**Results from Linear Regression Analysis**

Highest Influence Variables Mid Influence Variables Lowest Influence Variables

Agency code distinguishes between lenders- in the combined group it has high influence,

but is meaningless within a single lender group

**Key to Variables Associated with Coefficients Below**

“agency code", "property type", "loan purpose", "loan amount",

"county", "applicant race 1", "sex", "hoepa status",

"lien status", "loan type modified", "income cleaned", "income loan ratio"]]

**All Lenders**

Coefficients:

[-2.10446878e-02 -1.95126033e-01 -8.81049758e-02 5.94675167e-05

-5.90972071e-05 1.09153911e-02 -3.22002550e-02 -2.77555756e-16

-1.60400753e-01 5.83617654e-02 2.74727490e-05 -2.84877275e-04]

Mean squared error: 0.13

Variance score: 0.11

**All Banks**

Coefficients:

[-2.07480755e-02 -1.75183250e-01 -8.94022816e-02 4.17100207e-05

1.66191902e-06 1.84642903e-02 -2.92852815e-02 5.96744876e-16

-1.66949870e-01 3.93235115e-02 6.23906938e-05 -3.55406144e-04]

Mean squared error: 0.12

Variance score: 0.13

**All Online**

Coefficients:

[ 0.00000000e+00 -5.12069972e-02 -8.17226447e-02 1.73255736e-04

-3.82527873e-05 -1.70027880e-02 -2.41886597e-02 -2.77555756e-17

3.70073171e-02 8.17178658e-02 -2.14725223e-04 -1.35259511e-04]

Mean squared error: 0.13

Variance score: 0.07

**U.S. Bank**

Coefficients:

[ 0.00000000e+00 -1.92677733e-01 -1.15177032e-01 1.64413992e-04

-2.28407485e-05 3.08429792e-02 -3.86650208e-02 0.00000000e+00

-1.76475008e-01 6.30092891e-02 -1.36516695e-06 -3.37397365e-04]

Mean squared error: 0.16

Variance score: 0.09

**Wells Fargo**

Coefficients:

[ 0.00000000e+00 -2.00696984e-01 -8.53218766e-02 -5.08464455e-05

2.23573025e-05 1.91662305e-02 -2.80336551e-02 -1.38777878e-16

-1.88986841e-01 7.54008800e-02 1.41316413e-04 -4.44604220e-04]

Mean squared error: 0.14

Variance score: 0.11

**Bell Bank**

Coefficients:

[ 0.00000000e+00 4.44465513e-02 -3.27339938e-02 7.53639708e-05

1.06487962e-05 -1.90162827e-03 -1.31975543e-03 -6.93889390e-18

-4.31491538e-02 1.57652753e-02 -4.91576544e-05 -1.93935145e-04]

Mean squared error: 0.02

Variance score: 0.03

**Quicken Online**

Coefficients:

[ 0.00000000e+00 -1.06034972e-16 -3.70020747e-02 1.28400622e-04

-5.52723284e-05 4.55437207e-03 -1.36001925e-02 2.77555756e-17

-6.93889390e-18 1.24543325e-01 -4.07764924e-04 -2.28849619e-04]

Mean squared error: 0.19

Variance score: 0.01

**AMEC**

Coefficients:

[ 0.00000000e+00 -2.10310068e-01 -1.21428088e-02 -5.03996042e-06

7.43489946e-05 -8.69839888e-03 -9.52889940e-03 0.00000000e+00

1.38777878e-17 2.13380269e-02 -7.92602034e-05 -1.45271989e-04]

Mean squared error: 0.04

Variance score: 0.02

**Guaranteed Rate**

Coefficients:

[ 0.00000000e+00 -4.29344060e-17 -3.30846587e-02 1.33442551e-04

-1.04228439e-04 -1.01964537e-03 -2.29017822e-02 0.00000000e+00

7.08928436e-03 4.06042469e-02 2.10210673e-05 -1.80876035e-04]

Mean squared error: 0.05

Variance score: 0.06

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Null Hypothesis – There is no significance to this independent variable

an F-test in regression compares the fits of different linear models. Unlike t-tests that can assess only one regression coefficient at a time, the F-test can assess multiple coefficients simultaneously.

If the P value for the F-test of overall significance test is less than your significance level, you can reject the null-hypothesis and conclude that your model provides a better fit than the intercept-only model.

Great! That set of terms you included in your model improved the fit!

F-test captures only linear dependency

mutual information can capture any kind of dependency between variables

“agency code", "property type", "loan purpose", "loan amount",

"county", "applicant race 1", "sex", "hoepa status",

"lien status", "loan type modified", "income cleaned", "income loan ratio"]]

Highest f\_test

**All Lenders**

f\_test

[1.37084300e+03 1.38599479e+02 2.86100150e+03 5.86133086e+02

4.41096455e+00 1.71718082e+00 2.20435968e+02 nan

1.33548457e+03 9.33953622e+00 1.50284004e+02 1.01642297e+00]

Pval

[6.81720989e-296 5.96284360e-032 0.00000000e+000 1.03051087e-128

3.57138464e-002 1.90062607e-001 9.37122566e-050 nan

2.02629986e-288 2.24385320e-003 1.69243409e-034 3.13374075e-001]

mi

[0.0259884 0.00443392 0.04224767 0.01617257

0. 0.01321223 0.00943226 0.

0.01468929 0.00074181 0.00188357 0.01616489]

**All Banks**

f\_test

[1.39122804e+03 1.41288261e+02 2.09168086e+03 5.13262970e+02

6.75018050e-01 4.49626208e+01 6.65976748e+01 nan

1.38246627e+03 4.39049762e+01 1.39408037e+02 7.30893725e+00]

Pval

[2.74026524e-298 1.62176564e-032 0.00000000e+000 9.00117254e-113

4.11313479e-001 2.04068941e-011 3.44697551e-016 nan

1.84033702e-296 3.50013080e-011 4.16293548e-032 6.86476641e-003]

mi

[0.02036361 0.01067956 0.04837021 0.02061484

0.00131495 0.00674774 0.00558254 0.00349006

0.01897501 0. 0. 0.0181224 ]

**All Online**

f\_test

[ nan 0.99384046 819.50402253 72.41799899

6.50179656 164.2633322 196.57295934 nan

8.38009787 135.0780899 13.16643845 6.52124955]

Pval

[ nan 3.18821562e-001 1.50405697e-175 1.90361302e-017

1.07863740e-002 2.07854861e-037 2.22218636e-044 nan

3.79897057e-003 4.30908152e-031 2.85951070e-004 1.06690727e-002]

mi

[0. 0. 0.03328211 0.02159139

0.00107943 0.01635314 0.0142306 0.

0. 0.00201675 0.00227083 0.00618493]

**U.S.Bank**

f\_test

[ nan 2.17905038e+01 6.56509594e+02 2.34078039e+02

3.91954978e-01 1.37222538e+01 6.28971370e+01 nan

2.99319429e+02 4.35454825e+00 6.52436125e+01 1.67545905e+01]

Pval

[ nan 3.07799926e-006 1.41826332e-140 2.74869165e-052

5.31286932e-001 2.12996212e-004 2.39505352e-015 nan

3.67432728e-066 3.69338774e-002 7.33068106e-016 4.28519262e-005]

mi

[0.00000000e+00 0.00000000e+00 4.18625719e-02 1.24426857e-02

0.00000000e+00 1.26349362e-03 0.00000000e+00 0.00000000e+00

1.29332274e-02 8.33158763e-05 9.80933164e-03 1.80693741e-02]

**Wells Fargo**

f\_test

[ nan 7.87434918e+01 4.79052009e+02 1.33944393e+02

1.13179788e-01 3.19847060e+01 2.46875909e+01 nan

6.95962037e+02 9.52472637e+00 6.80946487e+01 4.40955439e+01]

Pval

[ nan 7.86002006e-019 1.47929002e-104 7.59815777e-031

7.36557341e-001 1.58226999e-008 6.81598696e-007 nan

5.83561546e-150 2.03091257e-003 1.68698756e-016 3.23486534e-011]

mi

[1.56784960e-06 0.00000000e+00 3.40293971e-02 1.72906653e-02

5.71129856e-03 9.63760100e-04 0.00000000e+00 2.61418882e-03

2.31551394e-02 0.00000000e+00 1.12949958e-02 2.32191629e-02]

**Bell Bank**

f\_test

[ nan 1.50015406e-01 1.33979572e+02 1.44028184e+01

1.19088040e+00 4.01768779e-01 6.46107877e-02 nan

5.91079484e+00 1.52404608e+01 8.54703522e+00 5.06877829e+01]

Pval

[ nan 6.98531960e-01 1.02423372e-30 1.48778828e-04

2.75188162e-01 5.26197114e-01 7.99358643e-01 nan

1.50723562e-02 9.55083862e-05 3.47151939e-03 1.18640936e-12]

mi

[0. 0. 0. 0.

0. 0. 0. 0.

0.00172052 0. 0.00512173 0.00842143]

**Quicken Online**

f\_test

[ nan nan 36.63749587 0.33156315

0.88955416 0.59190234 3.48708513 nan

nan 115.07960029 0.23806843 3.76502041]

Pval

[ nan nan 1.48384623e-09 5.64755560e-01

3.45625348e-01 4.41706123e-01 6.18842861e-02 nan

nan 1.12597120e-26 6.25617455e-01 5.23687230e-02]

mi

[0. 0. 0. 0.00732578

0.01105437 0.00932822 0.0064745 0.00463959

0.01021399 0.00589754 0.00440411 0.0041809 ]

**AMEC**

f\_test

[ nan 33.59494947 13.98480755 2.87074555

0.17699363 2.59972592 0.50818004 nan

nan 19.93802552 2.04164682 30.01253525]

Pval

[ nan 7.17491970e-09 1.86219907e-04 9.02612662e-02

6.73986596e-01 1.06941169e-01 4.75958852e-01 nan

nan 8.16381624e-06 1.53102250e-01 4.48879613e-08]

mi

[0. 0. 0.00236185 0.00522266

0.01553847 0. 0.01347353 0.01326397

0.01193667 0.00932071 0. 0.0289505 ]

**Guaranteed Rate**

f\_test

[ nan nan 28.2968896 9.24480657

1.54162222 0.07433243 7.27293561 nan

2.20356287 9.01981418 15.91396496 43.15042408]

Pval

[ nan nan 1.22086979e-07 2.40808458e-03

2.14596744e-01 7.85172734e-01 7.08906934e-03 nan

1.37930547e-01 2.72087772e-03 6.99216929e-05 7.26925019e-11]

mi

[0.01698757 0.01063075 0.03407852 0.0183266

0. 0. 0. 0.

0. 0.02409532 0.0190386 0. ]

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