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%THIS IS FOR PRODUCTION FUNCTION CONCAVE IN LABOR
clear
disp('New')
gamma=0.02;
rho=0.04;
L0=0.17;% L0:initial labor(consistent with tk0)
s =1.5;%s: sigma in the paper
INTMratio=0.35;%INTMratio: share of intermediates in production
a = INTMratio^0.5;%alpha in the paper
sl=0.5;% labour income share sl=k/(1-a^2);
k=sl*(1-a^2);
surplus=1-a-k
ell=k/(1-a)%elasticity to labor in aggregate PF. goes up with sl
mu=1/a;%mu: mark up
tk0=0.25;% tk0: initial capital tax rate
GOVEXPtoGDP = 0.1;% share of government expenditures over GDP
g = (1-INTMratio)*GOVEXPtoGDP;
TranferstoGDP=0.25;%TranferstoGDP: share of transfers over GDP
T=(1-INTMratio)*TranferstoGDP;
tw0 = k^(-1)*(g+T -tk0*(1-k-a^2)) % from eq. E23
chi=2.0463;%benchmark
C1=0.5490;%benchmark
% next five lines calculates Lb, gammab and Frb
Lss=@(x) (1-g-a^2+k*(1-tw0)*(1-s)*(1-chi)^(-1))/(a*(1-a))-...
(1-tk0)/s-x^(-1)*k*(1-tw0)*(1-s)/((1-chi)*a*(1-a))+rho*x^(k/(a-1))/(s*C1);
x=fzero(Lss,0.17);
Ltk0=x% Lb solving B4(L)=0, when initial capital tax is 0.25
gammatk0=(C1*Ltk0^(k/(1-a))*(1-tk0)-rho)/s%gammab
Frisch0=(1-Ltk0)/Ltk0/(1+(chi-1)/s)%calculates initial Frisch.
% calculates L for each combination of taxes using B4(L)=0
L=[];
for t=0.01:0.00001:0.9;
tw = k^(-1)*(g+T -t*(1-k-a^2)); %from eq. E23
Lss=@(x) (1-g-a^2+k*(1-tw)*(1-s)*(1-chi)^(-1))/(a*(1-a))-(1-t)/s-...
x^(-1)*k*(1-tw)*(1-s)/((1-chi)*a*(1-a))+rho*x^(k/(a-1))/(s*C1);
x=fzero(Lss, 0.17);
L=[L, x];
end
% From now on calculates optimal taxes etc.
t=0.01:0.00001:0.9;
tw = k^(-1)*(g+T -t*(1-k-a^2));
r=C1*L.^(k/(1-a));
V1=L.^(-1)*(k-1+a)/(1-a)-(2-s-chi)./((1-s).*(1-L))+...
(k/(1-a))*(1-t).*C1.*L.^(k/(1-a)-1)./(r.*(1-t)*(s-1)+rho);
%V1=de(log(1-s)V)/(1-s)deL
%from here calculates V2=dL/dt from B4(L)=0
V21=(1-s)*(L-1)/((1-chi)*a);
V22=-(1-a)*L/(k*s);
V23=(1-s)*(1-tw)./(L*(1-chi)*a);
V24=-rho*L.^(k/(a-1))/(C1*s);
V6=-(-a^2-k+1)/k;%V6=dtw/dt
V2=(V21.*V6+V22)./(V23+V24);% V2=dL/dt
%from here calculates welfare effect
V4=-1./(1-tw);
V5=-r./(r.*(1-t)*(s-1)+rho);

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D=V1.*V2+V4.*V6+V5;%welfare effect: last formula on page 52.
plot (t,D)%checks its behavior
[v,i]=min (abs(D));
topt=t(i)%optimal capital tax
twopt = k^(-1)*(g+T -topt*(1-(k+a^2)))
Lopt=L(i)%optimal labor
ropt=C1*Lopt.^(k/(1-a));
gammaopt=(C1*Lopt^(k/(1-a))*(1-topt)-rho)/s%optimal growth

Wopt=((Lopt.^(k+a-1)/(1-a)).*(1-twopt)).^(1-s).*(1-Lopt).^(2-chi-s))./...
(ropt.*(1-topt)*(s-1)+rho)/(1-s);
%max welfare
tw00=(g+T)/k;% labor tax with no tax on capital
L00=L(1)%labor with no tax on capital
r00=C1*L00.^(k/(1-a));
W00=((L00.^(k+a-1)/(1-a)).*(1-tw00)).^(1-s).*(1-L00).^(2-chi-s))./...
(r00.*(s-1)+rho)/(1-s);
% welfare with zero tax on capital (bar constants)
diff=(Wopt-W00)/abs(W00)
%gain in welfare from optimal tax, starting from zero.

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