Macro III: Problem Set 3

Deadline: Friday, 17/09/2018

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Source code disponível em: https://github.com/btebaldi/Macro3/tree/master/PSet_03

QUESTÃO 1 (a)-(e)

LIMPEZA DE VARIAVEIS

```
clearvars
clc
```

ITEM A DEFINICAO DE PARAMETROS

Defininimos os parametros que sao utilizados pelo problema

```
Econom_param.PeriodsPerYear = 6;
Econom_param.Beta_anual = 0.96;
Econom_param.Beta = (Econom_param.Beta_anual)^(1/Econom_param.PeriodsPerYear);
Econom_param.Sigma = 1.5;

eps = 1e-5;
```

DEFINICAO DO GRID DE INCOME

Vamos Construir a matrix de transição baseada nas informações fornecidas

```
Income.Grid.N = 2;
Income.Grid.Max = 1;
Income.Grid.Min = 0.1;
Income.Values = linspace(Income.Grid.Max, Income.Grid.Min, Income.Grid.N);
Income.PI = [0.925 (1-0.925); 0.5 (1-0.5)];
Income.P_LongRun = CalculaLongoPrazo(Income.PI);
```

Logo a renda media de equilibrio no longo prazo sera.

```
Income.Average = Income.Values*Income.P_LongRun;
Income.Early = Income.Average * Econom_param.PeriodsPerYear;
```

A duração média do desemprego é dada por 1/f, onde f neste caso é 0.5. Sendo assim a duracao média do desemprego é dois periodos. Como o periodo é de dois meses, temos que a duração média de desemprego é de 4 meses.

DEFINICAO DO GRID de ASSET

```
Borrow.Limit = -Income.Early;
Asset.Grid.N = 20;
Asset.Grid.Max = 3*Income.Average;
Asset.Grid.Min = Borrow.Limit;
Asset.Values = linspace(Asset.Grid.Min, Asset.Grid.Max, Asset.Grid.N);
```

DEFINICAO DA TAXA DE JUROS

Inicia a taxa de juros

```
Econom_param.r_anual = 0.034;
Econom_param.r_start = ((1+Econom_param.r_anual)^(1/Econom_param.PeriodsPerYear))-1;
Econom_param.r_UpperLimit = 1/Econom_param.Beta - 1;
Econom_param.r_LowerLimit = 0;
Econom_param.r = Econom_param.r_start;

% parametro que indica se a taxa esta fixa ou nao.
Econom_param.r_IsFixed = 0;
```

ACHANDO O EQUILIBRIO.

1. Determinar um r inicial
2. Resolver o Problema do Consumidor e obter a Politica
3. Determinar Lambda
4. Verificar se existe eequilibrio no mercado de assets
5. Se nao ha equilibrio estabelecer novo r, (voltar a ponto 2)
   onde $e > 0 \rightarrow r_j + 1 < r_j$ $e < 0 \rightarrow r_j + 1 > r_j$

```
nIntLimit = 1000;

for i=1:nIntLimit

    % (2) Resolve o Problema do consumidor
    [V0, U_Cube, Policy] = SolveConsumerProblem(Asset, Income, Econom_param);

    % (3) Determina a distribuicao estacionaria
    Lambda = ConstructLambda(Policy, Asset, Income);

    % (4) Determina demanda de assets
    Demanda = Lambda(:)' * Policy.AssetPrime.Values(:);

    % (5) Verifica se há equilibrio
    if abs(Demanda) < eps
        break;
    elseif Demanda > eps
        Econom_param.r_UpperLimit = Econom_param.r;
```

```
    elseif  Demanda < -eps
        Econom_param.r_LowerLimit = Econom_param.r;
    end

    % Caso a taxa esteja fixa não ha mais nada o que fazer
    if Econom_param.r_IsFixed == 1
        break;
    end

    % determina novo r
    r_old = Econom_param.r;
    Econom_param.r = (Econom_param.r_UpperLimit + Econom_param.r_LowerLimit)/2;

    % Caso a precisao da taxa seja muito pequena paramos a execucao.
    if abs(Econom_param.r - r_old) < eps^2
        break;
    end

    fprintf('Inter:%4d\tr_0: %1.6f\tr_1: %1.6f\tDem: %2.15f\n', i, r_old, Econom_param.r, Dema
end
```

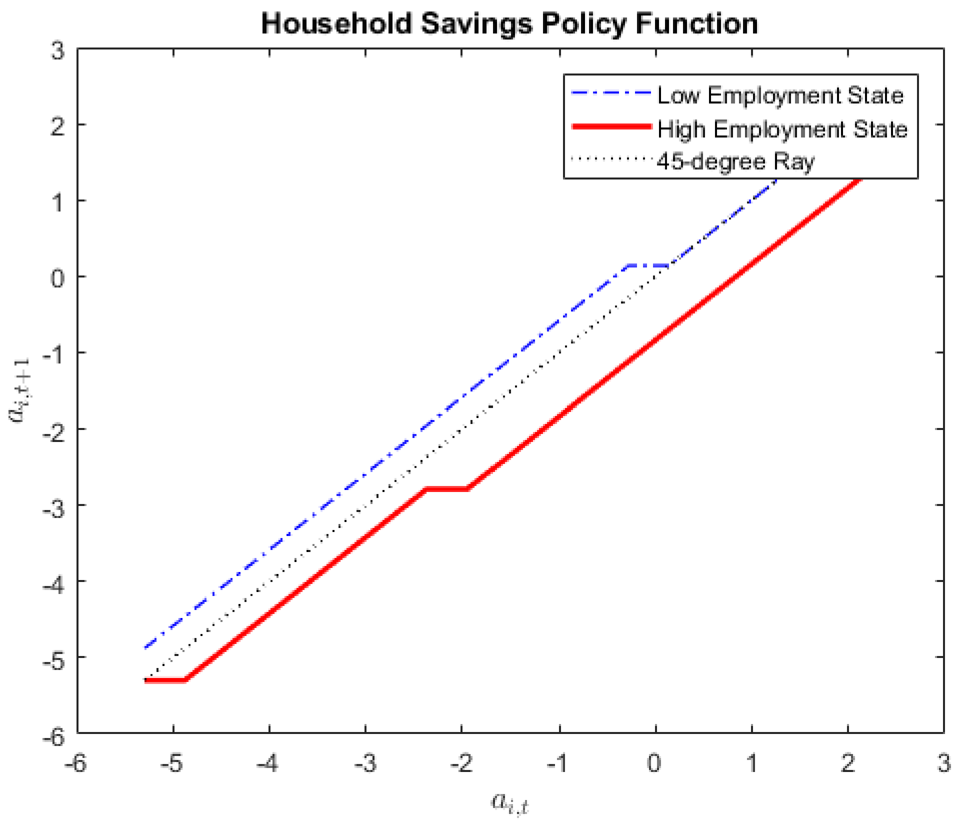
```
Inter:   1 r_0: 0.005588 r_1: 0.006207 Dem: -0.739618742602491
Inter:   2 r_0: 0.006207 r_1: 0.005898 Dem: 0.036345050466770
Inter:   3 r_0: 0.005898 r_1: 0.006053 Dem: -0.339060751860335
Inter:   4 r_0: 0.006053 r_1: 0.006130 Dem: -0.339060751860335
Inter:   5 r_0: 0.006130 r_1: 0.006169 Dem: -0.339060751860335
Inter:   6 r_0: 0.006169 r_1: 0.006149 Dem: 0.036345050466770
Inter:   7 r_0: 0.006149 r_1: 0.006159 Dem: -0.339060751860335
Inter:   8 r_0: 0.006159 r_1: 0.006164 Dem: -0.339060751860335
Inter:   9 r_0: 0.006164 r_1: 0.006161 Dem: 0.036345050466770
Inter:  10 r_0: 0.006161 r_1: 0.006163 Dem: -0.339060751860335
Inter:  11 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  12 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
Inter:  13 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
Inter:  14 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  15 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  16 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
Inter:  17 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  18 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
Inter:  19 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  20 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
Inter:  21 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  22 r_0: 0.006163 r_1: 0.006163 Dem: -0.339060751860335
Inter:  23 r_0: 0.006163 r_1: 0.006163 Dem: 0.036345050466770
```

```
% Limpa variaveis nao utilizadas
clear nIntLimit r_old
```

GRAFICO DA FUNCAO POLITICA DE A_{t+1} CONTRA A_t

```
fig1 = figure();
plot(Policy.AssetDomain, Policy.AssetPrime.Values(:,1),'b-.','LineWidth',1); hold on;
plot(Policy.AssetDomain, Policy.AssetPrime.Values(:,2),'r','LineWidth',2); hold on;
plot(Policy.AssetDomain, Policy.AssetDomain,'k:','LineWidth',1); hold off;
```

```
legend({'Low Employment State','High Employment State','45-degree Ray'});
title('Household Savings Policy Function');
xlabel('$a_{i,t}$','FontSize',12,'Interpreter','latex');
ylabel('$a_{i,t+1}$','FontSize',12,'Interpreter','latex');
```



SIMULACAO DE LIFE HISTORY

define uma funcao que indica, dado um valor de asset, qual o valor do grid que mais se aproxima do valor informado. Em outras palavras informa aonde um valor fornecido estaria no grid.

```
Policy.AssetIndexFunction = @(value) round((value-Policy.AssetDomain(1))/(Policy.AssetDomain(2

% Total de simulacoes
Simulation.N = 10000;

% Nivel inicial de ativos
asset_0 = 0;

% Estado inicial: Empregado.
Simulation.S0 = 1;
Simulation.Wage = 1;

% Inicializa os vetores da simulacao.
Simulation.Asset = nan(Simulation.N,1);
Simulation.AssetIndex = nan(Simulation.N,1);
Simulation.Consumption = nan(Simulation.N,1);
Simulation.Investment = nan(Simulation.N,1);
```

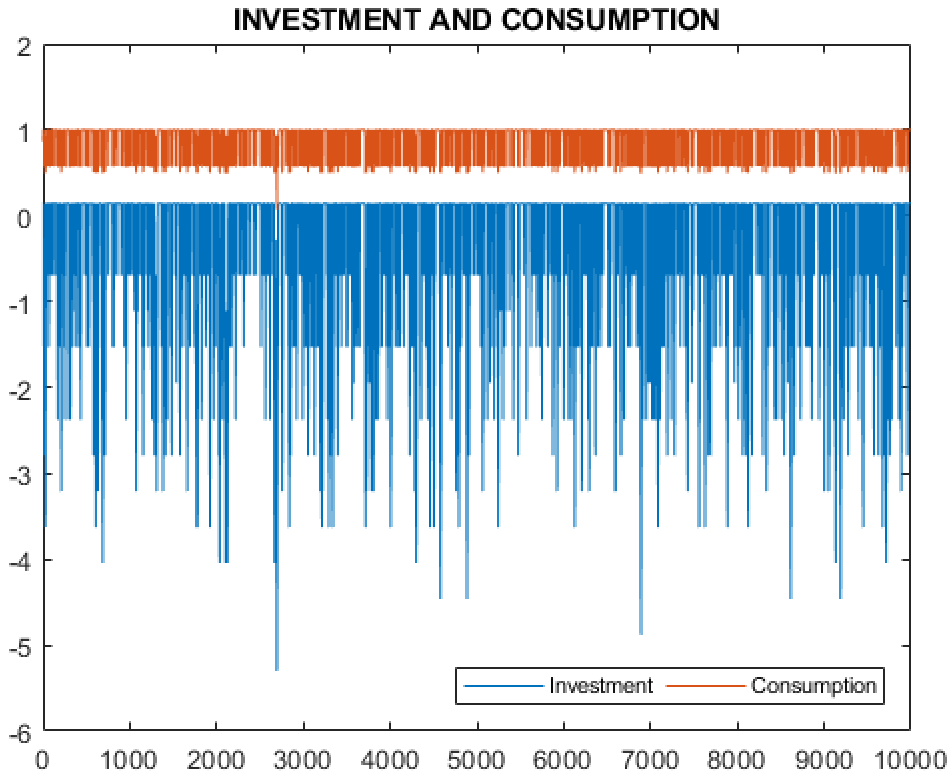
```
Simulation.LaborIncome = nan(Simulation.N,1);
Simulation.AssetIncome = nan(Simulation.N,1);
Simulation.Shock = nan(Simulation.N,1);

% Gera uma cadeia de choques no salario
[stateValue, stateIndex] = MarkovSimulation(Income.PI, Simulation.N, Income.Values, Simulation

for i = 1:Simulation.N
    % pega o estado do choque.
    Simulation.Asset(i) = asset_0;
    Simulation.AssetIndex(i) = Policy.AssetIndexFunction(asset_0);

    Simulation.Shock(i) = stateValue(i);

    % determina o investimento baseado no estado atual (asset\capital e
    % choque)
    Simulation.Investment(i) = Policy.AssetPrime.Values(Simulation.AssetIndex(i), stateIndex(

    % Determina a renda proveniente do trabalho
    Simulation.LaborIncome(i) = Simulation.Wage*stateValue(i);

    % Determina a renda proveniente do rendimento dos assets
    Simulation.AssetIncome(i) = (1 + Econom_param.r)*Simulation.Asset(i);

    % Determina o consumo pela equacao de equilibrio
    Simulation.Consumption(i) = Simulation.AssetIncome(i) + Simulation.LaborIncome(i) - Simula

    % Atualiza o asset
    asset_0 = Simulation.Investment(i);
end
fprintf('DONE\n');
```

```
DONE
```

GRAFICOS

Grafico de investimento vs consumo

```
x = 1:Simulation.N;
plot(x, Simulation.Investment, x, Simulation.Consumption);
title('INVESTMENT AND CONSUMPTION');
legend({'Investment','Consumption'},'FontSize', 8, 'Location','southeast', 'Orientation','Hor
```



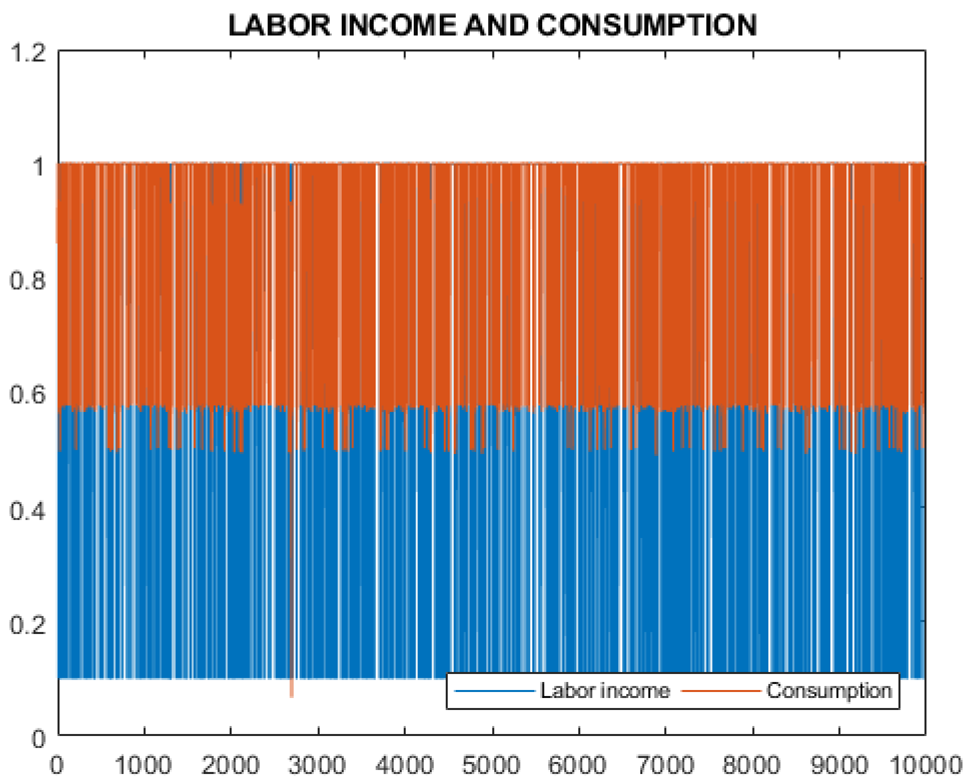
Covariancia de consumo e investimento

```
cov(Simulation.Consumption,Simulation.Investment)
```

```
ans =
    0.0344    0.0954
    0.0954    0.7458
```

Grafico de renda vs consumo

```
figure
plot(x, Simulation.LaborIncome, x, Simulation.Consumption);
title('LABOR INCOME AND CONSUMPTION');
legend({'Labor income','Consumption'},'FontSize', 8, 'Location','southeast', 'Orientation','Ho
```



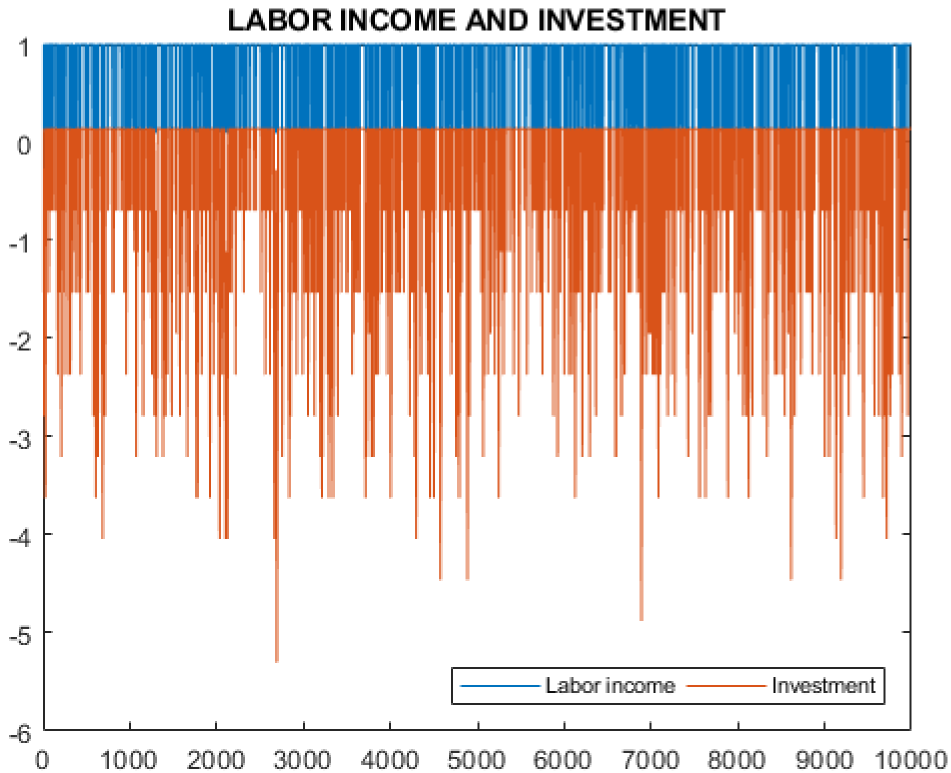
Covariancia de renda e consumo

```
cov(Simulation.LaborIncome, Simulation.Consumption)
```

```
ans =
    0.0891    0.0031
    0.0031    0.0344
```

Grafico de renda vs investimento

```
figure
plot(x, Simulation.LaborIncome, x, Simulation.Investment);
title('LABOR INCOME AND INVESTMENT');
legend({'Labor income','Investment'},'FontSize', 8, 'Location','southeast', 'Orientation','Hor
```



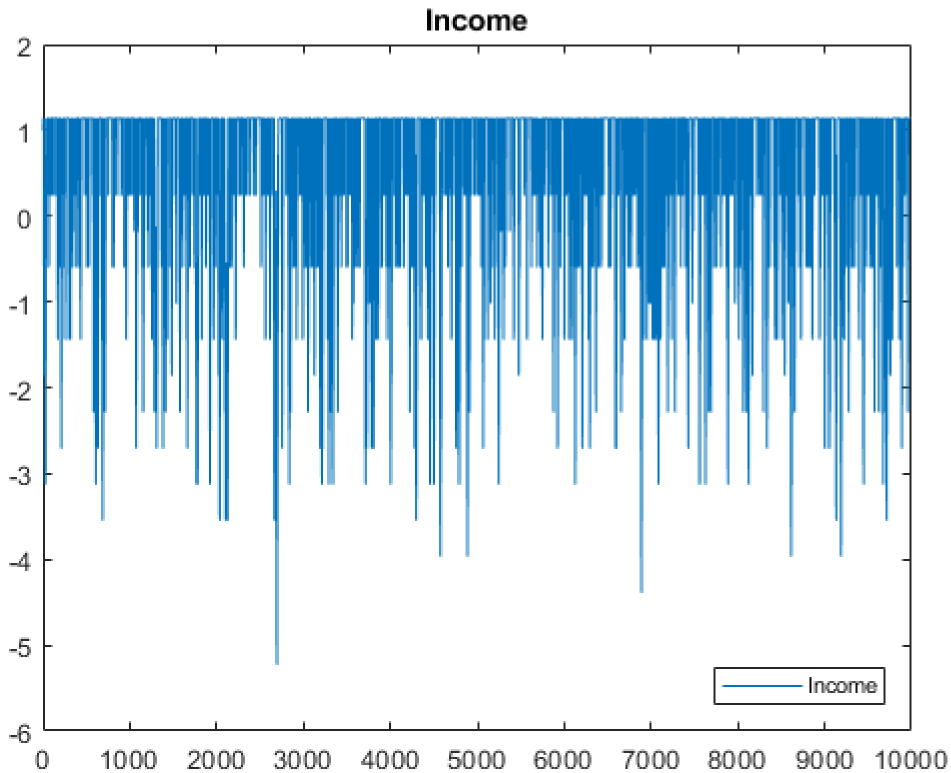
Covariancia de renda e investimento

```
cov(Simulation.LaborIncome, Simulation.Investment)
```

```
ans =
    0.0891    0.1495
    0.1495    0.7458
```

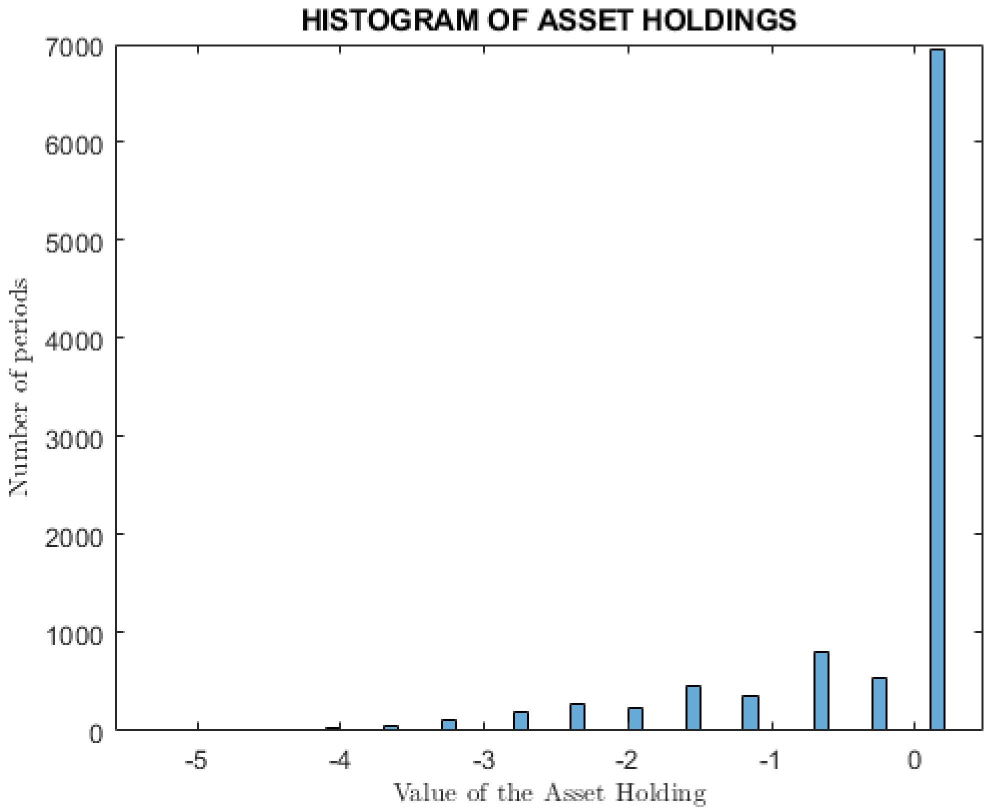
Grafico de riqueza total

```
figure
plot(x, Simulation.LaborIncome + Simulation.AssetIncome);
title('Income');
legend({'Income'},'FontSize', 8, 'Location','southeast', 'Orientation','Horizontal');
```



Histograma de ativos

```
figure
histogram(Simulation.Investment)
title('HISTOGRAM OF ASSET HOLDINGS')
xlabel('Value of the Asset Holding','FontSize',10,'Interpreter','latex');
ylabel('Number of periods','FontSize',10,'Interpreter','latex')
```




```
% limpa variaveis
clear x
```

CALCULO DOS VALORES EXPERADOS

average value of asset holdings

```
mean(Simulation.Asset)
```

```
ans = -0.3163
```

Average decline in consumption in response to entering unemployment

```
Delta.Consumption = Simulation.Consumption(2:end) - Simulation.Consumption(1:end-1);
Delta.Shock =  Simulation.Shock(2:end) - Simulation.Shock(1:end-1);
mean(Delta.Consumption(Delta.Shock < 0))
```

```
ans = 0.0318
```

```
clear Delta
```

Average consumption conditional on (i) employed; (ii) unemployed; (iii) unemployed for the last 12 months.

```
mean(Simulation.Consumption(Simulation.Shock==1))
```

```
ans = 0.8888
```

```
mean(Simulation.Consumption(Simulation.Shock==0.1))
```

```
ans = 0.8573
```

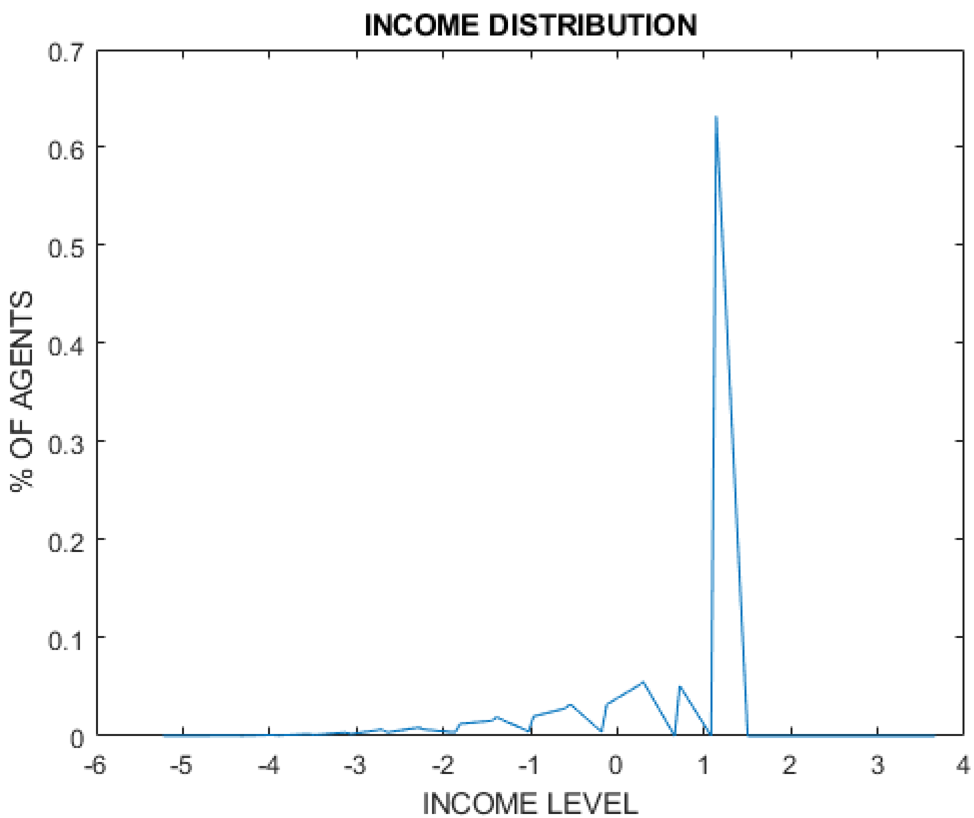
```
A = (Simulation.Shock==0.1)';
B = [1 1 1 1 1 1];
Unemployed6m = strfind(A,B)';

Consumption6Months = 0;
TotalPeriods = size(Unemployed6m,1);
for i=1:TotalPeriods
    Consumption6Months = Consumption6Months + mean(Simulation.Consumption(Unemployed6m(i):Uner
end
Consumption6Months/TotalPeriods
```

```
ans = 0.6358
```

```
clear A B Consumption6Months TotalPeriods Unemployed6m
```

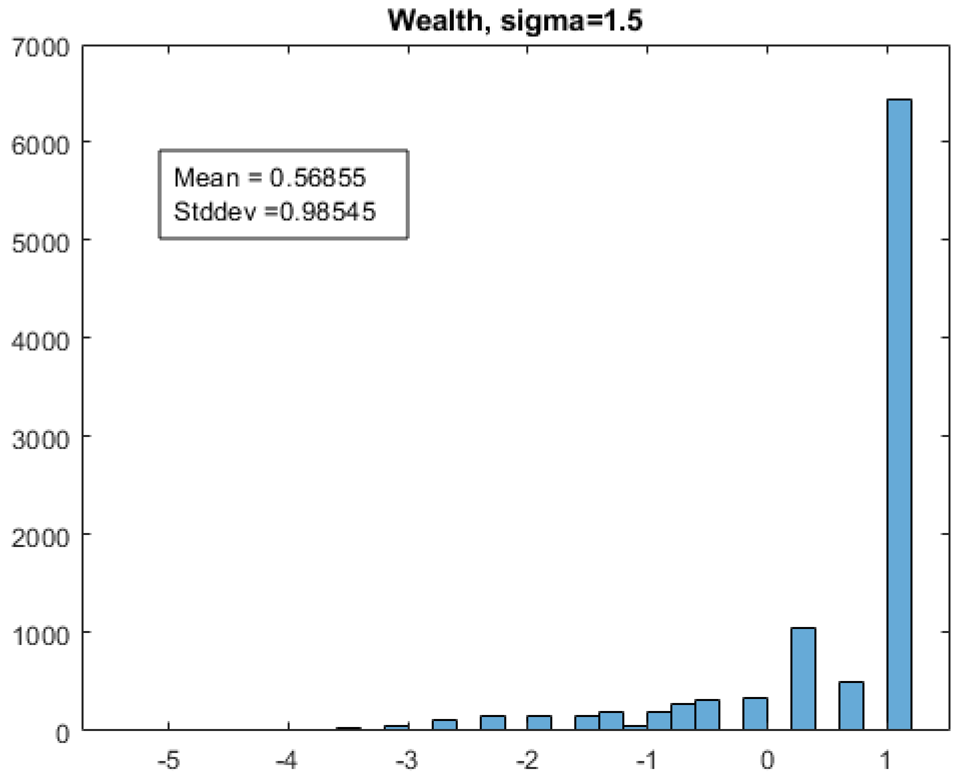
%% INCOME DISTRIBUTION

```
Total_Income =  ((1+Econom_param.r)*Asset.Values)'*ones(1,Income.Grid.N) + ones(1,Asset.Grid.N
[sortedIncome, index] = sort(Total_Income(:));
lambda_aux = Lambda(:);

figure
plot(sortedIncome, lambda_aux(index));
title('INCOME DISTRIBUTION');
xlabel('INCOME LEVEL');
ylabel('% OF AGENTS');
```



STANDARD MEASURES FOR WEALTH DISPERSION

```
mean_w = mean(Simulation.AssetIncome+Simulation.LaborIncome);
stdr_w = std(Simulation.AssetIncome+Simulation.LaborIncome);

figure
histogram(Simulation.AssetIncome+Simulation.LaborIncome);
annotation('textbox',[.2 .3 .4 .5],...
    'String',{['Mean = ' num2str(mean_w)],['Stddev =' num2str(stdr_w)]},...
'FitBoxtoText','on');
title(sprintf('Wealth, sigma=%1.1f',Econom_param.Sigma));
```


Wealth, sigma=1.5
Mean = 0.56855
Stddev =0.98545
7000
6000
5000
4000
3000
2000
1000
0
-5
-4
-3
-2
-1
0
1