clear all

%% Life history [survival(px) fertility(mx)]

LH\_smooth = [0.878640777 0

0.975524328 0

0.958846758 0

0.981477577 0

0.985106889 0

0.988432128 0

0.991597517 0

0.992417212 0

0.992162504 0

0.991970246 0

0.99191801 0

0.99317639 0

0.99293438 0

0.993975414 0

0.993356343 0

0.993924401 0

0.991934075 0

0.991698168 0.215588864

0.991888417 0.279545281

0.992276379 0.319357721

0.990682084 0.356643651

0.990231766 0.377941045

0.988344805 0.388560008

0.986524785 0.373160653

0.986912456 0.37408373

0.987930685 0.362389637

0.989026728 0.355580113

0.99109657 0.339946585

0.991010348 0.351766369

0.991248037 0.33597045

0.991365781 0.329341609

0.991484185 0.32596534

0.98990882 0.321961915

0.990586769 0.313941598

0.988975014 0.304987517

0.987166671 0.309283579

0.985995799 0.291419246

0.98672687 0.284918725

0.988619615 0.263062881

0.989688774 0.262263331

0.988173095 0.241293889

0.990226305 0.226360516

0.987777045 0.204336283

0.985725763 0.165865105

0.984035485 0.122914654

0.987859015 0.08224026

0.985077671 0.053587395

0.987168001 0.026431301

0.982274838 0.019288444

0.981159777 0.011788444

0.979259325 0.006308992

0.978039812 0

0.97214181 0

0.9677655 0

0.970072002 0

0.970876198 0

0.970934969 0

0.974353773 0

0.96853167 0

0.957522179 0

0.952102599 0

0.948921876 0

0.945161192 0

0.952547952 0

0.942805563 0

0.943831204 0

0.924244997 0

0.915742582 0

0.903276457 0

0.907667 0

0.888000444 0];

lx(1) = 1; % survivorship ~ cumulative survival probability

lx(2:72) = cumprod(LH\_smooth(:,1)); % FIG S1C

e0 = sum(lx); % life expectancty at birth

mx = LH\_smooth(:,2) ./ 2.05; % maternity function - only counts female births (assuming SRB = 1.05)

TFR = sum(LH\_smooth(:,2)); % total fertility rate (survival-conditioned lifetime fertility)

%% Strength and Skill ontogenies (after Gurven and Kaplan 2006)

% FIG S1A

xmax = 71; % maximum age in model (70 y)

Ssc = Seq(1:xmax)./max(Seq(1:xmax)); % Strength age profile

Ksc = Keq(1:xmax)./max(Keq(1:xmax)); % Skill age profile

% Requirements for strength (a) and skill (b)

a1 = 0.1; b1 = 0.1; % a1 = 0.3; b1 = 0.1;

a2 = 0.7; b2 = 0.1; % a2 = 0.7; b2 = 0.1;

a3 = 0.1; b3 = 0.7; % a3 = 0.3; b3 = 0.7;

a4 = 0.7; b4 = 0.7; % a4 = 0.7; b4 = 0.7;

% Baseline prod under S/K

Prod\_SK = [(Ssc.^a1).\*(Ksc.^b1); % FIG S1B

(Ssc.^a2).\*(Ksc.^b2); (Ssc.^a3).\*(Ksc.^b3);(Ssc.^a4).\*(Ksc.^b4)];

% Scaled production (relative to maximum = 1)

Prod\_SK\_sc = Prod\_SK ./ repmat(max(Prod\_SK')',1,71);

% Food contribution (survival-discounted reflecting population age structure)

Px\_SK = Prod\_SK .\* repmat(lx(1:71),4,1);

Pmax\_SK = max(Prod\_SK'); % peak production

PT\_SK = sum(Px\_SK'); % total lifetime production

Px\_SK\_sc= Prod\_SK\_sc .\* repmat(lx(1:71),4,1); % scaled production (for comparison)

Pmax\_SK\_sc = max(Prod\_SK\_sc'); % peak scaled production (Px = 1)

PT\_SK\_sc = sum(Px\_SK\_sc'); % total scaled production (units = peak production-years)

% Age of peak production

for isk = 1:4

Pmax(isk) = find(Prod\_SK\_sc(isk,:)==max(Prod\_SK\_sc(isk,:)));

end

% Lifetime Production (P\_T) under different strength/skill (S/K) requirements

iis = 0.1:0.05:1.2; % varying strength/skill requirments (\alpha, \beta)

for is = 1:length(iis)

PT\_SvarH(:,is) = Ssc.^iis(is) .\* (Ksc.^0.7); % High skill, vary strength

PT\_KvarH(:,is) = Ssc.^0.7 .\* (Ksc.^iis(is)); % High strength, vary skill

PT\_SvarL(:,is) = Ssc.^iis(is) .\* (Ksc.^0.1); % Low skill, vary strength

PT\_KvarL(:,is) = Ssc.^0.1 .\* (Ksc.^iis(is)); % Low strength, vary skill

end

% Continuously varying strength/skill requirments (for illustration)

% FIG S2

isks = 0.1:0.05:1.2;

for iss = 1:length(isks)

for isk = 1:length(isks)

Px\_isks(:,iss,isk) = Ssc.^isks(iss) .\* Ksc.^isks(isk);

Px\_isks\_sc(:,iss,isk) = Px\_isks(:,iss,isk) ./ max(Px\_isks(:,iss,isk));

end

end

%% Instruction effects on skills ontogeny (x,theta,a,b,t)

bmin = 11; % Earliest teacher onset - age 10

bmax = 65; % Oldest teacher onset - age 64

amax = 31; % oldest pupil onset - age 30

tmax = 25; % longest teaching duration - 25 y

xmax = 71; % oldest age (T) - 70 y

a = 1:amax; % pupil onset

b = 1:bmax; % teacher onset

theta = 0:0.01:1; % pupil boost

phi = 0:0.01:1; % teacher handicap ~ zero at iphi = 1 (Px\* = (1-phi)\*Px);

t = 1:tmax; % Max duration (if b+t < xmax)

% Rate of learning (dK/dx)

dKdx = Ksc(2:end) - Ksc(1:end-1); % slope of skill(age)

dK\_at\_Kb = repmat(dKdx',1,101,bmax,amax,tmax); % slope of skill with only teacher skill effects

K\_at\_Kb = zeros(xmax,101,bmax,amax,tmax); % cumulative skill with only teacher skill effects

dK\_at\_Ka = repmat(dKdx',1,101,bmax,amax,tmax); % slope of skill with teacher and pupil skill effects

K\_at\_Ka = zeros(xmax,101,bmax,amax,tmax); % cumulative skill with teacher and pupil skill effects

% Pupil skills ontogeny - FIG 2

for it = 1:tmax % Duration of instruction (t)

for ia = 1:amax % Pupil age at onset (a)

for ib = a(ia):bmax % Teacher age at onset (b)

b(ib) = ib;

tK = min(length(b(ib):b(ib)+t(it))-1,length(b(ib):xmax));

if ia+tK <=xmax % Caps duration at teacher age limit (xmax = 70)

for itheta = 1:101

theta(itheta) = (itheta-1) \* 0.01; % pupil boost (multiplier on slope of skill(ag)

% baseline skills ontogeny: pupil boost(theta) discounted (~ teacher survival, teacher skill)

K\_at\_Kb(a(ia):a(ia)+tK-1,itheta,ib,ia,it) = dKdx(a(ia):a(ia)+tK-1) +...

Ksc(b(ib):b(ib)+tK-1) .\* lx(b(ib):b(ib)+tK-1) .\* theta(itheta) .\* dKdx(a(ia):a(ia)+tK-1);

% baseline skills ontogeny: pupil boost(theta) discounted (~ teacher survival, teacher skill, pupil skill)

dK\_at\_Ka(a(ia):a(ia)+tK-1,itheta,ib,ia,it) = dKdx(a(ia):a(ia)+tK-1) +...

Ksc(a(ia):a(ia)+tK-1) .\* Ksc(b(ib):b(ib)+tK-1) .\* lx(b(ib):b(ib)+tK-1) .\* theta(itheta) .\* dKdx(a(ia):a(ia)+tK-1);

end

end

end

end

end

% Cumulative skill at each age assuming only teacher skill effects

K\_at\_Kb(2:xmax,:,:,:,:) = cumsum(dK\_at\_Kb(1:xmax-1,:,:,:,:)); % Cumulative skills ontogeny

K\_at\_Kb(K\_at\_Kb>1) = 1; % Cap K at 100% baseline max

K\_at\_Kb(59:xmax,:,:,:,:) = repmat(Ksc(59:end)',1,101,bmax,amax,tmax); % K after b at baseline

% Cumulative skill at each age assuming teacher and pupil skill effects

K\_at\_Ka(2:xmax,:,:,:,:) = cumsum(dK\_at\_Ka(1:xmax-1,:,:,:,:)); % Cumulative skills ontogeny

K\_at\_Ka(K\_at\_Ka>1) = 1; % Cap K at 100% baseline max

K\_at\_Ka(59:xmax,:,:,:,:) = repmat(Ksc(59:end)',1,101,bmax,amax,tmax); % K after b at baseline

% Benefit of pedagogy for skills ontogeny

Kb\_diff = K\_at\_Kb - repmat(Ksc',1,101,bmax,amax,tmax);

Ka\_diff = K\_at\_Ka - repmat(Ksc',1,101,bmax,amax,tmax);

% Age at mastery (min age s.t. Kx = max(Kx)) % FIG S3

for it = 1:tmax

for ia = 1:amax

for ib = bmin:bmax

for itheta = 1:101

xKmax\_b(itheta,ib,ia,it) = min(find(K\_at\_Kb(:,itheta,ib,ia,it)==1)); % teacher skill effects

xKmax\_a(itheta,ib,ia,it) = min(find(K\_at\_Ka(:,itheta,ib,ia,it)==1)); % teacher and pupil skill effects

end

end

end

end

% Optimal teacher age for pupil skills ontogeny (\*NOT\* acccounting for production tradeoffs) - FIG S4

bopt\_Kb = zeros(101,amax,tmax);

bopt\_Ka = zeros(101,amax,tmax);

for itheta = 2:101

for it = 1:tmax

for ia = 1:amax

% teacher skill effects

dummy\_bopt = find(squeeze(xKmax\_b(itheta,ib,:,it))==min(squeeze(xKmax\_b(itheta,ib,:,it))));

bopt\_Kb1(itheta,ia,it) = min(find(squeeze(xKmax\_b(itheta,:,ia,it))==min(squeeze(xKmax\_b(itheta,:,ia,it)))));

bopt\_Kb2(itheta,ia,it) = max(find(squeeze(xKmax\_b(itheta,:,ia,it))==min(squeeze(xKmax\_b(itheta,:,ia,it)))));

% teacher and pupil skill effects

dummy\_bopt = find(squeeze(xKmax\_a(itheta,ib,:,it))==min(squeeze(xKmax\_a(itheta,ib,:,it))));

bopt\_Ka1(itheta,ia,it) = min(find(squeeze(xKmax\_a(itheta,:,ia,it))==min(squeeze(xKmax\_a(itheta,:,ia,it)))));

bopt\_Ka2(itheta,ia,it) = max(find(squeeze(xKmax\_a(itheta,:,ia,it))==min(squeeze(xKmax\_a(itheta,:,ia,it)))));

end

end

end

save Instruction\_setup\_Kab % save results

save Instruction\_setup\_2 K\_at\_Kb K\_at\_Kb -v7.3 % save skills matrix (large memory requirement)

save Instruction\_setup\_2\_K\_at\_Ka K\_at\_Ka -v7.3 % save skills matrix (large memory requirement)

%% Lifetime production with teacher skill effect on pedagogy (no student skill effect)

% FIGS 3,4,S5,S6

% Teacher handicap

phi = 0.01\*[1:101]-0.01;

% Pupil boost

theta = phi;

% Age at onset for teacher (b) and pupil (a)

b = 1:bmax; a = 1:amax;

% Low Strength (S), Low Skill (K)

PT\_matLL\_Kb = zeros(length(phi),length(theta),length(b),length(a));

t = 1:25;it = 10; % assuming 10y instruction for illustration

alpha1 = 0.1; beta1 = 0.1; % strength(alpha1) and skill (beta1) requirements

Kx\_mat = K\_at\_Kb .^ beta1; % Skill effect on production

for iphi = 1:length(phi) % Teacher handicap (proportion of baseline teacher production)

for itheta = 1:length(theta) % Pupil boost (multiplier on slope of skill(age))

for ib = bmin:bmax % Teacher age at onset (b)

for ia = 1:amax % Pupil age at onset (a)

q = ib-ia; % age difference (teacher - pupil)

d(ia,ib,itheta,it) = min(t(it),xKmax\_b(itheta,ib,ia,it)-a(ia));

% Production without teacher handicap

Px\_mat(1:b(ib)-1) = lx(1:b(ib)-1) .\* (Ssc(1:b(ib)-1).^alpha1) .\*...

(Kx\_mat(1:b(ib)-1,itheta,ib,ia,it))';

% Production with teacher handicap

Px\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) = (1-phi(iphi)) .\* lx(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) .\*...

Ssc(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)).^alpha1 .\*...

Kx\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax),itheta,ib,ia,it)'.^beta1;

% Residual boost ~ Teaching ends when pupil attains mastery at xKmax

if b(ib)+d(ia,ib,itheta)+1 < xmax

Px\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax) = lx(b(ib)+d(ia,ib,itheta,it)+1:xmax) .\* (Ssc(b(ib)+d(ia,ib,itheta,it)+1:xmax).^alpha1) .\*...

(Kx\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax,itheta,ib,ia,it))';

else

end

% Lifetime production (survival-discounted ~ age structure of food contributions

PT\_matLL\_Kb(iphi,itheta,ib,ia) = sum(Px\_mat);

end

end

end

end

save PxLL\_Kb PT\_matLL\_Kb -v7.3

% clear PT\_matLL\_Kb Kx\_mat

% High Strength (S), Low Skill (K)

PT\_matHL\_Kb = zeros(length(phi),length(theta),length(b),length(a));

t = 1:25;it = 10; % assuming 10y instruction for illustration

alpha1 = 0.7; beta1 = 0.1; % strength(alpha1) and skill (beta1) requirements

Kx\_mat = K\_at\_Kb .^ beta1; % Skill effect on production

for iphi = 1:length(phi) % Teacher handicap (proportion of baseline teacher production)

for itheta = 1:length(theta) % Pupil boost (multiplier on slope of skill(age))

for ib = bmin:bmax % Teacher age at onset (b)

for ia = 1:amax % Pupil age at onset (a)

q = ib-ia; % age difference (teacher - pupil)

d(ia,ib,itheta,it) = min(t(it),xKmax\_b(itheta,ib,ia,it)-a(ia));

% Production without teacher handicap

Px\_mat(1:b(ib)-1) = lx(1:b(ib)-1) .\* (Ssc(1:b(ib)-1).^alpha1) .\*...

(Kx\_mat(1:b(ib)-1,itheta,ib,ia,it))';

% Production with teacher handicap

Px\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) = (1-phi(iphi)) .\* lx(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) .\*...

Ssc(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)).^alpha1 .\*...

Kx\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax),itheta,ib,ia,it)'.^beta1;

% Residual boost ~ Teaching ends when pupil attains mastery at xKmax

if b(ib)+d(ia,ib,itheta)+1 < xmax

Px\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax) = lx(b(ib)+d(ia,ib,itheta,it)+1:xmax) .\* (Ssc(b(ib)+d(ia,ib,itheta,it)+1:xmax).^alpha1) .\*...

(Kx\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax,itheta,ib,ia,it))';

else

end

% Lifetime production (survival-discounted ~ age structure of food contributions

PT\_matHL\_Kb(iphi,itheta,ib,ia) = sum(Px\_mat);

end

end

end

end

save PxHL\_Kb PT\_matHL\_Kb -v7.3

% clear PT\_matHL\_Kb Kx\_mat

% Low Strength (S), High Skill (K)

PT\_matLH\_Kb = zeros(length(phi),length(theta),length(b),length(a));

t = 1:25;it = 10; % assuming 10y instruction for illustration

alpha1 = 0.1; beta1 = 0.7; % strength(alpha1) and skill (beta1) requirements

Kx\_mat = K\_at\_Kb .^ beta1; % Skill effect on production

for iphi = 1:length(phi) % Teacher handicap (proportion of baseline teacher production)

for itheta = 1:length(theta) % Pupil boost (multiplier on slope of skill(age))

for ib = bmin:bmax % Teacher age at onset (b)

for ia = 1:amax % Pupil age at onset (a)

q = ib-ia; % age difference (teacher - pupil)

d(ia,ib,itheta,it) = min(t(it),xKmax\_b(itheta,ib,ia,it)-a(ia));

% Production without teacher handicap

Px\_mat(1:b(ib)-1) = lx(1:b(ib)-1) .\* (Ssc(1:b(ib)-1).^alpha1) .\*...

(Kx\_mat(1:b(ib)-1,itheta,ib,ia,it))';

% Production with teacher handicap

Px\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) = (1-phi(iphi)) .\* lx(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) .\*...

Ssc(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)).^alpha1 .\*...

Kx\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax),itheta,ib,ia,it)'.^beta1;

% Residual boost ~ Teaching ends when pupil attains mastery at xKmax

if b(ib)+d(ia,ib,itheta)+1 < xmax

Px\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax) = lx(b(ib)+d(ia,ib,itheta,it)+1:xmax) .\* (Ssc(b(ib)+d(ia,ib,itheta,it)+1:xmax).^alpha1) .\*...

(Kx\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax,itheta,ib,ia,it))';

else

end

% Lifetime production (survival-discounted ~ age structure of food contributions

PT\_matLH\_Kb(iphi,itheta,ib,ia) = sum(Px\_mat);

end

end

end

end

save PxLH\_Kb PT\_matLH\_Kb -v7.3

% clear PT\_matLH\_Kb Kx\_mat

% High Strength (S), High Skill (K)

PT\_matHH\_Kb = zeros(length(phi),length(theta),length(b),length(a));

t = 1:25;it = 10; % assuming 10y instruction for illustration

alpha1 = 0.7; beta1 = 0.7; % strength(alpha1) and skill (beta1) requirements

Kx\_mat = K\_at\_Kb .^ beta1; % Skill effect on production

for iphi = 1:length(phi) % Teacher handicap (proportion of baseline teacher production)

for itheta = 1:length(theta) % Pupil boost (multiplier on slope of skill(age))

for ib = bmin:bmax % Teacher age at onset (b)

for ia = 1:amax % Pupil age at onset (a)

q = ib-ia; % age difference (teacher - pupil)

d(ia,ib,itheta,it) = min(t(it),xKmax\_b(itheta,ib,ia,it)-a(ia));

% Production without teacher handicap

Px\_mat(1:b(ib)-1) = lx(1:b(ib)-1) .\* (Ssc(1:b(ib)-1).^alpha1) .\*...

(Kx\_mat(1:b(ib)-1,itheta,ib,ia,it))';

% Production with teacher handicap

Px\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) = (1-phi(iphi)) .\* lx(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)) .\*...

Ssc(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax)).^alpha1 .\*...

Kx\_mat(b(ib):min(b(ib)+d(ia,ib,itheta,it),xmax),itheta,ib,ia,it)'.^beta1;

% Residual boost ~ Teaching ends when pupil attains mastery at xKmax

if b(ib)+d(ia,ib,itheta)+1 < xmax

Px\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax) = lx(b(ib)+d(ia,ib,itheta,it)+1:xmax) .\* (Ssc(b(ib)+d(ia,ib,itheta,it)+1:xmax).^alpha1) .\*...

(Kx\_mat(b(ib)+d(ia,ib,itheta,it)+1:xmax,itheta,ib,ia,it))';

else

end

% Lifetime production (survival-discounted ~ age structure of food contributions

PT\_matHH\_Kb(iphi,itheta,ib,ia) = sum(Px\_mat);

end

end

end

end

save PxHH\_Kb PT\_matHH\_Kb -v7.3

% clear PT\_matHH\_Kb Kx\_mat

%% Optimal teacher age (\*CONSIDERING\* teacher production effects)

% with only teacher age effects on skills ontogeny

load PxLL\_Kb PT\_matLL\_Kb

isk = 1;

bopt\_LL\_Kb = zeros(length(phi),length(theta),length(a));

for iphi = 1:length(phi)-1

for itheta = 2:length(theta)

for ia = 1:length(a)

if max(PT\_matLL\_Kb(iphi,itheta,ia:bmax,ia)) > PT\_SK(isk)

bmin\_LL\_Kb(iphi,itheta,ia) = min(find(PT\_matLL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bmax\_LL\_Kb(iphi,itheta,ia) = max(find(PT\_matLL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bopt\_LL\_Kb(iphi,itheta,ia) = find(PT\_matLL\_Kb(iphi,itheta,ia:bmax,ia)==max(PT\_matLL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

else

bmin\_LL\_Kb(iphi,itheta,ia) = NaN;

bmax\_LL\_Kb(iphi,itheta,ia) = NaN;

bopt\_LL\_Kb(iphi,itheta,ia) = NaN;

end

end

end

end

load PxHL\_Kb PT\_matHL\_Kb

isk = 2;

bopt\_HL\_Kb = zeros(length(phi),length(theta),length(a));

for iphi = 1:length(phi)-1

for itheta = 2:length(theta)

for ia = 1:length(a)

if max(PT\_matHL\_Kb(iphi,itheta,ia:bmax,ia)) > PT\_SK(isk)

bmin\_HL\_Kb(iphi,itheta,ia) = min(find(PT\_matHL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bmax\_HL\_Kb(iphi,itheta,ia) = max(find(PT\_matHL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bopt\_HL\_Kb(iphi,itheta,ia) = find(PT\_matHL\_Kb(iphi,itheta,ia:bmax,ia)==max(PT\_matHL\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

else

bmin\_HL\_Kb(iphi,itheta,ia) = NaN;

bmax\_HL\_Kb(iphi,itheta,ia) = NaN;

bopt\_HL\_Kb(iphi,itheta,ia) = NaN;

end

end

end

end

load PxLH\_Kb PT\_matLH\_Kb

isk = 3;

bopt\_LH\_Kb = zeros(length(phi),length(theta),length(a));

for iphi = 1:length(phi)-1

for itheta = 2:length(theta)

for ia = 1:length(a)

if max(PT\_matLH\_Kb(iphi,itheta,ia:bmax,ia)) > PT\_SK(isk)

bmin\_LH\_Kb(iphi,itheta,ia) = min(find(PT\_matLH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bmax\_LH\_Kb(iphi,itheta,ia) = max(find(PT\_matLH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bopt\_LH\_Kb(iphi,itheta,ia) = find(PT\_matLH\_Kb(iphi,itheta,ia:bmax,ia)==max(PT\_matLH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

else

bmin\_LH\_Kb(iphi,itheta,ia) = NaN;

bmax\_LH\_Kb(iphi,itheta,ia) = NaN;

bopt\_LH\_Kb(iphi,itheta,ia) = NaN;

end

end

end

end

load PxHH\_Kb PT\_matHH\_Kb

isk = 4;

bopt\_HH\_Kb = zeros(length(phi),length(theta),length(a));

for iphi = 1:length(phi)-1

for itheta = 2:length(theta)

for ia = 1:length(a)

if max(PT\_matHH\_Kb(iphi,itheta,ia:bmax,ia)) > PT\_SK(isk)

bmin\_HH\_Kb(iphi,itheta,ia) = min(find(PT\_matHH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bmax\_HH\_Kb(iphi,itheta,ia) = max(find(PT\_matHH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

bopt\_HH\_Kb(iphi,itheta,ia) = find(PT\_matHH\_Kb(iphi,itheta,ia:bmax,ia)==max(PT\_matHH\_Kb(iphi,itheta,ia:bmax,ia)))+ia;

else

bmin\_HH\_Kb(iphi,itheta,ia) = NaN;

bmax\_HH\_Kb(iphi,itheta,ia) = NaN;

bopt\_HH\_Kb(iphi,itheta,ia) = NaN;

end

end

end

end

save Px\_opt\_Kb