**EKT 720 Assignment 3**

1. The estimated regression line is:

*Prop* = 106.85085 + 0.7971 *Income +* 0.*4945 Stand +* 139.9591 *Ratio +* 133.0302 *Double*

1. The results in the program show the estimation of the parameters of the model based on the leave one out approach. To test the estimated parameters, the estimated regression equation can be used to calculate the observation that is left one to test the significance of the line in estimation. The results in the program estimates the model *n* times, leaving one observation each time. The results are in the form of a table where each column represents a parameter in the model, starting with *β1* and ending with *β5*.
2. Using the results in ‘b’, the average of the results is given in this section. The value of the averages of the individual parameters are very close to those estimated in the initial estimated regression line given in ‘a’. This means that on average, the estimated regression line is given by:

*Prop* = 106.4981 + 0.79732 *Income +* 0.49549 *Stand +* 140.2023 *Ratio +* 133.05019 *Double*

1. As shown in the results of the program, on average the estimated regression line is given by:

*Prop* = 108.0474 + 0.8098 *Income +* 0.4938 *Stand +* 132.9033 *Ratio +* 130.5417 *Double*

1. As shown in the results of the program, on average the estimated regression line is given by:

*Prop* = 93.8343 + 0.8117 *Income +* 0.49703 *Stand +* 145.0029 *Ratio +* 135.39209 *Double*

\*\*Assignment 3 coding\*\*;

**proc** **iml**;

use a;

read all into c;

n=nrow(c);

y=c[,**6**];

income=c[,**1**]+c[,**2**];

house=c[,**3**];

stand=c[,**4**];

double=c[,**5**];

ratio=house/stand;

x=j(n,**1**,**1**)||income||stand||ratio||double;

yx=y||x[,**2**:**5**];

print '3a';

bhat=inv(x`\*x)\*x`\*y;

print bhat;

result=j(n,**5**,**.**);

print '3b';

m=y||x[,**2**:**5**];

do i=**1** to n;

if i=**1** then lout=m[**2**:n,]; /\*if removing the first obs\*/

else if i=n then lout=m[**1**:n-**1**,]; /\*if removing the last obs\*/

else lout=m[**1**:i-**1**,]//m[i+**1**:n,]; /\*if removing obs in between, concatinate vertically\*/

y\_rem=lout[,**1**];

x\_rem=j(n-**1**,**1**,**1**)||lout[,**2**:**5**];

bhat\_rem=inv(x\_rem`\*x\_rem)\*x\_rem`\*y\_rem;

\*\*print bhat\_rem;

result[i,]=bhat\_rem`;

end;

print result;

print '3c';

aresult=result[:,]; /\*average\*/

print aresult;

print '3d';

result\_d=j(n,**5**,**.**);

\*\*u=sample(1:30,30);

\*\*s=x[u];

do i=**1** to n;

b=j(n,**1**,**0**);

draw=int(uniform(b)\*n)+**1**;

sample=m[draw,];

\*\*print draw sample;

x\_sam=j(n,**1**,**1**)||sample[,**2**:**5**];

y\_sam=sample[,**1**];

bhat\_d=inv(x\_sam`\*x\_sam)\*x\_sam`\*y\_sam;

result\_d[i,]=bhat\_d`;

end;

print result\_d;

print '3d average';

aresult\_d=result\_d[:,];

print aresult\_d;

print '3e';

result\_e=j(**100**,**5**,**.**);

do i=**1** to **100**;

b1=j(n,**1**,**0**);

draw1=int(uniform(b1)\*n)+**1**;

sample1=m[draw1,];

\*\*print draw sample;

xe\_sam=j(n,**1**,**1**)||sample1[,**2**:**5**];

ye\_sam=sample1[,**1**];

bhat\_e=inv(xe\_sam`\*xe\_sam)\*xe\_sam`\*ye\_sam;

result\_e[i,]=bhat\_e`;

end;

print result\_e;

print '3e average';

aresult\_e=result\_e[:,];

print aresult\_e;

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| --- |
| 3a |

| **bhat** |
| --- |
| 106.85085 |
| 0.7970982 |
| 0.4954084 |
| 139.95912 |
| 133.03019 |

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| --- |
| 3b |

| **result** | | | | |
| --- | --- | --- | --- | --- |
| 127.70109 | 0.7852868 | 0.4889042 | 121.1254 | 134.82822 |
| 105.13005 | 0.7976525 | 0.4964962 | 140.26458 | 133.44209 |
| 109.86095 | 0.7955925 | 0.492758 | 139.71557 | 129.57704 |
| 91.215882 | 0.8168917 | 0.4879476 | 159.39092 | 144.97683 |
| 104.56749 | 0.7863398 | 0.4969371 | 148.01829 | 134.27254 |
| 65.730456 | 0.8101562 | 0.519125 | 165.86762 | 118.55801 |
| 110.17841 | 0.7941665 | 0.4941684 | 137.98904 | 133.33092 |
| 105.76806 | 0.7945086 | 0.4960053 | 142.76673 | 133.13812 |
| 105.60718 | 0.8007671 | 0.4961701 | 137.40567 | 133.50628 |
| 79.013358 | 0.7983528 | 0.5177756 | 160.00848 | 130.21487 |
| 143.84255 | 0.7742924 | 0.4891075 | 112.65597 | 129.19128 |
| 114.67298 | 0.7976942 | 0.4917042 | 132.39265 | 132.56561 |
| 107.43153 | 0.8162341 | 0.486159 | 131.09629 | 135.94782 |
| 107.86645 | 0.8017534 | 0.4983826 | 132.45259 | 132.16017 |
| 106.99173 | 0.7970072 | 0.4953556 | 139.8706 | 133.08821 |
| 107.39437 | 0.7940505 | 0.5018392 | 134.63326 | 132.30435 |
| 107.23878 | 0.7959601 | 0.4951851 | 140.79747 | 132.84107 |
| 104.61928 | 0.7901064 | 0.4938937 | 149.97023 | 133.53692 |
| 113.32885 | 0.7956668 | 0.4898356 | 139.42308 | 131.9269 |
| 92.173328 | 0.8004039 | 0.5051155 | 152.48566 | 130.65843 |
| 125.45941 | 0.7768477 | 0.497813 | 127.40919 | 130.26905 |
| 102.59881 | 0.8037391 | 0.4988612 | 135.92692 | 133.90561 |
| 100.89459 | 0.8063927 | 0.4995816 | 136.69164 | 137.3621 |
| 104.80612 | 0.7948083 | 0.4970755 | 143.00666 | 134.20388 |
| 123.56676 | 0.7695618 | 0.5012178 | 122.82433 | 135.92795 |
| 108.45917 | 0.7962002 | 0.4925795 | 142.4837 | 132.47396 |
| 94.302292 | 0.8404831 | 0.4716231 | 149.85384 | 136.83839 |
| 109.1384 | 0.7947174 | 0.4909835 | 145.2388 | 132.02484 |
| 110.2418 | 0.7891373 | 0.4988103 | 135.09322 | 133.91208 |
| 105.14397 | 0.8049574 | 0.4833223 | 149.21059 | 134.52228 |

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| 3c |

| **aresult** | | | | |
| --- | --- | --- | --- | --- |
| 106.49814 | 0.7973243 | 0.4954911 | 140.2023 | 133.05019 |

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| 3d |

| **result\_d** | | | | |
| --- | --- | --- | --- | --- |
| 80.907535 | 0.8363571 | 0.4679907 | 190.13915 | 122.12178 |
| 125.13371 | 0.7575384 | 0.5021936 | 132.14196 | 130.95429 |
| 134.32115 | 0.7548375 | 0.5207092 | 119.46246 | 105.60225 |
| 132.55763 | 0.8193451 | 0.4972353 | 98.553998 | 151.73421 |
| 14.153839 | 0.7166868 | 0.5389992 | 321.46768 | 148.83876 |
| 288.89153 | 0.6814583 | 0.4651564 | -6.757442 | 124.14352 |
| 111.64554 | 0.7608951 | 0.5150508 | 128.62296 | 121.3116 |
| 79.161501 | 0.787524 | 0.5368697 | 136.67162 | 138.21728 |
| 41.853882 | 0.8364468 | 0.4981717 | 200.10375 | 128.72385 |
| 204.80352 | 0.7603286 | 0.4484876 | 79.438834 | 136.18266 |
| 94.163938 | 0.7905157 | 0.4926347 | 178.93199 | 139.48363 |
| 1.5905722 | 0.8244054 | 0.5431866 | 223.98203 | 141.32887 |
| 204.08212 | 0.8317196 | 0.4227393 | 56.591673 | 125.97778 |
| 55.519545 | 0.8252517 | 0.471459 | 249.76713 | 121.99818 |
| 151.11312 | 0.7359939 | 0.5128983 | 98.492924 | 137.9064 |
| 234.75351 | 0.7799495 | 0.4206305 | 49.843754 | 105.79417 |
| 239.689 | 0.702292 | 0.4547028 | 64.786778 | 133.15357 |
| 127.95148 | 0.7582647 | 0.4979032 | 146.02265 | 102.23659 |
| 107.19398 | 0.8498093 | 0.455899 | 138.20885 | 133.4848 |
| 26.002592 | 0.8512551 | 0.5063609 | 204.83687 | 115.25485 |
| 167.79397 | 0.7521638 | 0.4884439 | 83.785431 | 127.35234 |
| -13.25141 | 0.9437224 | 0.4760367 | 212.76815 | 126.72793 |
| 95.270609 | 0.8004778 | 0.4975552 | 138.7042 | 144.16044 |
| 76.880152 | 0.8574129 | 0.4462915 | 188.40899 | 163.30852 |
| -82.10451 | 0.8587761 | 0.6004626 | 270.98194 | 140.1592 |
| -108.2545 | 0.8942939 | 0.5932112 | 294.85515 | 95.611283 |
| 2.889172 | 0.8392834 | 0.5733343 | 161.40902 | 122.78122 |
| 142.06678 | 0.8060484 | 0.4203978 | 180.19115 | 130.78568 |
| 81.972873 | 0.8438171 | 0.4263243 | 241.43832 | 142.19408 |
| 15.126213 | 1.0287043 | 0.3564895 | 247.01019 | 176.1068 |

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| 3d average |

| **aresult\_d** | | | | |
| --- | --- | --- | --- | --- |
| 94.462636 | 0.8095192 | 0.4882608 | 161.02874 | 131.12122 |

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| 3e |

| **result\_e** | | | | |
| --- | --- | --- | --- | --- |
| 184.53882 | 0.8230227 | 0.4152801 | 82.21662 | 96.124357 |
| 45.43135 | 0.7900885 | 0.5598803 | 183.32153 | 124.32456 |
| 116.60377 | 0.6941588 | 0.5667707 | 132.01831 | 128.03151 |
| 72.869878 | 0.8721153 | 0.4426375 | 199.94234 | 140.32042 |
| 73.669596 | 0.9646794 | 0.4610754 | 79.060784 | 184.41783 |
| 152.24464 | 0.7235 | 0.5186546 | 104.8836 | 153.50064 |
| 81.622041 | 0.7887349 | 0.5162056 | 166.90325 | 137.10238 |
| 97.512291 | 0.8113705 | 0.5355313 | 101.09905 | 134.11893 |
| 88.836789 | 0.8182422 | 0.5152652 | 125.40773 | 126.03326 |
| 83.578421 | 0.8163129 | 0.4841539 | 166.61941 | 133.91166 |
| 234.40082 | 0.7748682 | 0.4618513 | 2.1836095 | 115.1286 |
| 54.490161 | 0.8413036 | 0.5194492 | 170.30484 | 117.23396 |
| 7.8209379 | 0.7701955 | 0.6259587 | 181.17202 | 86.287981 |
| 87.019703 | 0.8789191 | 0.3962178 | 199.38327 | 152.13135 |
| 48.604332 | 0.7834886 | 0.5490678 | 184.80486 | 113.2458 |
| 32.838659 | 0.9424078 | 0.4545496 | 170.93841 | 164.22339 |
| 97.877453 | 0.849642 | 0.477061 | 126.49419 | 165.09806 |
| 189.54811 | 0.7912063 | 0.4737438 | 37.039518 | 139.27651 |
| 118.13694 | 0.8784303 | 0.4288393 | 135.107 | 144.91233 |
| 107.06521 | 0.7374553 | 0.5378704 | 158.73444 | 99.200352 |
| 121.66804 | 0.7610965 | 0.4975086 | 145.59873 | 109.81538 |
| 46.038234 | 0.7730122 | 0.5418614 | 198.55485 | 132.46642 |
| 62.816824 | 0.7685096 | 0.5540043 | 175.75621 | 105.87575 |
| 74.10451 | 0.8169783 | 0.5289813 | 146.02011 | 130.43542 |
| 101.78171 | 0.794524 | 0.5194157 | 107.87127 | 119.37284 |
| 156.72359 | 0.7949022 | 0.4780927 | 75.510006 | 153.1856 |
| -3.143786 | 0.9795833 | 0.4050988 | 254.27095 | 161.75864 |
| 175.20628 | 0.7160164 | 0.4980075 | 96.729802 | 133.05692 |
| 89.880889 | 0.7908731 | 0.4888195 | 162.01028 | 146.55244 |
| -12.93745 | 0.8412112 | 0.5345437 | 241.10246 | 147.02507 |
| -5.926474 | 0.8885893 | 0.5431521 | 194.3386 | 141.56618 |
| 150.03889 | 0.7794596 | 0.4646296 | 121.25621 | 138.87202 |
| 47.218057 | 0.794731 | 0.5116662 | 185.80523 | 156.46873 |
| 18.716209 | 0.8396986 | 0.550843 | 176.56213 | 135.66811 |
| 121.0564 | 0.8541973 | 0.443307 | 141.39846 | 133.02177 |
| 127.02946 | 0.7991905 | 0.4796509 | 131.24736 | 138.25997 |
| 90.230197 | 0.7705075 | 0.4897264 | 182.07816 | 124.77919 |
| 80.526054 | 0.7168381 | 0.5500388 | 172.59294 | 135.5295 |
| 167.39722 | 0.7360619 | 0.4957977 | 81.813214 | 135.48925 |
| 77.877997 | 0.8776737 | 0.4593458 | 160.65468 | 155.89376 |
| 66.784735 | 0.9414121 | 0.4371471 | 149.33144 | 168.54986 |
| 27.262483 | 0.8618445 | 0.472669 | 243.4492 | 162.92323 |
| 155.71611 | 0.7913336 | 0.5060184 | 16.96169 | 172.42865 |
| 95.034889 | 0.8344275 | 0.4479994 | 183.29386 | 148.13504 |
| 56.429363 | 0.8034144 | 0.512033 | 188.19358 | 95.192344 |
| -26.80464 | 0.8269462 | 0.5648394 | 248.30817 | 160.28037 |
| 37.528074 | 0.8237037 | 0.5152814 | 210.00966 | 119.79652 |
| 146.70521 | 0.726783 | 0.5247418 | 122.58397 | 116.94632 |
| 54.130722 | 0.8215895 | 0.5409216 | 152.56714 | 121.78319 |
| 127.23328 | 0.7860171 | 0.4606321 | 152.71436 | 126.71854 |
| 108.9139 | 0.8278363 | 0.451987 | 164.34968 | 130.76373 |
| 172.68405 | 0.8014058 | 0.4348747 | 100.04885 | 160.04127 |
| 149.89952 | 0.8708436 | 0.3980935 | 126.54852 | 135.97513 |
| 204.45869 | 0.7150476 | 0.4728708 | 50.703137 | 158.04304 |
| 204.73245 | 0.7588977 | 0.4569018 | 50.401428 | 140.14979 |
| 48.24661 | 0.7643088 | 0.578759 | 168.81983 | 94.612231 |
| 212.74153 | 0.6909118 | 0.4949806 | 65.387335 | 114.54341 |
| 154.3806 | 0.7647785 | 0.4732514 | 100.33252 | 135.596 |
| 82.529557 | 0.863054 | 0.4602228 | 170.9251 | 136.36343 |
| 91.448138 | 0.8744237 | 0.4479087 | 137.59647 | 122.84374 |
| 85.642812 | 0.7453092 | 0.5656518 | 120.83418 | 139.61852 |
| -53.86677 | 0.9838298 | 0.5118824 | 209.02699 | 137.80094 |
| -44.03087 | 0.9211597 | 0.5330948 | 231.01195 | 145.54914 |
| 33.476292 | 0.8869307 | 0.4903305 | 201.99161 | 130.13365 |
| 118.03371 | 0.8565926 | 0.4125398 | 163.77571 | 157.6522 |
| 176.12282 | 0.7318312 | 0.5069047 | 65.929068 | 117.85237 |
| 170.951 | 0.7348283 | 0.5116183 | 76.398999 | 120.09055 |
| 207.87794 | 0.7292638 | 0.4909965 | 58.43892 | 120.68687 |
| 176.56194 | 0.7316756 | 0.4711106 | 94.535783 | 142.05142 |
| 94.192996 | 0.7787491 | 0.5189832 | 154.40352 | 131.75165 |
| -5.099673 | 0.8711762 | 0.5164152 | 227.65588 | 134.52252 |
| 77.512684 | 0.8761644 | 0.4588261 | 153.55715 | 133.34844 |
| 137.27675 | 0.7876336 | 0.4763717 | 126.90471 | 119.62067 |
| 128.82349 | 0.8347437 | 0.4336269 | 145.81878 | 179.34819 |
| 120.16683 | 0.7930507 | 0.477923 | 138.38189 | 138.56191 |
| 196.0555 | 0.7584021 | 0.4752911 | 63.67157 | 106.34914 |
| 82.673211 | 0.854328 | 0.5245743 | 105.80069 | 159.91062 |
| 63.736065 | 0.7786833 | 0.5601541 | 120.93788 | 145.11306 |
| 69.753609 | 0.8253645 | 0.4576268 | 187.42099 | 148.46695 |
| 166.58647 | 0.8174622 | 0.4518104 | 76.266137 | 128.76978 |
| -146.912 | 0.8216701 | 0.674425 | 321.98698 | 84.137193 |
| 176.32662 | 0.7899717 | 0.4827975 | 63.50421 | 135.16057 |
| 45.845355 | 0.8174487 | 0.5351518 | 186.30522 | 123.04129 |
| 132.68787 | 0.8894199 | 0.4448822 | 90.356497 | 127.60634 |
| 228.84944 | 0.6838721 | 0.4882671 | 50.255311 | 142.81963 |
| -7.892358 | 0.8283762 | 0.57016 | 209.2887 | 143.27223 |
| 82.57388 | 0.8677197 | 0.4773091 | 157.74581 | 145.29323 |
| 112.07153 | 0.8675845 | 0.4561376 | 130.80978 | 146.59217 |
| 130.53376 | 0.8067855 | 0.4779385 | 121.7736 | 133.55005 |
| 89.285288 | 0.9125835 | 0.4446977 | 112.76689 | 166.65023 |
| 136.23398 | 0.7588526 | 0.5107106 | 111.87928 | 127.83612 |
| 120.26326 | 0.7798072 | 0.4639046 | 171.12632 | 140.96162 |
| 99.09512 | 0.7561938 | 0.5000605 | 171.18615 | 126.67137 |
| -23.03811 | 0.8212614 | 0.5823104 | 217.1977 | 116.48801 |
| 102.16556 | 0.786324 | 0.4997516 | 146.23639 | 143.54968 |
| -103.8994 | 0.8041061 | 0.5972412 | 336.09537 | 95.692371 |
| 119.42183 | 0.8218376 | 0.4696494 | 125.76492 | 194.63198 |
| 123.52246 | 0.7900628 | 0.5333525 | 93.005825 | 126.57136 |
| 71.75434 | 0.8184434 | 0.5318727 | 137.77891 | 129.13753 |
| 61.025498 | 0.8597314 | 0.4897523 | 161.12844 | 140.94525 |

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| 3e average |

| **aresult\_e** | | | | |
| --- | --- | --- | --- | --- |
| 93.834287 | 0.8117201 | 0.4970279 | 145.00287 | 135.39209 |