

```
function Ch16
% This program computes the steady state of our model with capital and
% linear taxes. The code examines the impact of changing the tax rate on
% labor and capital.

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Parameters %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

gama = 0.5; % Frisch elasticity (1/gama) parameter for labor
% micro (0,0.5) macro (2,4)

g = .01; % growth rate of labor productivity

beta = 1/1.02; % discount rate given risk-free rate

alpha = 1/3; % capital's share

tau = g; % growth rate of money, inflation is 1+tau / 1+g

% Z has been normalized to 1.

delta = .08; % depreciation rate of capital

global Param

Param = [gama g beta tau alpha delta];

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

OUTCOMES = []; % setting up storage matrix

for tK = [0:.05:.80];

    for tL = [0:.05:.80];
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EQout = EQ(tK,tL,gama,g,beta,tau,alpha,delta);
OUTCOMES = [OUTCOMES; EQout']; % Eq outcomes for different taxes

end;

end;

[Y,I] = max(OUTCOMES(:,9)) % gives the maximum Government Revenue and
% the row corresonfing to that economy

OUTCOMES(I,:)

%%%%%%%%%%%% Transformation to do the mesh figures %%%%%%%%%%%%%

Labor=[];
Consumption=[];
Capital=[];
CapTax=[];
LabTax=[];
TotTax=[];
InstUtil=[];
tK = [0:.05:.80];
tL = [0:.05:.80];

for i = 1:17

    for j = 1:17

        EQout = EQ(tK(i),tL(j),gama,g,beta,tau,alpha,delta);
        OUTCOMES = [OUTCOMES; EQout']; % Eq outcomes for different taxes
        Labor(i,j)=EQout(4);
        Consumption(i,j)=EQout(5);
        Capital(i,j)=EQout(3)*EQout(4);
        CapTax(i,j)=EQout(8);
        LabTax(i,j)=EQout(7);
        TotTax(i,j)=EQout(9);
    
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        InstUtil(i,j)=log(EQout(5))-(EQout(4)^(1+gama))/(1+gama);

    end

end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Scatter Plots and Mesh Figures %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Laffer cost curves %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)
scatter3(OUTCOMES(:,1), OUTCOMES(:,2), OUTCOMES(:,7))
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('labor tax revenue')

figure(2)
mesh(tK,tL,LabTax')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('labor tax revenue')

figure(3)
scatter3(OUTCOMES(:,1), OUTCOMES(:,2), OUTCOMES(:,8))
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('capital tax revenue')

figure(4)
mesh(tK,tL,CapTax')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('capital tax revenue')

figure(5)
scatter3(OUTCOMES(:,1), OUTCOMES(:,2), OUTCOMES(:,9))
```

```
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('total tax revenue')

figure(6)
mesh(tK,tL,TotTax')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('total tax revenue')

%%%%%%%%%%%% Mesh Figures %%%%%%%%%%%%%%
%%%%%%%% Labor, Consumption and Capital %%%%%%%%%

figure(7)
mesh(tK,tL,Labor')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('Labor')

figure(8)
mesh(tK,tL,Consumption')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('Consumption')

figure(9)
mesh(tK,tL,Capital')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('Capital')

figure(10)
mesh(tK,tL,InstUtil')
xlabel('capital taxes')
ylabel('labor taxes')
zlabel('Instant Utility')
```

```
%%%%%%%%%%%%%% Efficient Taxation %%%%%%%%%%%%%%%

% Here we fix G (Government Revenue) and then solve for the taxes that
% deliver this level while giving the highest consumption.

EQout = EQ(.15, .15, gama, g, beta, tau, alpha, delta);

G = EQout(9); % total revenue

Param = [Param G]; % increase the vector of parameters to 7 elements

CASE2 = []; % allocation memory
sol = .2; % initial value for the numerical optimization
options = optimoptions('fsolve', 'Display', 'none');

for tK = [0:0.05:0.75];

    Param(8)=tK; % increase number of parameters to 8 elements

    sol = fsolve(@Rev, sol, options); % computes the tL for the exogenous tK and G

    tL = sol;

    EQout = EQ(tK, tL, gama, g, beta, tau, alpha, delta);

    CASE2 = [CASE2; EQout'];

end;

figure(11)
scatter3(CASE2(:,1), CASE2(:,2), CASE2(:,5))
xlabel('capital taxes')
ylabel('labor taxes')
```

```

xlabel('Consumption fixing Revenue')

figure(12)
scatter3(CASE2(:,1), CASE2(:,2), CASE2(:,4))
xlabel('capital taxes')
ylabel('labor taxes')
xlabel('Labor fixing Revenue')

%%%%%%%%%%%%% Adding in Waste %%%%%%%%%%%%%%

disp('          Waste Special')
disp('_____')

disp('Here is the first case with no waste')

tK = 0.15; tL = 0.15;

Wout0 = EQ(tK,tL,gama,g,beta,tau,alpha,delta);

Wout0 = [Wout0; 0]

disp(' ')

disp('Here is the second case with waste')
% Waste is 10 percent of total taxes without waste

WL = 0.1 * Wout0(9)/Wout0(4)*.99 % this is ratio waste over labor
% adjusted downwards by 0.99 since L will be higher

KL = LabCap(tK,g,beta,alpha,delta)^(-1); % capital-to-labor ratio

C = KL^alpha - (g+delta)*KL - WL; % this is normalized consumption C/L from EQ 67.

I = (g+delta)*KL; % ditto for investment

Factor = (beta/(1+tau))/C;

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    Factor = Factor*(1-tL)*(1-alpha)*KL^alpha;

Lab = Factor^(1/(1+gama)); % this is the level of labor effort.

Cons = C*Lab; % level of consumption

Inv = I*Lab; % level of output

Out = Lab*KL^alpha; % this is the level of output

LabT = (1-alpha)*tL*Out; % labor tax revenue

CapT = alpha*tK*Out; % capital tax revenue

Waste = Out - Cons -Inv

Wout1 = [tK tL KL Lab Cons Inv LabT CapT LabT+CapT Waste]';

[Wout0 Wout1]

% with waste consumption is smaller and labor larger

end % function close

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
function LK = LabCap(tK,g,beta,alpha,delta)

LK = ( (1+g)/beta -1 +delta )/(alpha*(1-tK)); % this was fixed

LK = LK ^ (1/(1-alpha)); % effective labor to capital ratio
                        % and labor to capital ratio given Z=1

end

```

```

function EQout = EQ(tK,tL,gama,g,beta,tau,alpha,delta)

KL = LabCap(tK,g,beta,alpha,delta)^(-1); % capital-to-labor ratio

C = KL^alpha - (g+delta)*KL; % this is normalized consumption C/L from EQ 67.

I = (g+delta)*KL; % ditto for investment

    Factor = (beta/(1+tau))/C;

    Factor = Factor*(1-tL)*(1-alpha)*KL^alpha;

Lab = Factor^(1/(1+gama)); % this is the level of labor effort.

Cons = C*Lab; % level of consumption

Inv = I*Lab; % level of output

Out = Cons+Inv; % this is the level of output

LabT = (1-alpha)*tL*Out; % labor tax revenue

CapT = alpha*tK*Out; % capital tax revenue

EQout = [tK tL KL Lab Cons Inv LabT CapT LabT+CapT]';

end

function REVout = Rev(tL);

global Param %Param = [gama g beta tau alpha delta]

gama = Param(1); g = Param(2); beta = Param(3); tau = Param(4);
alpha = Param(5); delta = Param(6); G = Param(7); tK = Param(8);

EQout = EQ(tK,tL,gama,g,beta,tau,alpha,delta);
%EQout = [tK tL KL Lab Cons Inv LabT CapT LabT+CapT]';

```



```
REVout = EQout(9) - G;
```

```
end
```

```
Y =
```

```
0.3502
```

```
I =
```

```
47
```

```
ans =
```

```
Columns 1 through 7
```

```
0.1000    0.6000    4.4917    0.4899    0.6102    0.1980    0.3233
```

```
Columns 8 through 9
```

```
0.0269    0.3502
```

```
Waste Special
```

```
Here is the first case with no waste
```

```
Wout0 =
```

```
0.1500
```

```
0.1500
```

```
4.1226
```

```
0.8001
```

```
0.9860
```

```
0.2969
0.1283
0.0641
0.1924
0
```

Here is the second case with waste

WL =

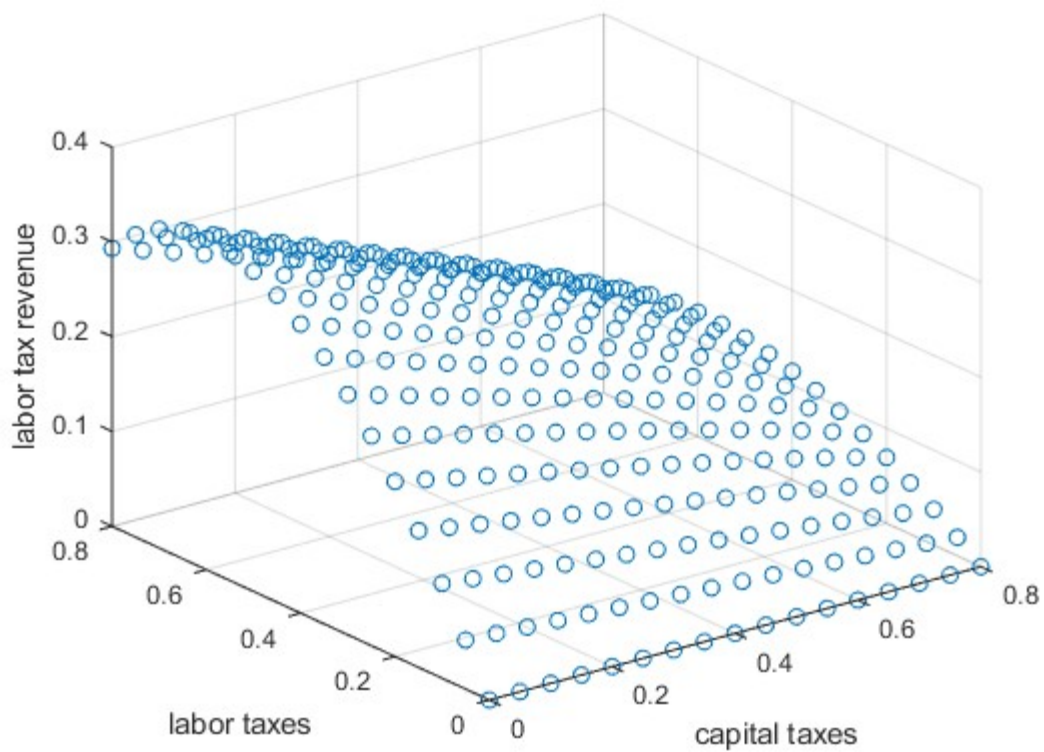
```
0.0238
```

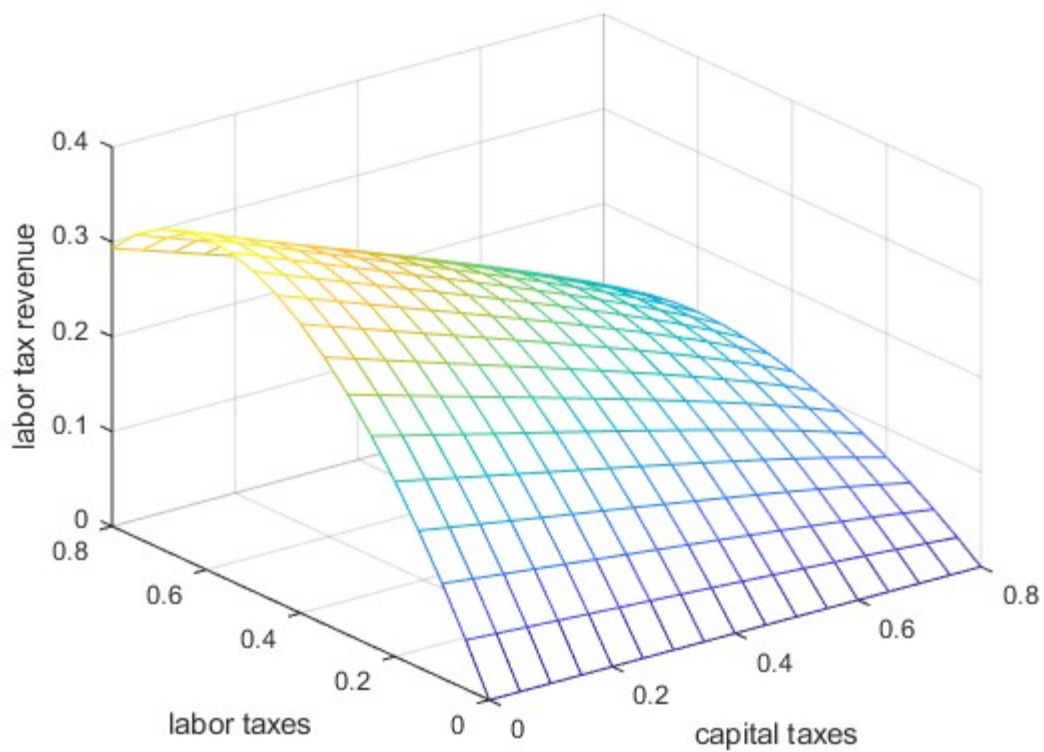
Waste =

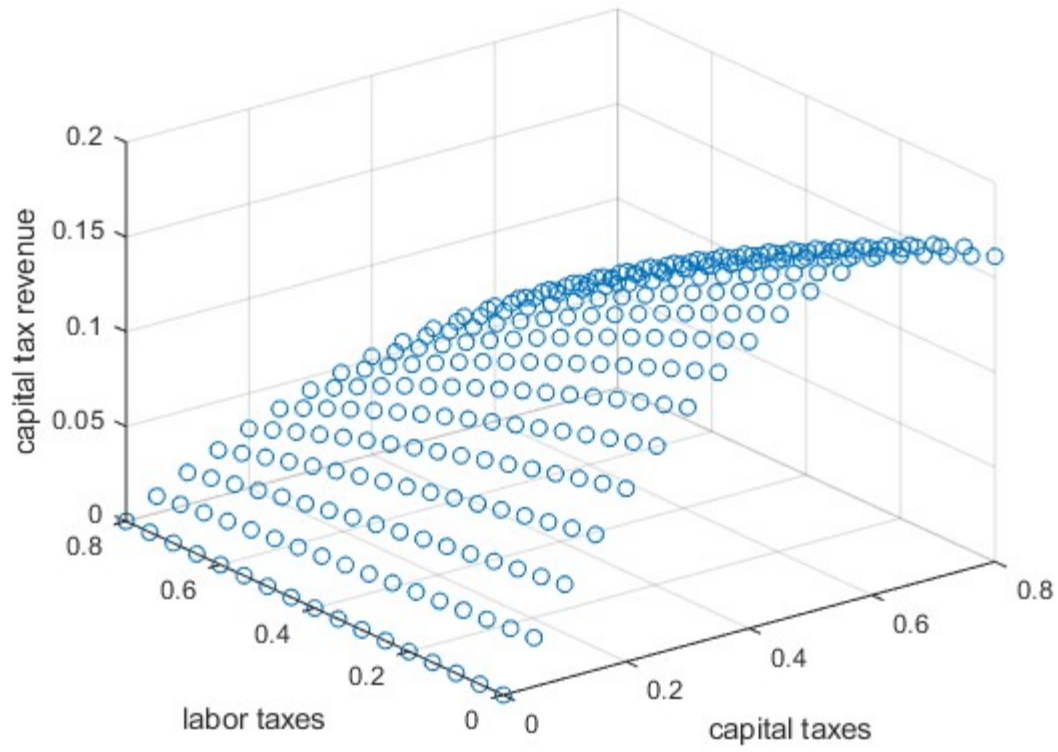
```
0.0193
```

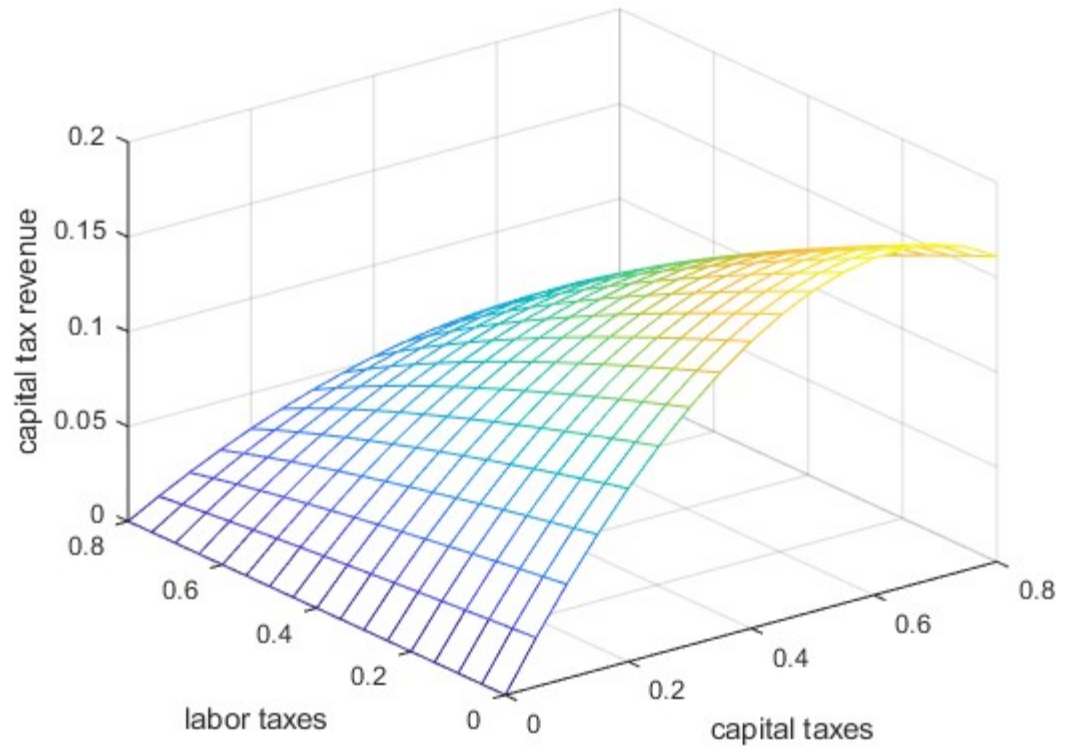
ans =

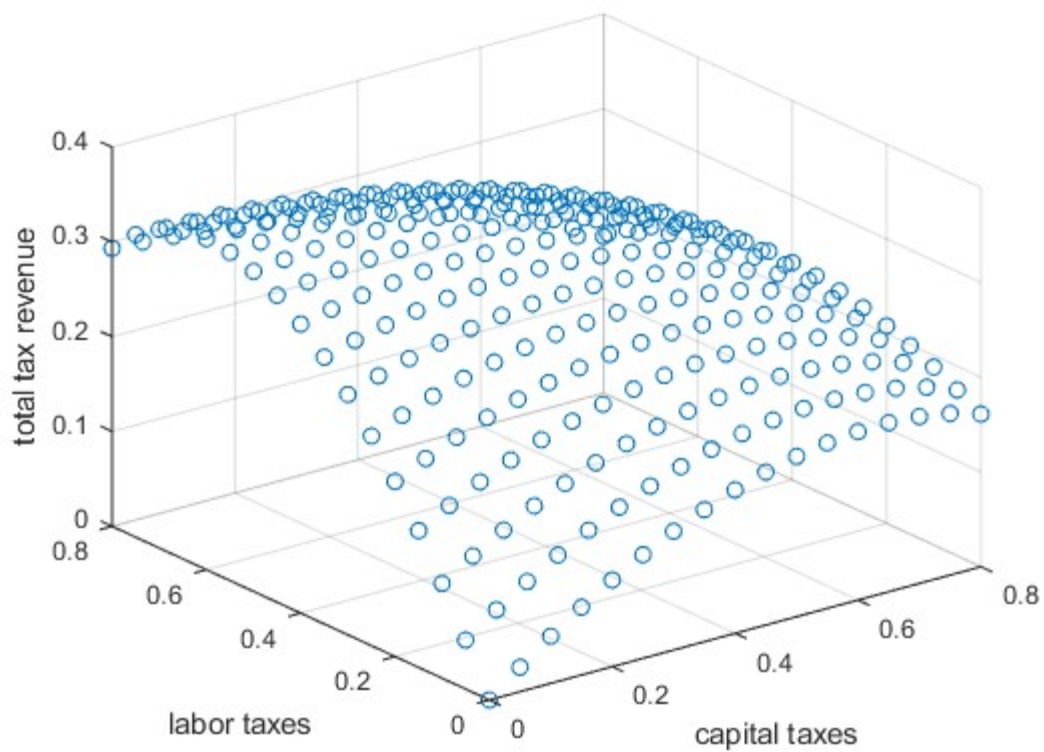
```
0.1500 0.1500
0.1500 0.1500
4.1226 4.1226
0.8001 0.8106
0.9860 0.9797
0.2969 0.3007
0.1283 0.1300
0.0641 0.0650
0.1924 0.1950
0      0.0193
```

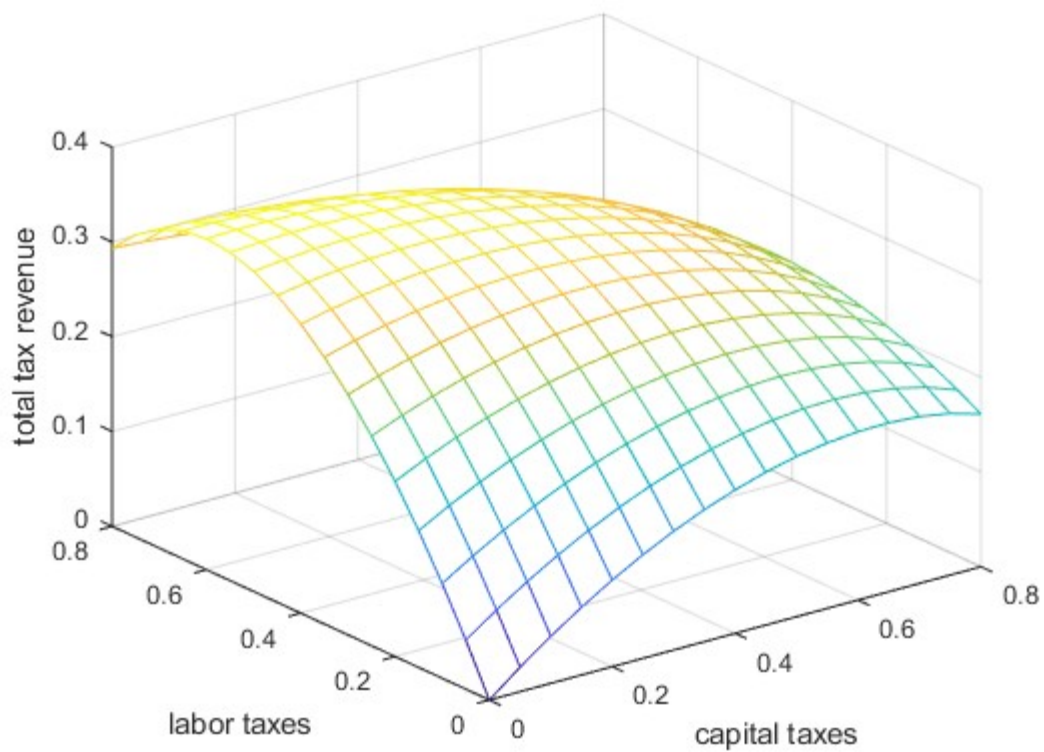


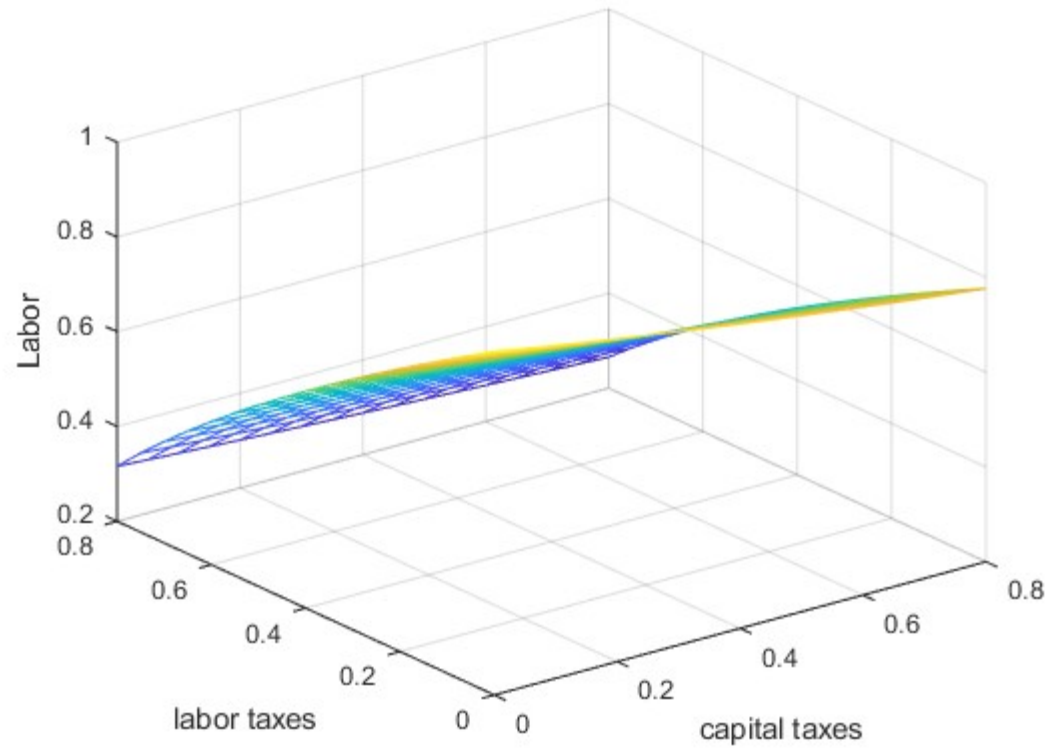


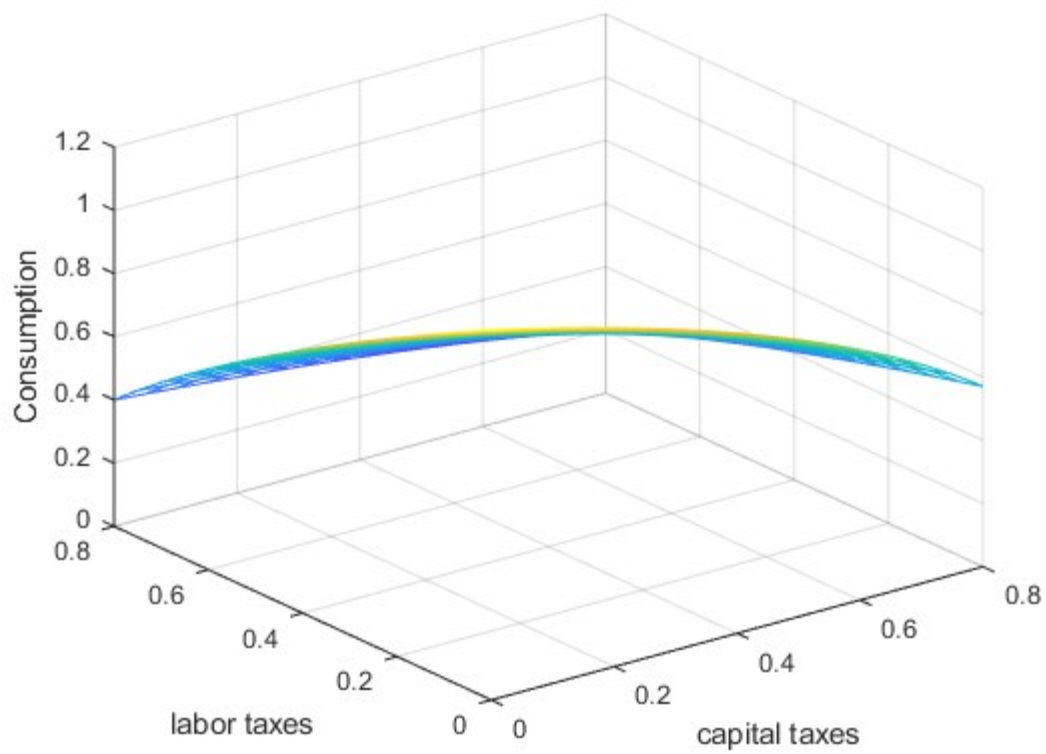


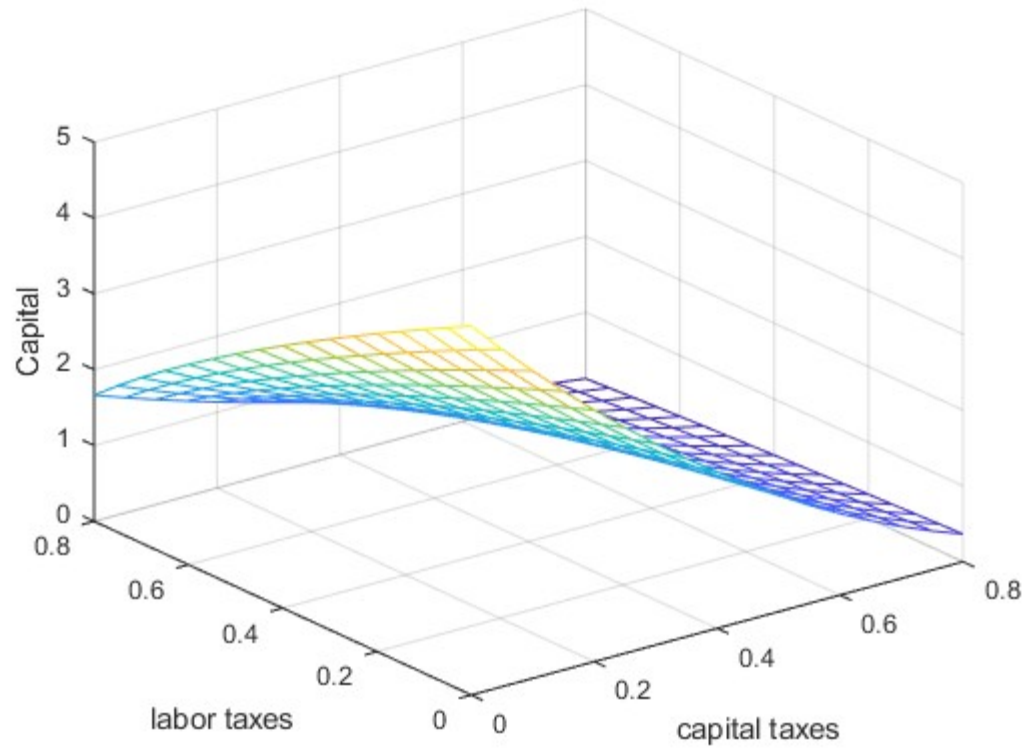


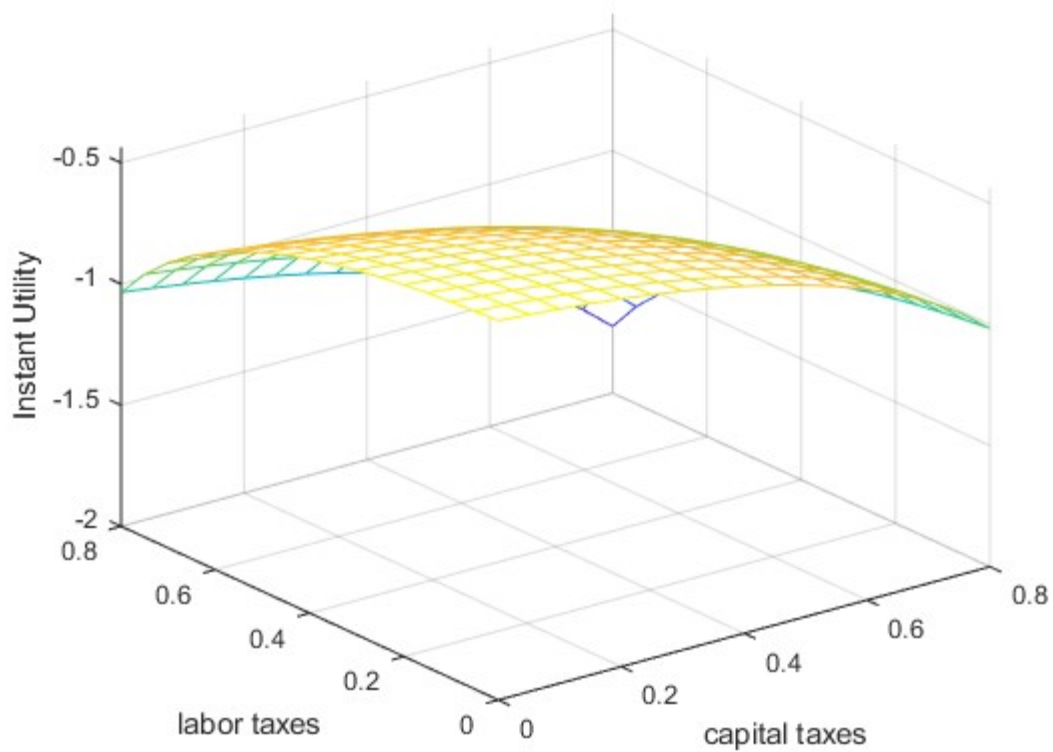


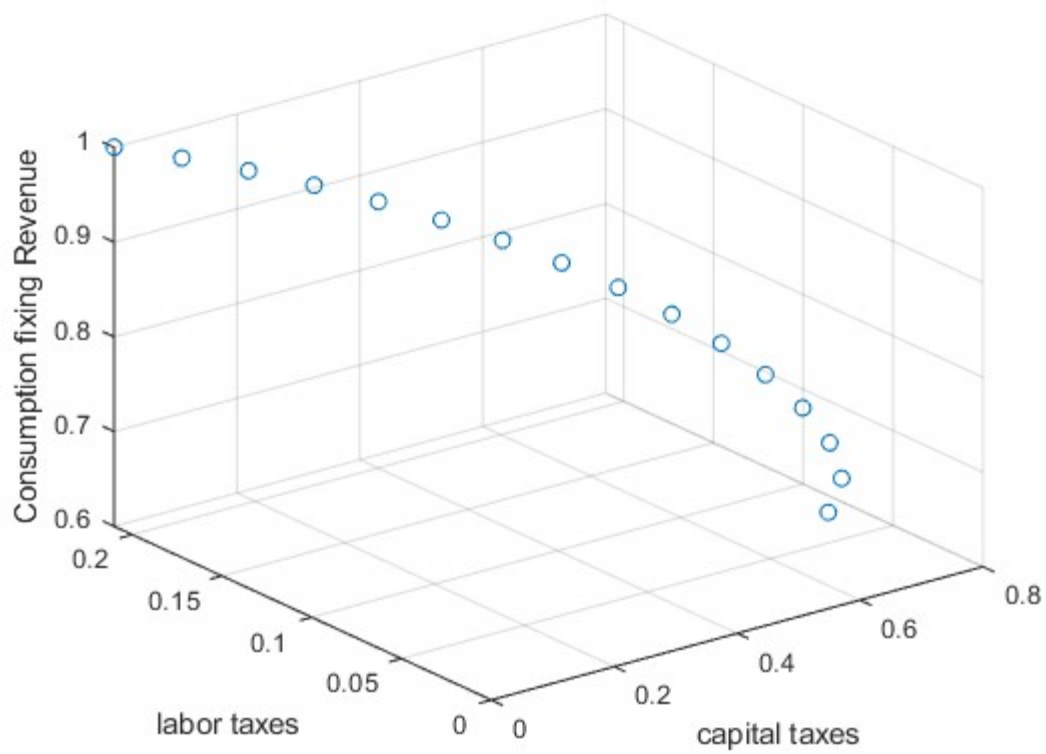


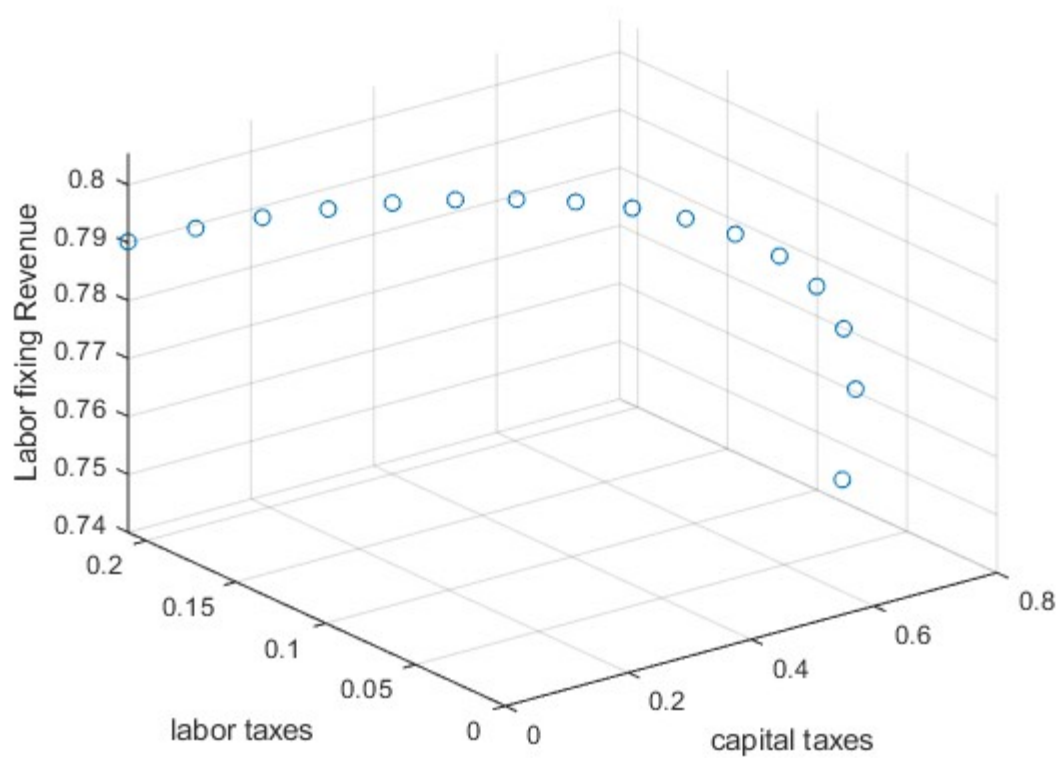












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