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%Calculates optimal taxes as described in 'Factor Income Taxation in a Horizontal
%Innovation Model' when sigma is less than one: see Tables123.m for
%detailed explanations
disp('New')
gamma=0.02;
rho=0.04;
L0=0.17;
s =0.98;
INTMratio=0.45;
a = INTMratio^0.5;
tk0=0.25;
GOVEXPToGDP = 0.1;
g = (1-INTMratio)*GOVEXPToGDP;
TranferstoGDP=0.25;
T=(1-INTMratio)*TranferstoGDP;
tw0 = -a*tk0+(g+T)/(1-a);
r=(s*gamma+rho)/(1-tk0);
C1=r/L0;
eta=a^((1+a)/(1-a))/C1;
chil=s*(s-1)*(1-L0)*(1-tw0)/a;
chi2=rho/C1+L0*(tk0-1+s/a+s-s*g/(a*(1-a)));
chi=1+chil/chi2%calculates implied chi from eq. 45
if chi>1|chi+s<1
    disp('Error: chi must be between 1-s and 1')
else
if rho/C1<((1-g)/a)^(1/(1-a))*(1-s) ; %condition (48) in prop. 9;
    disp('Error: condition for social planner violated')
else
if r*(1-tk0)<gamma% see eq.(28)
    disp('Error: TVC violated in initial equilibrium')
else
Frisch0=(1-L0)/L0/(1+(chi-1)/s)
t=0:0.00001:1;
tw=-a*t+(g+T)/(1-a);
V1=(2-s-chi)./(1-s).*(1-L)-C1*(1-t)./(C1*L.*(1-t)*(s-1)+rho);
V2=s*(s-1)*(1-L)/(1-chi)+L;
V3=(s/a)*(1-s)*(1-tw)/(1-chi)-1+t+s+(s/a)*(1-g/(1-a));
V4=a./(1-tw);
V5=-r./(r*(1-t)*(s-1)+rho);
D=V1.*V2.*V3.^(-1)+V4+V5;
plot (t,D)
[v,i]=min (abs(D));
topt=t (i)
twopt=-a*topt+(g+T)/(1-a)
if twopt<0
    disp('Error: taxes cannot be negative')
else
if (s/a)*(1-twopt)*(s-1)/(chi-1)+topt-1+s+(s/a)*(1-g/(1-a))<0
    disp('Error: indeterminacy')%from ineq.47
else
Lopt=L(i)
gammaopt=(C1*Lopt*(1-topt)-rho)/s
ropt=C1*Lopt;
if ropt*(1-t(i))<gammaopt% check TVC( ineq.28).
    disp('Error: TVC violated with optimal taxes')

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else
tw00 =(g+T)/(1-a);
L00=L(1);
gamma00=(C1*L00-rho)/s;
if L00<0
    disp('Error: labor cannot be negative')
else
if gamma00<0
    disp('Error: growth cannot be negative')
else
if C1*L00*(s-1)< -rho
    disp('Error: TVC violated with no tax on capital')%( ineq.28)
else
Wopt=(1-twopt).^ (1-s) .* (1-Lopt).^ (2-s-chi) .* (C1*Lopt*(s-1) .* (1-topt)+rho).^ (-1);
W00=(1-tw00).^ (1-s) .* (1-L00).^ (2-s-chi) .* (C1*L00*(s-1)+rho).^ (-1);
diff=(Wopt-W00)/abs(W00)
%gain in welfare from optimal ( rather than zero)capital tax
end
end
end
end
end
end
end
end
end
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