clear

clc

tic

%Independence

%input of simulation

 model = 'MAR(0,1)';

 H = 1;

 dfchi = 4\*H;

 phi = 0;

 df = [-1,0,6];

 long = 5000;

 nobs = [100,200,500];

 result(10,9) = zeros;

 ggfval = zeros(long,9);

 critic = zeros(1,9);

%for on coef

%%% r=1 for level and r=2:10 for power

for m = 1:3

 eps = zeros(600,long);

 for mm = 1:long

 rng(mm,"twister");

 if df(m) >= 2

 epss = trnd(df(m),600,1);

 elseif df(m) == 0

 X1 = exprnd(1, 600, 1);

 X2 = exprnd(1, 600, 1);

 epss = X1-X2;

 elseif df(m) == -1

 epss = unifrnd(-1,1,600,1);

 end

 eps(:,mm) = epss;

 end

 for i = 1:3

 ar5 = zeros(long,10);

 for j = 1:long

 z = eps(1:nobs(i)+100,j);

 z(1:50,:) = [];

 z = z(1:end-50,1);

 gfval = dependence(z,H);

 ggfval(j,3\*(i-1)+m) = nobs(i)\*gfval;

 if nobs(i)\*gfval > chi2inv(0.95,dfchi)

 ar5(j,1) = 1;

 end

 end

 sortggfval = sort(ggfval);

 critic(1,3\*(i-1)+m) = sortggfval(0.95\*long,3\*(i-1)+m);

 for r = 2:10

 psi = (r-1)/(10);

 sortggfval = sort(ggfval);

 for j = 1:long

 z = DGP24(model,nobs(i),phi,psi,eps(1:nobs(i)+100,j));

 gfval = dependence(z,H);

 if nobs(i)\*gfval > critic(1,3\*(i-1)+m)

 ar5(j,r) = 1;

 end

 end

 end

 s = 3\*(i-1)+m;

 for rr = 1:10

 result(rr,s) = sum(ar5(:,rr))/long;

 end

 end

end

% save("Jan31-24-local-independence-5000.mat","result");

toc

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

function [s1] = dependence(nn,H)

 ps = nn;

 eps(:,1) = ps;

 eps(:,2) = (eps(:,1)).^2;

 meann = mean(eps);

 eps(:,1) = eps(:,1) - meann(1);

 eps(:,2) = eps(:,2) - meann(2);

 corr = 0;

 pnobs = size(eps,1);

 vc = cov(eps);

 invv = inv(vc);

 epl = eps;

 i = 1;

 while i<(H+1)

 eps = eps(2:end,:);

 epl = epl(1:(end-1),:);

 co = (eps'\*epl)/(pnobs);

 sco = co\*invv\*co'\*invv;

 corr = corr+(sum(diag(sco)))';

 i = i+1;

 end

 s1 = corr;

end

clear

clc

tic

%code of MAR(0,1) size

model = 'MAR(0,1)';

H = 3;

dfchi = 4\*H;

df = [-1,0,6];

long = 5000;

nobs = [100,200,500];

phi = 0;

result(9,9) = zeros;

jumps(9,9) = zeros;

for m = 1:3

 eps = zeros(600,long+2000);

 for mm = 1:long+2000

 rng(mm,"twister");

 if df(m) >= 2

 epss = trnd(df(m),600,1);

 elseif df(m) == 0

 X1 = exprnd(1, 600, 1);

 X2 = exprnd(1, 600, 1);

 epss=X1-X2;

 elseif df(m) == -1

 epss = unifrnd(-1,1,[600,1]);

 end

 eps(:,mm) = epss;

 end

 for i = 1:3

 ar5 = zeros(long+1000,9);

 bais=zeros(long+1000,9);

 gg=zeros(long,9);

 for r = 1:9

 %psi = 0.7;

 psi = r/10;

 jj=1;

 j=1;

 while jj< long+1

 z = DGP24(model,nobs(i),phi,psi,eps(1:nobs(i)+100,j));

 [g,gfval] = EST24('MAR(0,1)',z, H,psi);

 if g<1 && g>0

 if nobs(i)\*gfval> chi2inv(0.95,dfchi-1)

 ar5(j,r) = 1;

 end

 jj=jj+1;

 else

 bais(j,r)=1;

 end

 j=j+1;

 end

 end

 s = 3\*(i-1)+m;

 for rr = 1:9

 jumps(rr,s) = sum(bais(:,rr));

 result(rr,s) = sum(ar5(:,rr))/(long);

 end

 end

end

% save("Jan31-24-MAR01-power-0.7-5000.mat","result");

% save("Jan31-24-jumps-MAR01-power-0.7-5000.mat","jumps");

toc

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

clear

clc

%code of MAR11 size

tic

model = 'MAR(1,1)';

H = 4;

dfchi = 4\*H;

phi = 0;

df = [-1,0,6];

long = 5000;

nobs = [100,200,500];

result(9,9) = zeros;

jumps(9,9) = zeros;

for m = 1:3

 eps = zeros(600,long+10000);

 parfor mm = 1:long+10000

 rng(mm,"twister");

 if df(m) >= 2

 epss = trnd(df(m),600,1);

 elseif df(m) == 0

 X1 = exprnd(1, 600, 1);

 X2 = exprnd(1, 600, 1);

 epss=X1-X2;

 elseif df(m) == -1

 epss = unifrnd(-1,1,600,1);

 end

 eps(:,mm) = epss;

 end

 for i = 1:3

 ar5 = zeros(long,9);

 bais=zeros(long,9);

 gg=zeros(long,2,9);

 for r = 1:9

 phi = r/10;

 psi = 1-r/10;

 jj=1;

 j=1;

 while jj< long+1

 z = DGP24(model,nobs(i),phi,psi,eps(1:(nobs(i)+100),j));

 [g,gfval] = EST24('MAR(1,1)',z, H,[psi,phi]');

 gg(j,:,r) =g';

 if all(g<1) && all(g>0)

 if nobs(i)\*gfval > chi2inv(0.95,dfchi-2)

 ar5(j,r) = 1;

 end

 jj=jj+1;

 else

 bais(j,r)=1;

 end

 j=j+1;

 end

 end

 s = 3\*(i-1)+m;

 for rr = 1:9

 jumps(rr,s) = sum(bais(:,rr));

 result(rr,s) = sum(ar5(:,rr))/(long-jumps(rr,s));

 end

 end

end

 save("Jan31-24-MAR11-size-5000.mat","result");

toc

 function [z] = DGP24(modelname,nobs,phi,psi,eps)

 nobs = nobs+100;

 s1 = 'MAR(0,1)' ;

 s2 = 'MAR(1,1)';

 t1 = strcmp(modelname,s1);

 t2 = strcmp(modelname,s2);

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

 if t1 == 1 %MAR(0,1)

 y = zeros(nobs,1);

 y(1,1) = 0.1;

 y(nobs,1) = 0.1;

 i = nobs-1;

 while i >0

 y(i,1) = psi\*y(i+1,1) + eps(i,1);

 i = i-1;

 end

 y(1:50,:) = [];

 y = y(1:end-50,1);

 [z] = y;

 end

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

 if t2 == 1 %MAR(1,1)

 nve = zeros(nobs,1);

 nu = zeros(nobs,1);

 nve(1,1) = eps(1,1);

 nu(nobs,1) = eps(1,1);

 y = zeros(nobs,1);

 i = 2;

 while i < nobs +1

 nve(i,1) = eps(i,1) + phi\*nve(i-1,1);

 i = i+1;

 end

 i = 1;

 while i < nobs

 k = nobs-i;

 nu(k,1) = eps(k,1) + psi\*nu(k+1,1);

 i = i+1;

 end

 i = 1;

 while i < nobs

 term = 1 - phi\*psi;

 y(i) = (1/term) \* (nve(i,1) + psi\*nu(i+1,1));

 i = i+1;

 end

 y(1:50,:) = [];

 y = y(1:end-50,1);

 z = y;

 end

end

function [z , zfval] = EST24(modelname,inputmatrix,H,start)

 s1 = 'MAR(0,1)' ;

 s2 = 'MAR(1,1)';

 t1 = strcmp(modelname,s1);

 t2 = strcmp(modelname,s2);

 if t1 == 1

 options = optimoptions(@fmincon,'Algorithm' ...

 ,'interior-point','Display','off');

 gcovAR01c = @(d) fitAR01new(inputmatrix,H,d);

 [z,zfval] = fmincon(gcovAR01c,start,[],[],[],[],[],[],[],options);

 end

 if t2 == 1

 gcovMAR11g = @(g) fitMAR11Gcovnew(inputmatrix,H,g);

 options = optimoptions(@fmincon,'Algorithm' ...

 ,'interior-point','Display','off');

 [z,zfval] = fmincon(gcovMAR11g,start,[],[],[],[],[],[],[],options);

 end

end

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

function [s1] = fitAR01new(nn,H,b)

 nobss = size(nn,1);

 mm = nn;

 te = nobss-1;

 eps = zeros(te,2);

 i = 1;

 while i< nobss

 ps(i,1) = mm(i,1) - b(1,1)\*mm(i+1,1);

 i = i+1;

 end

 eps(:,1) = ps;

 eps(:,2) = (eps(:,1)).^2;

 meann = mean(eps);

 eps(:,1) = eps(:,1) - meann(1);

 eps(:,2) = eps(:,2) - meann(2);

 corr = 0;

 pnobs = size(eps,1);

 vc = cov(eps);

 invv = inv(vc);

 epl = eps;

 i = 1;

 while i < (H+1)

 eps = eps(2:end,:);

 epl = epl(1:(end-1),:);

 co = (eps'\*epl)/(pnobs-1);

 sco = co\*invv\*co'\*invv;

 corr = corr+(sum(diag(sco)))';

 i = i+1;

 end

 s1 = corr;

end

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

function [s1] = fitMAR11Gcovnew(nn,H,b)

%%%b(1,1) psi b(2,1) phi

 nobss = size(nn,1);

 mm = nn;

 te = nobss-2;

 eps = zeros(te,2);

 i = 2;

 while i< nobss

 ps(i,1) = (1+b(2,1)\*b(1,1))\*mm(i,1) - b(1,1)\*mm(i+1,1) -b(2,1)\*mm(i-1,1);

 i = i+1;

 end

 eps(:,1) = ps(2:(nobss-1),1);

 eps(:,2) = (eps(:,1)).^2;

 meann = mean(eps);

 eps(:,1) = eps(:,1) - meann(1);

 eps(:,2) = eps(:,2) - meann(2);

 corr = 0;

 pnobs = size(eps,1);

 vc = cov(eps);

 invv = inv(vc);

 epl = eps;

 i = 1;

 while i < (H+1)

 eps = eps(2:end,:);

 epl = epl(1:(end-1),:);

 co = (eps'\*epl)/(pnobs-1);

 sco = co\*invv\*co'\*invv;

 corr = corr+(sum(diag(sco)))';

 i = i+1;

 end

 s1 = corr;

end

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