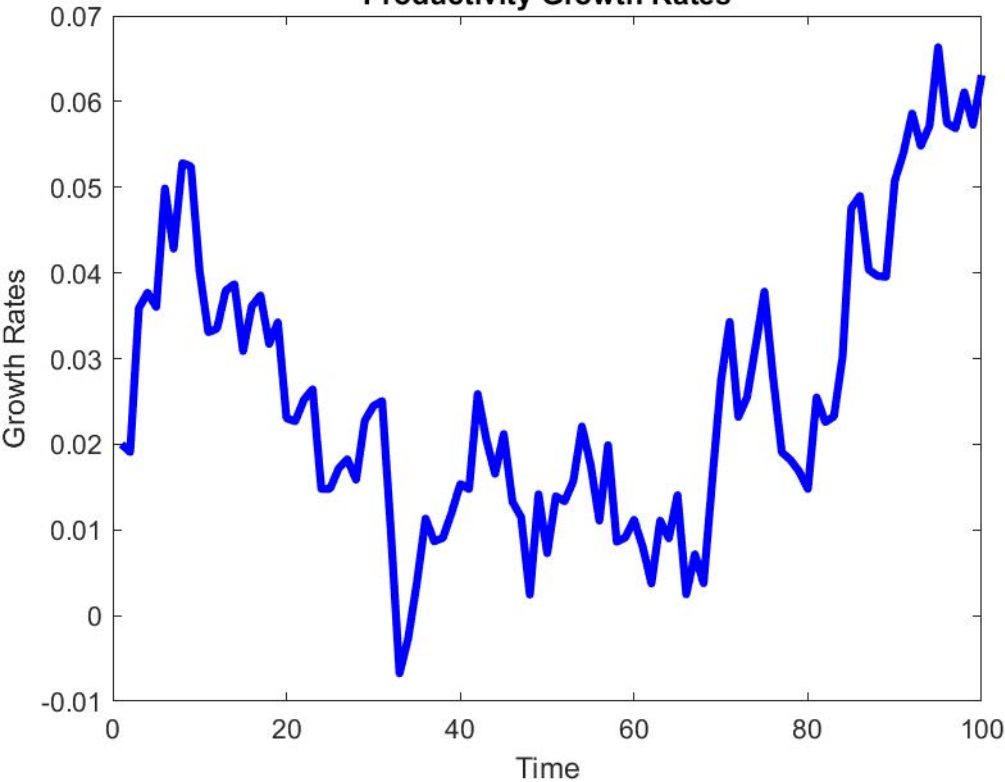
1.0000	-0.1367	0.3329
-0.1367	1.0000	-0.9629
0.3329	-0.9629	1.0000

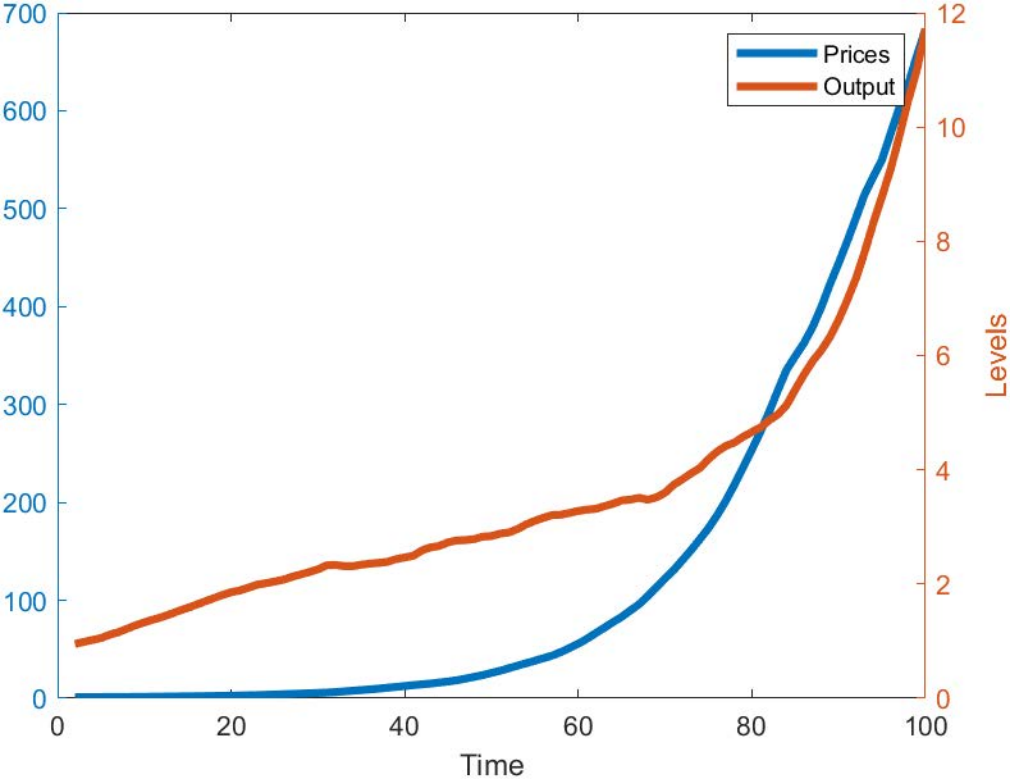
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>>
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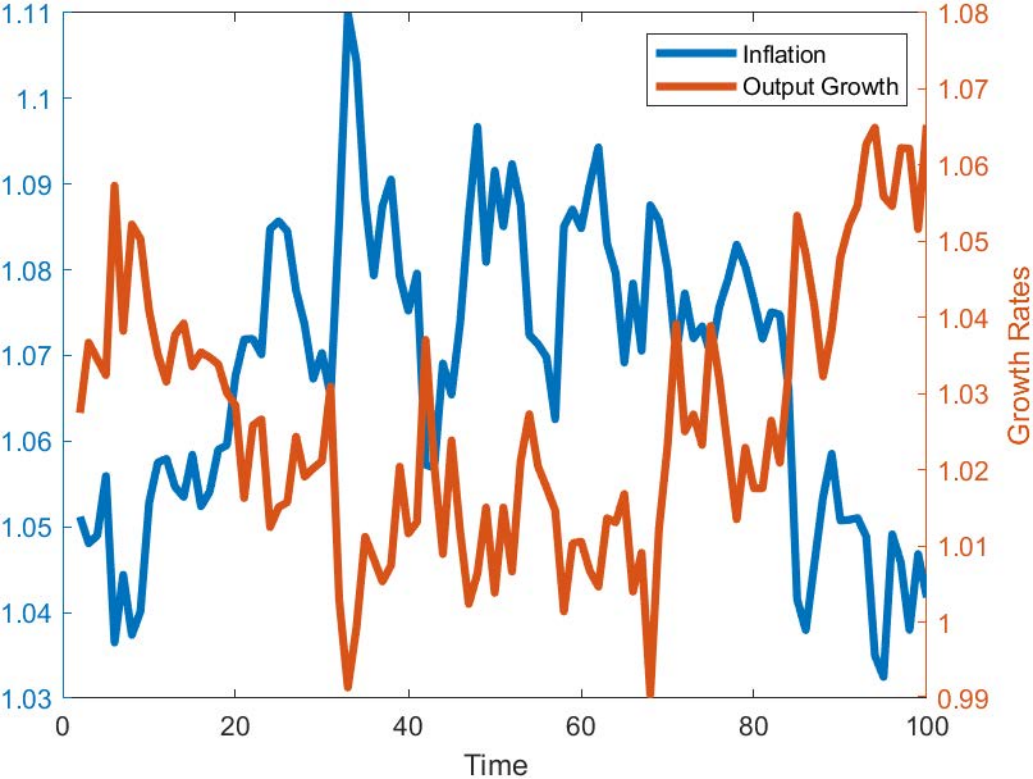
Money Growth Rates



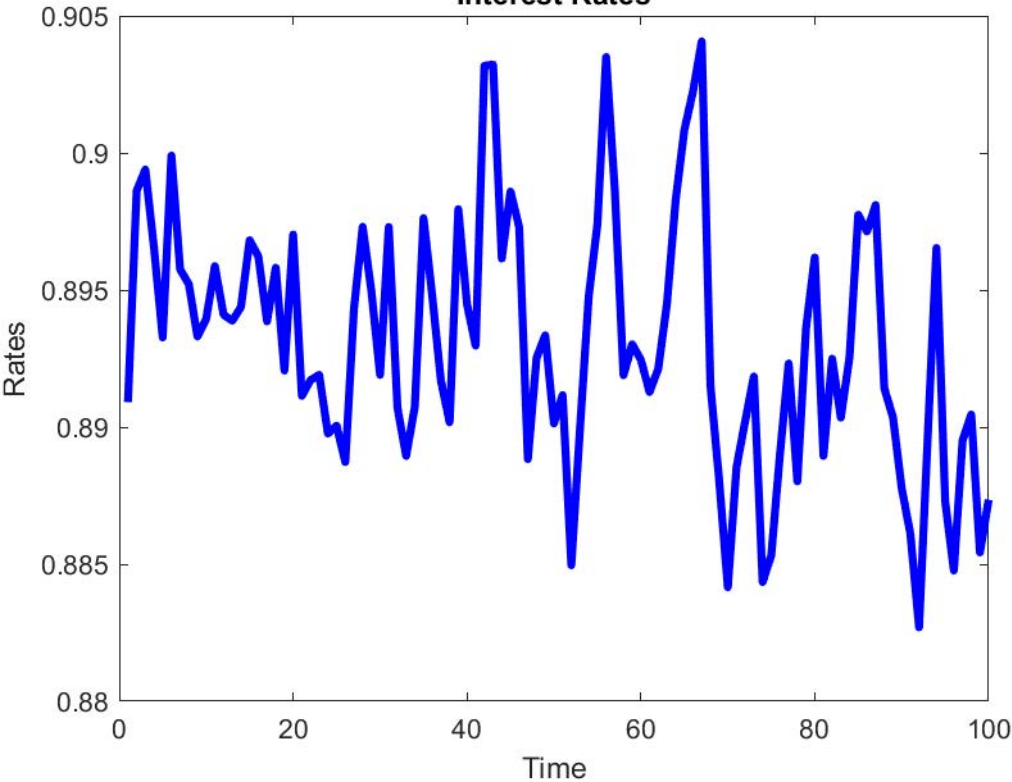
Productivity Growth Rates



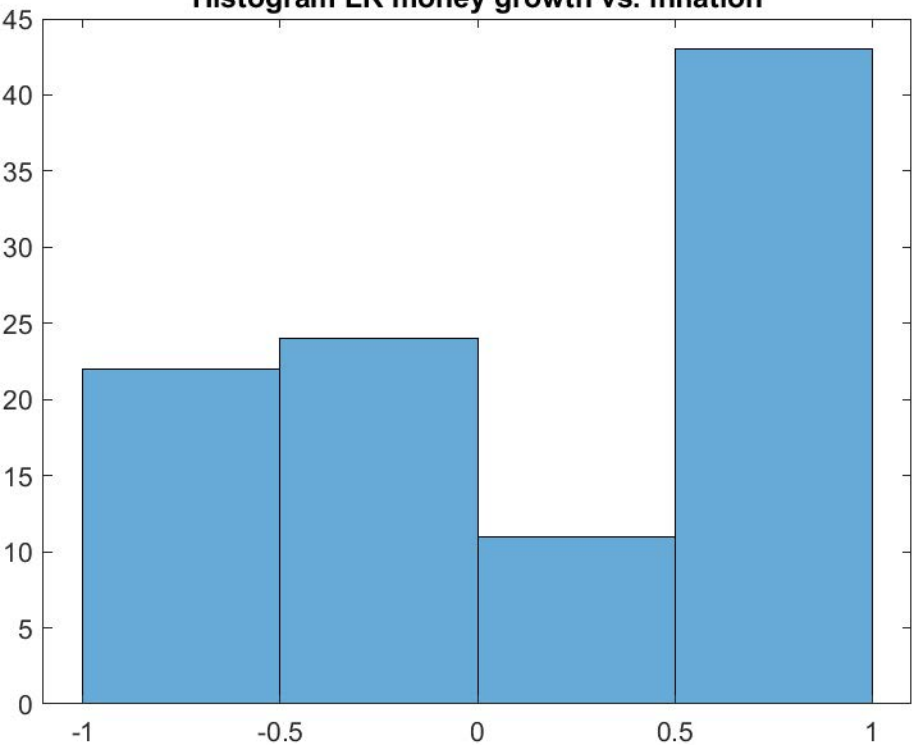




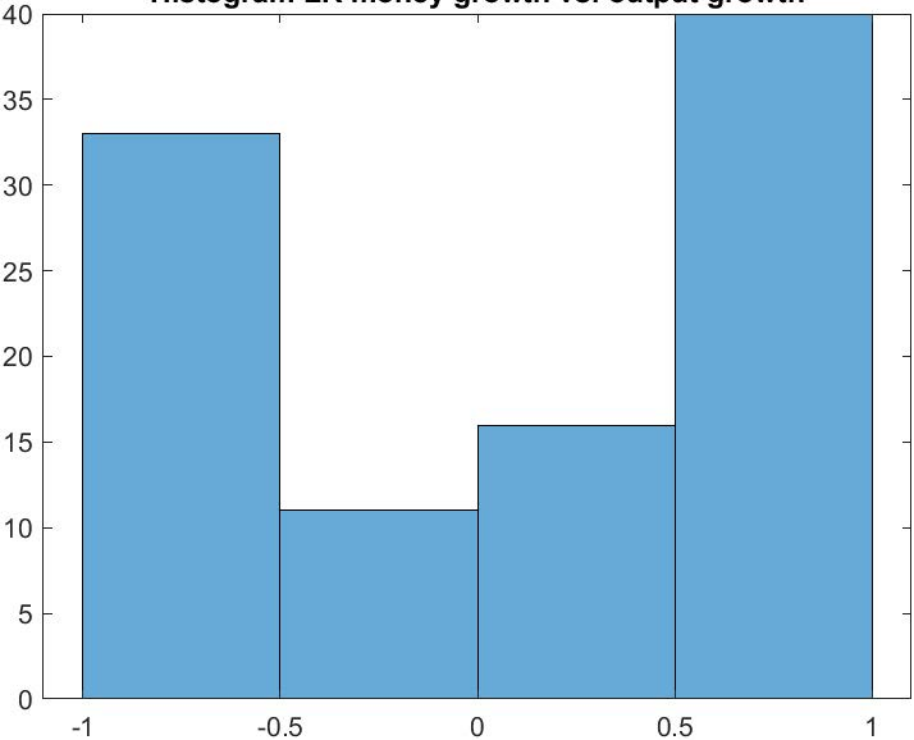
Interest Rates



Histogram LR money growth vs. inflation



Histogram LR money growth vs. output growth



Histogram LR inflation vs. output growth

