# Integrated Data Envelopment Analysis Methods for Measuring Technical, Environmental, and Eco-efficiencies

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## 1. Matlab Codes

## 1.1 centralized method

[n m]=size(X);

[n s]=size(Y\_g);

[n p]=size(Y\_b);

for i=1:n

Aeq=[zeros(1,s) X(i,:) zeros(1,s) Y\_b(i,:)];

beq=1;

f=-[Y\_g(i,:) zeros(1,m) zeros(1,s) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=linprog(f,A,b,Aeq,beq,LB);

e(i,1)=-f\*w(:,i);

end

for i=1:n

Aeq1=[zeros(1,s) X(i,:) zeros(1,s) zeros(1,p)];

Aeq2=[Y\_g(i,:) -e(i,1)\*X(i,:) zeros(1,s) -e(i,1)\*Y\_b(i,:)];

Aeq=[Aeq1;Aeq2];

beq=[1;0];

f=-[zeros(1,s) zeros(1,m) Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=linprog(f,A,b,Aeq,beq,LB);

e1(i,1)=-f\*w(:,i);

end

alpha1 = (w(m+1:m+s,:)./w(1:s,:))';

for i=1:n

Aeq1=[zeros(1,s) zeros(1,m) zeros(1,s) Y\_b(i,:)];

Aeq2=[Y\_g(i,:) -e(i,1)\*X(i,:) zeros(1,s) -e(i,1)\*Y\_b(i,:)];

Aeq=[Aeq1;Aeq2];

beq=[1;0];

f=-[Y\_g(i,:) zeros(1,m) -Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=linprog(f,A,b,Aeq,beq,LB);

e2(i,1)=-f\*w(:,i);

ui = w(1:s,i);

pi = w(s+m+1:s+m+s,i);

lambda1(i,1) = (Y\_g(i,:)\*pi)/(Y\_g(i,:)\*ui);

lambda2(i,1) = 1 - lambda1(i,1);

end

alpha2 = (w(m+1:m+s,:)./w(1:s,:))';

E = 1./e;

E2 = 1./e2;

E2\_1 = (E-E2.\*lambda2)./lambda1;

e2\_1 = 1./E2\_1;

EE = [e e2\_1 e2 lambda1 lambda2];

## 1.2. Idea point based method

[n m]=size(X);

[n s]=size(Y\_g);

[n p]=size(Y\_b);

for i=1:n

Aeq=[zeros(1,s) X(i,:) zeros(1,s) zeros(1,p)];

beq=1;

f=-[zeros(1,s) zeros(1,m) Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e1\_U(i,1)=-f\*w(:,i);

end

for i=1:n

Aeq=[zeros(1,s) zeros(1,m) zeros(1,s) Y\_b(i,:)];

beq=1;

f=-[Y\_g(i,:) zeros(1,m) -Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e2\_U(i,1)=-f\*w(:,i);

end

for i=1:n

Aeq=[zeros(1,s) X(i,:) zeros(1,s) zeros(1,p);Y\_g(i,:) zeros(1,m) -Y\_g(i,:) -e2\_U(i,1)\*Y\_b(i,:)];

beq=[1;0];

f=-[zeros(1,s) zeros(1,m) Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e1\_L(i,1)=-f\*w(:,i);

end

for i=1:n

Aeq=[zeros(1,s) zeros(1,m) zeros(1,s) Y\_b(i,:);zeros(1,s) -e1\_U(i,1)\*X(i,:) Y\_g(i,:) zeros(1,p)];

beq=[1;0];

f=-[Y\_g(i,:) zeros(1,m) -Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A=[A1;A2;A3;A4];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e2\_L(i,1)=-f\*w(:,i);

end

delta\_e2 = e2\_U-e2\_L;

delta\_e1 = e1\_U-e1\_L;

for i=1:n

if delta\_e1(i) >= 0.0001

K(i) = floor(delta\_e1(i)/0.0001)+1;

for k=1:K(i)+1

e1\_k(i,k) = e1\_U(i) - (k-1)\*0.0001;

e2\_k(i,k)=e2\_e1\_fun(Y\_g,X,Y\_b,e1\_k(i,k),i);

end

else

K(i)=0;

end

end

tol = 0.000001;

for i=1:n

iter = 0;

gama\_U = 1;

gama\_L = 0;

delta\_gama = gama\_U - gama\_L;

while delta\_gama>tol

iter = iter + 1;

gama1 = (gama\_U+gama\_L)/2;

Aeq=[zeros(1,s) X(i,:) zeros(1,s) zeros(1,p)];

beq=[1];

f=-[zeros(1,s+m+s+p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

b1=zeros(2\*n+s+s,1);

A5=[zeros(1,s) zeros(1,m) -Y\_g(i,:) zeros(1,p)];

b2=-gama1\*e1\_U(i);

A6=[-Y\_g(i,:) zeros(1,m) Y\_g(i,:) gama1\*e2\_U(i)\*Y\_b(i,:)];

b3=0;

A=[A1;A2;A3;A4;A5;A6];

b=[b1;b2;b3];

LB=[zeros(1,s+m+s+p)]';

[w fval exitflag]=cplexlp(f,A,b,Aeq,beq,LB);

if exitflag==-2

gama\_U=gama1;

else

gama\_L=gama1;

end

delta\_gama = gama\_U-gama\_L;

flag1(i,iter) = exitflag;

delta\_gama1(i,iter) = delta\_gama;

end

gama(i,1)=gama1;

end

e1\_star = gama.\*e1\_U;

e2\_star = gama.\*e2\_U;

for i=1:n

Aeq=[zeros(1,s) X(i,:) zeros(1,s) zeros(1,p);[-Y\_g(i,:) zeros(1,m) Y\_g(i,:) e2\_star(i)\*Y\_b(i,:)]];

beq=[1;0];

f=-[zeros(1,s) zeros(1,m) Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A5=[];

A=[A1;A2;A3;A4;A5];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e1\_hat(i,1)=-f\*w(:,i);

end

for i=1:n

Aeq=[zeros(1,s) zeros(1,m) zeros(1,s) Y\_b(i,:);zeros(1,s) -e1\_star(i)\*X(i,:) Y\_g(i,:) zeros(1,p)];

beq=[1;0];

f=-[Y\_g(i,:) zeros(1,m) -Y\_g(i,:) zeros(1,p)];

A1=[zeros(n,s) -X Y\_g zeros(n,p)];

A2=[Y\_g zeros(n,m) -Y\_g -Y\_b];

A3=[-0.9\*eye(s) zeros(s,m) eye(s) zeros(s,p)];

A4=[0.5\*eye(s) zeros(s,m) -eye(s) zeros(s,p)];

A5=[];

A=[A1;A2;A3;A4;A5];

b=zeros(2\*n+s+s,1);

LB=[zeros(1,s+m+s+p)]';

w(:,i)=cplexlp(f,A,b,Aeq,beq,LB);

e2\_hat(i,1)=-f\*w(:,i);

ui = w(1:s,i);

pi = w(s+m+1:s+m+s,i);

lambda1(i,1) = (Y\_g(i,:)\*pi)/(Y\_g(i,:)\*ui);

lambda2(i,1) = 1 - lambda1(i,1);

end

E1\_hat = 1./e1\_hat;

E2\_star = 1./e2\_star;

E\_hat = lambda1.\*E1\_hat + lambda2.\*E2\_star;

e\_hat = 1./E\_hat;

beta1=e1\_hat./e1\_star;

beta2=e2\_hat./e2\_star;

results=[e1\_U e2\_U gama e1\_hat e2\_star e\_hat lambda1 lambda2];

## 2. Data set

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Region | Length of Road | Civil Vehicles | Number of employees | Gasoline | Diesel Oil | Energy | Pensenger turnover | Freights turnover | CO2 | 2014 |
| Beijing | 21673 | 517.11 | 273618 | 7255.92 | 517.558 | 7255.92 | 136.08 | 156.19 | 517.558 | 2014 |
| Tianjin | 15718 | 261.58 | 51413 | 5906.372 | 422.5069 | 5906.372 | 88.56 | 313.7 | 422.5069 | 2014 |
| Hebei | 174492 | 816.29 | 138157 | 21699.22 | 1555.199 | 21699.22 | 296.53 | 6577.89 | 1555.199 | 2014 |
| Shanxi | 139434 | 378.27 | 82492 | 20674.09 | 1477.638 | 20674.09 | 196.62 | 1278.57 | 1477.638 | 2014 |
| Inner Mongolia | 167515 | 306.87 | 73428 | 17925.6 | 1277.167 | 17925.6 | 173.44 | 1872.71 | 1277.167 | 2014 |
| Liaoning | 110973 | 457.05 | 142378 | 35527.48 | 2520.006 | 35527.48 | 362.43 | 2792.02 | 2520.006 | 2014 |
| Jilin | 94191 | 248.35 | 60989 | 10148.32 | 731.0458 | 10148.32 | 168.7 | 1100 | 731.0458 | 2014 |
| Heilongjiang | 160206 | 289.81 | 76624 | 17143.17 | 1204.128 | 17143.17 | 216.07 | 972.92 | 1204.128 | 2014 |
| Shanghai | 12633 | 234.91 | 202798 | 13355.97 | 945.9252 | 13355.97 | 119.12 | 352.42 | 945.9252 | 2014 |
| Jiangsu | 156094 | 944.35 | 239597 | 41311.7 | 2895.505 | 41311.7 | 847.28 | 1790.4 | 2895.505 | 2014 |
| Zhejiang | 115426 | 901.99 | 159724 | 29890.28 | 2103.522 | 29890.28 | 582.99 | 1322.13 | 2103.522 | 2014 |
| Anhui | 173763 | 358.74 | 112095 | 22920.4 | 1641.135 | 22920.4 | 733.99 | 6544.02 | 1641.135 | 2014 |
| Fujian | 99535 | 332.97 | 105271 | 17212.01 | 1221.717 | 17212.01 | 330.64 | 821.44 | 1221.717 | 2014 |
| Jiangxi | 152067 | 246.84 | 106077 | 17121.42 | 1225.852 | 17121.42 | 307.69 | 2829.02 | 1225.852 | 2014 |
| Shandong | 252786 | 1199.71 | 234278 | 39011.36 | 2809.375 | 39011.36 | 520.34 | 5494.78 | 2809.375 | 2014 |
| Henan | 249831 | 700.69 | 234278 | 30324 | 2150.147 | 30324 | 712.39 | 4488.01 | 2150.147 | 2014 |
| Hubei | 226912 | 354.4 | 145880 | 29060.19 | 2043.325 | 29060.19 | 415.07 | 2046.28 | 2043.325 | 2014 |
| Hunan | 235392 | 366.74 | 103424 | 23013.12 | 1642.06 | 23013.12 | 721.93 | 2329.54 | 1642.06 | 2014 |
| Guangdong | 202915 | 1177.37 | 380485 | 56216.74 | 4014.164 | 56216.74 | 1202.48 | 3003.36 | 4014.164 | 2014 |
| Guangxi | 111384 | 276.29 | 82659 | 17779.05 | 1269.106 | 17779.05 | 415.73 | 1857.18 | 1269.106 | 2014 |
| Hainan | 24852 | 64.8 | 19638 | 2918.853 | 209.6811 | 2918.853 | 84.98 | 75.42 | 209.6811 | 2014 |
| Chongqing | 122846 | 192.77 | 165898 | 16583.24 | 1196.362 | 16583.24 | 333.27 | 695.89 | 1196.362 | 2014 |
| Sichuan | 301816 | 573.03 | 195737 | 12243.04 | 867.6836 | 12243.04 | 599.15 | 1273.13 | 867.6836 | 2014 |
| Guizhou | 172564 | 201 | 54795 | 14474.72 | 1030.59 | 14474.72 | 377.87 | 610.64 | 1030.59 | 2014 |
| Yunnan | 222940 | 374.01 | 72439 | 23260.77 | 1661.742 | 23260.77 | 323.1 | 921.98 | 1661.742 | 2014 |
| Shaanxi | 165249 | 336.08 | 117312 | 17041.48 | 1219.522 | 17041.48 | 323.14 | 1685.02 | 1219.522 | 2014 |
| Gansu | 133597 | 156.38 | 50523 | 12562.66 | 905.9285 | 12562.66 | 212.01 | 811.21 | 905.9285 | 2014 |
| Qinghai | 70117 | 58.84 | 18818 | 2946.273 | 212.6337 | 2946.273 | 40.33 | 202.76 | 212.6337 | 2014 |
| Ningxia | 28554 | 79.23 | 15857 | 3846.773 | 278.1284 | 3846.773 | 58.34 | 509.43 | 278.1284 | 2014 |
| Xinjiang | 170155 | 236.96 | 84780 | 16628.65 | 1188.933 | 16628.65 | 319.62 | 928.54 | 1188.933 | 2014 |
| Beijing | 21849 | 530.83 | 282196 | 7398.386 | 527.688 | 7398.386 | 138.3 | 165.19 | 527.688 | 2014 |
| Tianjin | 16110 | 274.14 | 51638 | 6104.419 | 436.8104 | 6104.419 | 88.47 | 349.02 | 436.8104 | 2014 |
| Hebei | 179200 | 930.08 | 144943 | 20006.19 | 1438.763 | 20006.19 | 290.48 | 7019.56 | 1438.763 | 2014 |
| Shanxi | 140436 | 424.36 | 84807 | 19998.4 | 1429.667 | 19998.4 | 181.99 | 1363.2 | 1429.667 | 2014 |
| Inner Mongolia | 172167 | 342.14 | 69230 | 16376.88 | 1163.161 | 16376.88 | 161.4 | 2103.47 | 1163.161 | 2014 |
| Liaoning | 115430 | 520.04 | 136190 | 37754.18 | 2679.824 | 37754.18 | 375.61 | 3074.9 | 2679.824 | 2014 |
| Jilin | 96041 | 284.57 | 54719 | 10908.79 | 783.9905 | 10908.79 | 173.27 | 1190.78 | 783.9905 | 2014 |
| Heilongjiang | 162464 | 322.78 | 74614 | 17979.98 | 1259.142 | 17979.98 | 231.23 | 1008.46 | 1259.142 | 2014 |
| Shanghai | 12945 | 255.03 | 209885 | 13433.71 | 949.8757 | 13433.71 | 124.34 | 300.82 | 949.8757 | 2014 |
| Jiangsu | 157521 | 1095.45 | 253433 | 43578.52 | 3054.543 | 43578.52 | 852 | 1978.52 | 3054.543 | 2014 |
| Zhejiang | 116367 | 1012.05 | 165213 | 30121.88 | 2118.079 | 30121.88 | 558.06 | 1419.43 | 2118.079 | 2014 |
| Anhui | 174373 | 422.46 | 116732 | 25152.14 | 1799.724 | 25152.14 | 799.37 | 7392.37 | 1799.724 | 2014 |
| Fujian | 101190 | 386.6 | 108676 | 19400.14 | 1374.532 | 19400.14 | 334.95 | 974.8 | 1374.532 | 2014 |
| Jiangxi | 155515 | 287.68 | 103656 | 17457.7 | 1248.124 | 17457.7 | 316.48 | 3073.31 | 1248.124 | 2014 |
| Shandong | 259515 | 1350.25 | 234715 | 40309.44 | 2903.074 | 40309.44 | 511.41 | 5711.38 | 2903.074 | 2014 |
| Henan | 249857 | 969.28 | 242084 | 29784.36 | 2114.096 | 29784.36 | 844.86 | 4822.37 | 2114.096 | 2014 |
| Hubei | 236933 | 422.23 | 156845 | 31167.08 | 2190.957 | 31167.08 | 483.89 | 2340.56 | 2190.957 | 2014 |
| Hunan | 236250 | 434.48 | 107524 | 25238.97 | 1801.409 | 25238.97 | 776.48 | 2578.9 | 1801.409 | 2014 |
| Guangdong | 212094 | 1331.84 | 383629 | 59013.1 | 4210.495 | 59013.1 | 1629.79 | 3113.84 | 4210.495 | 2014 |
| Guangxi | 114900 | 316.53 | 79232 | 19690.47 | 1406.087 | 19690.47 | 413.23 | 2068.51 | 1406.087 | 2014 |
| Hainan | 26002 | 75.11 | 19568 | 2690.116 | 192.5279 | 2690.116 | 89.08 | 81.5 | 192.5279 | 2014 |
| Chongqing | 127392 | 237.04 | 181971 | 15728.04 | 1132.271 | 15728.04 | 352.58 | 797.8 | 1132.271 | 2014 |
| Sichuan | 309742 | 666.92 | 207857 | 17493.24 | 1231.624 | 17493.24 | 630.03 | 1510.51 | 1231.624 | 2014 |
| Guizhou | 179079 | 244.72 | 54836 | 15359.53 | 1093.472 | 15359.53 | 412.92 | 776.95 | 1093.472 | 2014 |
| Yunnan | 230398 | 429.74 | 78844 | 26084.03 | 1862.059 | 26084.03 | 321.06 | 1002.35 | 1862.059 | 2014 |
| Shaanxi | 167145 | 384.88 | 111184 | 17918.31 | 1282.174 | 17918.31 | 339.02 | 1917.45 | 1282.174 | 2014 |
| Gansu | 138084 | 185.31 | 48691 | 12740.97 | 918.0384 | 12740.97 | 229.02 | 992.6 | 918.0384 | 2014 |
| Qinghai | 72703 | 68.84 | 14738 | 3368.332 | 242.9462 | 3368.332 | 46.5 | 234.36 | 242.9462 | 2014 |
| Ningxia | 31276 | 91.05 | 15682 | 4034.071 | 291.8973 | 4034.071 | 65.68 | 530.47 | 291.8973 | 2014 |
| Xinjiang | 175468 | 272.21 | 82557 | 17184.36 | 1228.667 | 17184.36 | 279.81 | 1037.32 | 1228.667 | 2014 |
| Beijing | 21885 | 533.81 | 288787 | 6955.776 | 495.9219 | 6955.776 | 130.12 | 156.36 | 495.9219 | 2015 |
| Tianjin | 16550 | 273.62 | 56129 | 6352.607 | 455.0474 | 6352.607 | 81.7 | 345.2 | 455.0474 | 2015 |
| Hebei | 184553 | 1075.03 | 150198 | 19750.68 | 1419.009 | 19750.68 | 268.44 | 6821.48 | 1419.009 | 2015 |
| Shanxi | 140960 | 468.97 | 84688 | 20648 | 1477.008 | 20648 | 164.53 | 1374.76 | 1477.008 | 2015 |
| Inner Mongolia | 175374 | 373.61 | 66565 | 14714.23 | 1036.82 | 14714.23 | 160.34 | 2239.96 | 1036.82 | 2015 |
| Liaoning | 120365 | 582.5 | 134523 | 38584.81 | 2738.167 | 38584.81 | 313.09 | 2850.68 | 2738.167 | 2015 |
| Jilin | 97326 | 313.74 | 56383 | 10092.27 | 725.0187 | 10092.27 | 177.82 | 1051.22 | 725.0187 | 2015 |
| Heilongjiang | 163233 | 351.75 | 74505 | 18036.44 | 1262.549 | 18036.44 | 229.56 | 929.27 | 1262.549 | 2015 |
| Shanghai | 13195 | 282.23 | 206868 | 13788.23 | 976.5858 | 13788.23 | 125.45 | 289.56 | 976.5858 | 2015 |
| Jiangsu | 158805 | 1240.91 | 253790 | 44943.43 | 3151.727 | 44943.43 | 825.45 | 2072.96 | 3151.727 | 2015 |
| Zhejiang | 118015 | 1120.58 | 165240 | 31367.22 | 2206.248 | 31367.22 | 544.76 | 1513.92 | 2206.248 | 2015 |
| Anhui | 186940 | 498.7 | 123153 | 25388.83 | 1805.059 | 25388.83 | 574.88 | 4721.87 | 1805.059 | 2015 |
| Fujian | 104585 | 435.37 | 107797 | 20191.81 | 1427.257 | 20191.81 | 267.29 | 1020.25 | 1427.257 | 2015 |
| Jiangxi | 156625 | 338.94 | 104811 | 19071.46 | 1360.617 | 19071.46 | 284.74 | 3022.72 | 1360.617 | 2015 |
| Shandong | 263447 | 1510.81 | 224541 | 41262.4 | 2970.537 | 41262.4 | 471.37 | 5876.99 | 2970.537 | 2015 |
| Henan | 250584 | 952.01 | 249899 | 31338.6 | 2220.34 | 31338.6 | 743.91 | 4542.67 | 2220.34 | 2015 |
| Hubei | 252980 | 498.63 | 160326 | 31282.36 | 2196.809 | 31282.36 | 489.29 | 2380.62 | 2196.809 | 2015 |
| Hunan | 236886 | 507.88 | 103606 | 28563.51 | 2039.679 | 28563.51 | 635.64 | 2553.52 | 2039.679 | 2015 |
| Guangdong | 216023 | 1471.4 | 385321 | 61850.01 | 4408.534 | 61850.01 | 1034.94 | 3108.81 | 4408.534 | 2015 |
| Guangxi | 117993 | 363.82 | 78600 | 21857.9 | 1560.169 | 21857.9 | 410.82 | 2122.6 | 1560.169 | 2015 |
| Hainan | 26860 | 83.29 | 19668 | 2829.01 | 202.4752 | 2829.01 | 79.29 | 78.66 | 202.4752 | 2015 |
| Chongqing | 140551 | 278.61 | 179925 | 19287.91 | 1388.897 | 19287.91 | 376.45 | 851.23 | 1388.897 | 2015 |
| Sichuan | 315582 | 767.13 | 192997 | 15635.69 | 1093.792 | 15635.69 | 671.63 | 1480.58 | 1093.792 | 2015 |
| Guizhou | 186407 | 292.61 | 55655 | 18570.52 | 1319.254 | 18570.52 | 422.79 | 782.47 | 1319.254 | 2015 |
| Yunnan | 236007 | 484.23 | 80384 | 24542.57 | 1754.705 | 24542.57 | 330.21 | 1077.89 | 1754.705 | 2015 |
| Shaanxi | 170069 | 438.12 | 112248 | 16900.75 | 1206.643 | 16900.75 | 293.23 | 1826.8 | 1206.643 | 2015 |
| Gansu | 140052 | 239.36 | 48834 | 11745.97 | 844.3697 | 11745.97 | 248.75 | 912.14 | 844.3697 | 2015 |
| Qinghai | 75593 | 78.18 | 15041 | 3440.803 | 248.2229 | 3440.803 | 44.65 | 222.13 | 248.2229 | 2015 |
| Ningxia | 33240 | 100.94 | 12640 | 4076.49 | 294.6785 | 4076.49 | 68.04 | 571.85 | 294.6785 | 2015 |
| Xinjiang | 178263 | 294.47 | 80850 | 20278.37 | 1449.698 | 20278.37 | 249.27 | 1060.46 | 1449.698 | 2015 |
| Beijing | 22026 | 547.44 | 279180 | 6480.661 | 462.044 | 6480.661 | 117.67 | 161.32 | 462.044 | 2016 |
| Tianjin | 16764 | 273.69 | 57471 | 5916.741 | 424.2177 | 5916.741 | 78.39 | 372.49 | 424.2177 | 2016 |
| Hebei | 188431 | 1245.89 | 148054 | 23304.22 | 1675.959 | 23304.22 | 244.18 | 7294.59 | 1675.959 | 2016 |
| Shanxi | 142066 | 526.39 | 83031 | 20944.2 | 1497.591 | 20944.2 | 141.14 | 1452.06 | 1497.591 | 2016 |
| Inner Mongolia | 196061 | 418.53 | 69790 | 14037.82 | 983.0121 | 14037.82 | 152.75 | 2423.64 | 983.0121 | 2016 |
| Liaoning | 120613 | 659.41 | 122195 | 39294.86 | 2790.56 | 39294.86 | 306.70 | 2936.76 | 2790.56 | 2016 |
| Jilin | 102484 | 352.93 | 52935 | 9786.227 | 703.1253 | 9786.227 | 168.72 | 1084.77 | 703.1253 | 2016 |
| Heilongjiang | 164502 | 394.19 | 72898 | 15484.82 | 1075.224 | 15484.82 | 200.10 | 904.76 | 1075.224 | 2016 |
| Shanghai | 13292 | 322.87 | 196395 | 15075.29 | 1066.388 | 15075.29 | 114.98 | 281.98 | 1066.388 | 2016 |
| Jiangsu | 157304 | 1427.91 | 259038 | 46092.78 | 3232.532 | 46092.78 | 779.98 | 2140.33 | 3232.532 | 2016 |
| Zhejiang | 119053 | 1257.35 | 165609 | 30904.14 | 2165.025 | 30904.14 | 465.12 | 1626.78 | 2165.025 | 2016 |
| Anhui | 197588 | 600.81 | 128272 | 25527.38 | 1814.122 | 25527.38 | 491.27 | 4915.71 | 1814.122 | 2016 |
| Fujian | 106757 | 493.64 | 104685 | 21487.42 | 1516.441 | 21487.42 | 251.95 | 1094.70 | 1516.441 | 2016 |
| Jiangxi | 161909 | 399.29 | 103024 | 19328.2 | 1378.851 | 19328.2 | 282.34 | 3147.50 | 1378.851 | 2016 |
| Shandong | 265720 | 1723.34 | 224205 | 42199.51 | 3037.087 | 42199.51 | 472.40 | 6071.43 | 3037.087 | 2016 |
| Henan | 267441 | 1104.47 | 254487 | 30116.62 | 2141.681 | 30116.62 | 760.57 | 4838.53 | 2141.681 | 2016 |
| Hubei | 260179 | 588.69 | 166210 | 39474.27 | 2781.577 | 39474.27 | 487.33 | 2506.86 | 2781.577 | 2016 |
| Hunan | 238273 | 595.8 | 102405 | 29581.02 | 2109.305 | 29581.02 | 577.03 | 2686.57 | 2109.305 | 2016 |
| Guangdong | 218085 | 1674.64 | 393904 | 68766.23 | 4891.514 | 68766.23 | 1079.80 | 3381.92 | 4891.514 | 2016 |
| Guangxi | 120547 | 424.9 | 75405 | 22977.68 | 1630.716 | 22977.68 | 390.05 | 2248.46 | 1630.716 | 2016 |
| Hainan | 28217 | 96.32 | 21705 | 2551.076 | 181.618 | 2551.076 | 75.36 | 76.11 | 181.618 | 2016 |
| Chongqing | 142921 | 327.47 | 172431 | 20358.47 | 1466.382 | 20358.47 | 336.75 | 935.45 | 1466.382 | 2016 |
| Sichuan | 324138 | 880.8 | 191317 | 23925.55 | 1681.446 | 23925.55 | 597.84 | 1565.31 | 1681.446 | 2016 |
| Guizhou | 191626 | 348.7 | 55171 | 20425.27 | 1447.598 | 20425.27 | 443.10 | 873.23 | 1447.598 | 2016 |
| Yunnan | 238052 | 552.05 | 79584 | 25342 | 1811.839 | 25342 | 319.99 | 1173.06 | 1811.839 | 2016 |
| Shaanxi | 172471 | 491.23 | 115492 | 15254.4 | 1087.983 | 15254.4 | 290.80 | 1925.83 | 1087.983 | 2016 |
| Gansu | 143039 | 277.25 | 48593 | 10810.61 | 775.0643 | 10810.61 | 253.26 | 949.64 | 775.0643 | 2016 |
| Qinghai | 78585 | 88.65 | 16308 | 4042.157 | 291.6751 | 4042.157 | 47.50 | 236.04 | 291.6751 | 2016 |
| Ningxia | 33940 | 115.34 | 11387 | 4247.93 | 306.7205 | 4247.93 | 64.42 | 577.56 | 306.7205 | 2016 |
| Xinjiang | 182085 | 327.06 | 79460 | 21535.44 | 1539.021 | 21535.44 | 213.47 | 1102.21 | 1539.021 | 2016 |