

APPENDIX G

MATLAB CODES FOR NUMERICAL EXAMPLE

Numerical Example 1

```

alpha3=0.5;
n_N=0.02;
n_S=0.04;
new_N=0.4;
new_S=0.6;
beta_S = 0.9;
beta_N = 0.8;
for alpha1 = 0.1:0.1:0.5
    for alpha2 = 0.5:0.1:0.9
        gamma=alpha1*alpha3+alpha2*(1-alpha3);
        A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
        B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
        delta_w=(1-alpha1)*(A^alpha1);
        delta_r=alpha1*A^(alpha1-1);
        phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
        optimal_p=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi)
    end
end

function
p_steadys=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi)
%gamma=alpha1*alpha3+alpha2*(1-alpha3);
%A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
%B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
%delta_w=(1-alpha1)*(A^alpha1);
%delta_r=alpha1*A^(alpha1-1);
%phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
syms p
p=solve(phi*(1+theta)*delta_w*p^((alpha2-gamma)/(alpha2-
alpha1))+phi*theta*delta_r*delta_w*p^((2*alpha2-gamma)/(alpha2-
alpha1))+theta*delta_w*p^((alpha2-1)/(alpha2-alpha1))-B);
p_steadys=double(p)

```

Numerical Example 2

```

alpha1=0.3;
alpha2=0.6;
beta_N=0.7;
beta_S=0.9;
n_N=0.02;
n_S=0.04;
new_N=0.4;
new_S=0.6;
for alpha3 = 0.1:0.1:0.9
    gamma=alpha1*alpha3+alpha2*(1-alpha3);
    A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
    B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
    delta_w=(1-alpha1)*(A^alpha1);
    delta_r=alpha1*A^(alpha1-1);
    phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
    optimal_p=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi)
end

```

```

function
p_steadys=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi)
%gamma=alpha1*alpha3+alpha2*(1-alpha3);
%A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
%B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
%delta_w=(1-alpha1)*(A^alpha1);
%delta_r=alpha1*A^(alpha1-1);
%phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
syms p
p=solve(phi*(1+theta)*delta_w*p^((alpha2-gamma)/(alpha2-
alpha1))+phi*theta*delta_r*delta_w*p^((2*alpha2-gamma)/(alpha2-
alpha1))+theta*delta_w*p^((alpha2-1)/(alpha2-alpha1))-B);
p_steadys=double(p)

```

Numerical Example 3

```

alpha1=0.2;
alpha2=0.7;
alpha3=0.5;
n_N=0.02;
n_S=0.04;
new_N=0.5;
new_S=0.5;
for beta_S = 0.5:0.1:0.9
    for beta_N = 0.3:0.1:0.7
        gamma=alpha1*alpha3+alpha2*(1-alpha3);
        A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
        B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
        delta_w=(1-alpha1)*(A^alpha1);
        delta_r=alpha1*A^(alpha1-1);
        phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
        theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
        optimal_p=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi,theta)
    end
end

function
p_steadys=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi,theta)
%gamma=alpha1*alpha3+alpha2*(1-alpha3);
%A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
%B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
%delta_w=(1-alpha1)*(A^alpha1);
%delta_r=alpha1*A^(alpha1-1);
%phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
%theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
syms p
p=solve(phi*(1+theta)*delta_w*p^((alpha2-gamma)/(alpha2-
alpha1))+phi*theta*delta_r*delta_w*p^((2*alpha2-gamma)/(alpha2-
alpha1))+theta*delta_w*p^((alpha2-1)/(alpha2-alpha1))-B);
p_steadys=double(p)

```

Numerical Example 4

```

alpha1=0.2;
alpha2=0.7;
alpha3=0.5;
new_N=0.3;
new_S=0.7;
beta_S = 0.9;
beta_N = 0.8;
for n_N=0.01:0.01:0.05
    for n_S=0.03:0.01:0.08
        gamma=alpha1*alpha3+alpha2*(1-alpha3);
        A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
        B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
        delta_w=(1-alpha1)*(A^alpha1);
        delta_r=alpha1*A^(alpha1-1);
        phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
        theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
        optimal_p=psteadys2(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi,theta)
    end
end

function
p_steadys=psteadys4(alpha1,alpha2,alpha3,beta_N,beta_S,n_N,n_S,new_N,new_S,
gamma,B,delta_w,delta_r,phi,theta)
%gamma=alpha1*alpha3+alpha2*(1-alpha3);
%A=((alpha2/alpha1)^alpha2*((1-alpha2)/(1-alpha1))^(1-alpha2))^(1/(alpha1-
alpha2));
%B=((alpha2/alpha1)^alpha1*((1-alpha2)/(1-alpha1))^(1-alpha1))^(1/(alpha1-
alpha2));
%delta_w=(1-alpha1)*(A^alpha1);
%delta_r=alpha1*A^(alpha1-1);
%phi=((1-alpha3)/alpha3)^(alpha3-1)*((B-A)/A^alpha1);
%theta=((1-beta_N)/(1-n_N)*new_N+(1-beta_S)/(1-n_S)*new_S);
syms p
p=solve(phi*(1+theta)*delta_w*p^((alpha2-gamma)/(alpha2-
alpha1))+phi*theta*delta_r*delta_w*p^((2*alpha2-gamma)/(alpha2-
alpha1))+theta*delta_w*p^((alpha2-1)/(alpha2-alpha1))-B);
p_steadys=double(p)

```