Reggression

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## R Markdown

MasterData\_Sales <- read.csv(file = "C:/Users/Kristopher/odrive/Google Drive/Water Transfer Project/Modified\_Data\_Models/MasterData\_Sales.csv")

# Sales

table(MasterData\_Sales$Type)

##   
## AgtoAg AgtoEnvio AgtoUrban UrbantoAg UrbantoEnviro   
## 194 55 918 8 4   
## UrbantoUrban   
## 170

mean(MasterData\_Sales$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Sales$Type)

## AgtoAg AgtoEnvio AgtoUrban UrbantoAg UrbantoEnviro   
## 2723.7021 2917.1864 5135.3672 298.4463 161.1661   
## UrbantoUrban   
## 2058.3235

sd(MasterData\_Sales$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Sales$Type)

## AgtoAg AgtoEnvio AgtoUrban UrbantoAg UrbantoEnviro   
## 3089.2018 4913.1470 4309.8446 401.7575 216.7191   
## UrbantoUrban   
## 2893.5597

table(MasterData\_Sales$State)

##   
## AZ CA CO ID MT NM NV OR TX UT WA WY   
## 89 29 960 17 2 54 81 11 49 42 11 4

mean(MasterData\_Sales$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Sales$State)

## AZ CA CO ID MT NM   
## 1088.70127 1527.60235 5333.22565 88.33752 1857.68115 1857.77670   
## NV OR TX UT WA WY   
## 3895.10832 139.70462 501.92270 936.15086 412.56849 984.48142

sd(MasterData\_Sales$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Sales$State)

## AZ CA CO ID MT NM   
## 1546.96365 2603.55383 4189.01755 63.13781 2485.42214 1660.43811   
## NV OR TX UT WA WY   
## 5068.30221 121.96956 430.60430 830.06278 360.61872 706.85770

## Regression

reg1 <- lm(log(InflationAdjustedPricePerAnnualAcreFoot) ~ CommitedAverageAcreFeet + AgtoUrban + AgtoEnivo + UrbantoAg + UrbantoEnviro + UrbantoUrban + PDSI + Jan + Feb + Mar + Apr + May + Jun + Jul.Aug + Oct + Nov + Dec + AZ + CA + ID + MT + NM + NV + OR + TX + UT + WA + WY, data = MasterData\_Sales)  
summary(reg1)

##   
## Call:  
## lm(formula = log(InflationAdjustedPricePerAnnualAcreFoot) ~ CommitedAverageAcreFeet +   
## AgtoUrban + AgtoEnivo + UrbantoAg + UrbantoEnviro + UrbantoUrban +   
## PDSI + Jan + Feb + Mar + Apr + May + Jun + Jul.Aug + Oct +   
## Nov + Dec + AZ + CA + ID + MT + NM + NV + OR + TX + UT +   
## WA + WY, data = MasterData\_Sales)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -8.5705 -0.7377 0.1982 0.6925 3.1292   
##   
## Coefficients:  
## Estimate Std. Error t value  
## (Intercept) 7.5033524857 0.1255742404 59.752  
## CommitedAverageAcreFeet -0.0000005550 0.0000001581 -3.511  
## AgtoUrban 0.7962309038 0.0867149294 9.182  
## AgtoEnivo 0.4464011793 0.1963916576 2.273  
## UrbantoAg -1.4224713577 0.4084940495 -3.482  
## UrbantoEnviro -1.0846433883 0.5614886799 -1.932  
## UrbantoUrban 0.6656139826 0.1325260364 5.023  
## PDSI -0.0861367845 0.0114067460 -7.551  
## Jan 0.0483469269 0.1343066126 0.360  
## Feb -0.1884133811 0.1371265617 -1.374  
## Mar 0.1235308885 0.1387853218 0.890  
## Apr -0.0523247551 0.1454637528 -0.360  
## May -0.2788744487 0.1377719905 -2.024  
## Jun 0.0082847230 0.1380359680 0.060  
## Jul.Aug -0.1688548755 0.1278168210 -1.321  
## Oct -0.0704721632 0.1436347978 -0.491  
## Nov -0.0692064731 0.1542803659 -0.449  
## Dec -0.0468199529 0.1607595708 -0.291  
## AZ -1.8235258665 0.1471043498 -12.396  
## CA -1.5310982557 0.2091975550 -7.319  
## ID -3.0610382858 0.2840855566 -10.775  
## MT -1.7985129854 0.7651948077 -2.350  
## NM -0.8052873422 0.1534368111 -5.248  
## NV -0.4521047275 0.1396376451 -3.238  
## OR -3.6860670591 0.3644767874 -10.113  
## TX -2.1301305775 0.1628779004 -13.078  
## UT -1.7023036619 0.1697023977 -10.031  
## WA -2.1968634433 0.3374596682 -6.510  
## WY -1.4998274874 0.5455154142 -2.749  
## Pr(>|t|)   
## (Intercept) < 0.0000000000000002 \*\*\*  
## CommitedAverageAcreFeet 0.000462 \*\*\*  
## AgtoUrban < 0.0000000000000002 \*\*\*  
## AgtoEnivo 0.023185 \*   
## UrbantoAg 0.000513 \*\*\*  
## UrbantoEnviro 0.053607 .   
## UrbantoUrban 0.000000579822457 \*\*\*  
## PDSI 0.000000000000080 \*\*\*  
## Jan 0.718924   
## Feb 0.169672   
## Mar 0.373582   
## Apr 0.719122   
## May 0.043153 \*   
## Jun 0.952150   
## Jul.Aug 0.186707   
## Oct 0.623767   
## Nov 0.653811   
## Dec 0.770912   
## AZ < 0.0000000000000002 \*\*\*  
## CA 0.000000000000433 \*\*\*  
## ID < 0.0000000000000002 \*\*\*  
## MT 0.018900 \*   
## NM 0.000000178662038 \*\*\*  
## NV 0.001235 \*\*   
## OR < 0.0000000000000002 \*\*\*  
## TX < 0.0000000000000002 \*\*\*  
## UT < 0.0000000000000002 \*\*\*  
## WA 0.000000000106503 \*\*\*  
## WY 0.006052 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.068 on 1320 degrees of freedom  
## Multiple R-squared: 0.4554, Adjusted R-squared: 0.4438   
## F-statistic: 39.42 on 28 and 1320 DF, p-value: < 0.00000000000000022

bptest(reg1)

##   
## studentized Breusch-Pagan test  
##   
## data: reg1  
## BP = 71.054, df = 28, p-value = 0.00001324

vif(reg1)

## CommitedAverageAcreFeet AgtoUrban AgtoEnivo   
## 1.118925 1.932244 1.782778   
## UrbantoAg UrbantoEnviro UrbantoUrban   
## 1.162638 1.101586 2.286227   
## PDSI Jan Feb   
## 1.066553 2.070002 1.975071   
## Mar Apr May   
## 1.968751 1.826288 1.980344   
## Jun Jul.Aug Oct   
## 1.974501 2.295213 1.841269   
## Nov Dec AZ   
## 1.660893 1.603757 1.576035   
## CA ID MT   
## 1.088026 1.186877 1.024462   
## NM NV OR   
## 1.069244 1.300659 1.269822   
## TX UT WA   
## 1.097534 1.026727 1.088546   
## WY   
## 1.039802

resettest(reg1)

##   
## RESET test  
##   
## data: reg1  
## RESET = 13.75, df1 = 2, df2 = 1318, p-value = 0.00000123

dwtest(reg1)

##   
## Durbin-Watson test  
##   
## data: reg1  
## DW = 1.2834, p-value < 0.00000000000000022  
## alternative hypothesis: true autocorrelation is greater than 0

reg2 <- coeftest(reg1, vcov. = vcovHC(reg1, "HC1"))  
reg2

##   
## t test of coefficients:  
##   
## Estimate Std. Error t value  
## (Intercept) 7.50335248567 0.13846700597 54.1887  
## CommitedAverageAcreFeet -0.00000055502 0.00000020949 -2.6494  
## AgtoUrban 0.79623090384 0.10341816622 7.6991  
## AgtoEnivo 0.44640117932 0.25690169808 1.7376  
## UrbantoAg -1.42247135773 0.58855418971 -2.4169  
## UrbantoEnviro -1.08464338833 0.69593874420 -1.5585  
## UrbantoUrban 0.66561398264 0.20833161326 3.1950  
## PDSI -0.08613678446 0.01093810385 -7.8749  
## Jan 0.04834692687 0.13631168129 0.3547  
## Feb -0.18841338111 0.13530240272 -1.3925  
## Mar 0.12353088848 0.12895041061 0.9580  
## Apr -0.05232475510 0.13276312016 -0.3941  
## May -0.27887444868 0.14854721495 -1.8773  
## Jun 0.00828472305 0.13300454801 0.0623  
## Jul.Aug -0.16885487554 0.14122290743 -1.1957  
## Oct -0.07047216321 0.13794802830 -0.5109  
## Nov -0.06920647310 0.14688678847 -0.4712  
## Dec -0.04681995294 0.14544260500 -0.3219  
## AZ -1.82352586651 0.29847097316 -6.1096  
## CA -1.53109825569 0.28985560854 -5.2823  
## ID -3.06103828576 0.27114011172 -11.2895  
## MT -1.79851298537 1.28687335407 -1.3976  
## NM -0.80528734217 0.13164835016 -6.1170  
## NV -0.45210472754 0.14179135502 -3.1885  
## OR -3.68606705911 0.45533581603 -8.0953  
## TX -2.13013057751 0.13865960610 -15.3623  
## UT -1.70230366191 0.17438296987 -9.7619  
## WA -2.19686344327 0.23514921686 -9.3424  
## WY -1.49982748739 0.35487521399 -4.2264  
## Pr(>|t|)   
## (Intercept) < 0.00000000000000022 \*\*\*  
## CommitedAverageAcreFeet 0.008159 \*\*   
## AgtoUrban 0.000000000000026717 \*\*\*  
## AgtoEnivo 0.082509 .   
## UrbantoAg 0.015789 \*   
## UrbantoEnviro 0.119347   
## UrbantoUrban 0.001432 \*\*   
## PDSI 0.000000000000007069 \*\*\*  
## Jan 0.722887   
## Feb 0.163995   
## Mar 0.338252   
## Apr 0.693555   
## May 0.060691 .   
## Jun 0.950342   
## Jul.Aug 0.232043   
## Oct 0.609534   
## Nov 0.637608   
## Dec 0.747569   
## AZ 0.000000001312410822 \*\*\*  
## CA 0.000000149084594663 \*\*\*  
## ID < 0.00000000000000022 \*\*\*  
## MT 0.162473   
## NM 0.000000001254529258 \*\*\*  
## NV 0.001464 \*\*   
## OR 0.000000000000001286 \*\*\*  
## TX < 0.00000000000000022 \*\*\*  
## UT < 0.00000000000000022 \*\*\*  
## WA < 0.00000000000000022 \*\*\*  
## WY 0.000025383645981889 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Leases

MasterData\_Leases <- read.csv(file = "C:/Users/Kristopher/odrive/Google Drive/Water Transfer Project/Modified\_Data\_Models/MasterData\_Leases.csv")  
  
# Regression without the zero price listed in the dataset  
leasereg1.1 <- lm(log(InflationAdjustedPricePerAnnualAcreFoot) ~ AgtoUrban + AgtoEnivo + UrbantoAg + UrbantoEnviro + UrbantoUrban + EnvirotoEnviro + CommitedAverageAcreFeet + LeaseDuration + PDSI + Jan + Feb + Mar + Apr + May + Jun + Jul.Aug + Oct + Nov + Dec + AZ + CA + ID + MT + NM + NV + OR + TX + UT + WA + WY, data = subset(MasterData\_Leases, InflationAdjustedPricePerAnnualAcreFoot!= 0))  
  
bptest(leasereg1.1)

##   
## studentized Breusch-Pagan test  
##   
## data: leasereg1.1  
## BP = 120.78, df = 30, p-value = 0.0000000000007544

vif(leasereg1.1)

## AgtoUrban AgtoEnivo UrbantoAg   
## 1.721202 1.739278 1.183927   
## UrbantoEnviro UrbantoUrban EnvirotoEnviro   
## 1.535589 1.585610 1.057708   
## CommitedAverageAcreFeet LeaseDuration PDSI   
## 1.108168 1.180445 1.250801   
## Jan Feb Mar   
## 1.718966 1.874988 1.524031   
## Apr May Jun   
## 1.770328 1.613700 1.703262   
## Jul.Aug Oct Nov   
## 1.592376 1.910659 1.552874   
## Dec AZ CA   
## 1.693741 1.505276 2.661094   
## ID MT NM   
## 1.982122 1.546458 1.820637   
## NV OR TX   
## 1.077980 1.668344 2.080225   
## UT WA WY   
## 1.203080 1.262136 1.400100

resettest(leasereg1.1)

##   
## RESET test  
##   
## data: leasereg1.1  
## RESET = 4.1422, df1 = 2, df2 = 662, p-value = 0.0163

dwtest(leasereg1.1)

##   
## Durbin-Watson test  
##   
## data: leasereg1.1  
## DW = 1.8586, p-value = 0.006604  
## alternative hypothesis: true autocorrelation is greater than 0

leasereg2.1 <- coeftest(leasereg1.1, vcov. = vcovHC(leasereg1.1, "HC1"))  
print(summary(leasereg1.1))

##   
## Call:  
## lm(formula = log(InflationAdjustedPricePerAnnualAcreFoot) ~ AgtoUrban +   
## AgtoEnivo + UrbantoAg + UrbantoEnviro + UrbantoUrban + EnvirotoEnviro +   
## CommitedAverageAcreFeet + LeaseDuration + PDSI + Jan + Feb +   
## Mar + Apr + May + Jun + Jul.Aug + Oct + Nov + Dec + AZ +   
## CA + ID + MT + NM + NV + OR + TX + UT + WA + WY, data = subset(MasterData\_Leases,   
## InflationAdjustedPricePerAnnualAcreFoot != 0))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.3554 -0.7272 -0.0557 0.7136 4.3963   
##   
## Coefficients:  
## Estimate Std. Error t value  
## (Intercept) 2.8208873730 0.2152971113 13.102  
## AgtoUrban 1.0404491497 0.1543898175 6.739  
## AgtoEnivo 0.3208803277 0.1533920066 2.092  
## UrbantoAg -0.5916672850 0.3458365609 -1.711  
## UrbantoEnviro -0.0411789036 0.2751706140 -0.150  
## UrbantoUrban 1.4580276642 0.1768180467 8.246  
## EnvirotoEnviro -0.1086634890 0.7919689709 -0.137  
## CommitedAverageAcreFeet -0.0000002221 0.0000002137 -1.039  
## LeaseDuration 0.0402196103 0.0046033164 8.737  
## PDSI -0.0512905696 0.0234393051 -2.188  
## Jan 0.1150115043 0.2289117025 0.502  
## Feb 0.0848290922 0.2296937824 0.369  
## Mar -0.1294105166 0.2615499247 -0.495  
## Apr 0.0345362825 0.2275876168 0.152  
## May -0.3938577678 0.2481906949 -1.587  
## Jun -0.2882222972 0.2232350932 -1.291  
## Jul.Aug 0.2347453422 0.2359882927 0.995  
## Oct 0.0172451985 0.2059102477 0.084  
## Nov -0.4397216050 0.2670092110 -1.647  
## Dec 0.1923854001 0.2339375500 0.822  
## AZ 0.5676931010 0.2912467342 1.949  
## CA 0.6069014748 0.1813718867 3.346  
## ID -1.8750057353 0.2277466808 -8.233  
## MT -0.0365292812 0.2870794040 -0.127  
## NM 0.4398270702 0.2566523584 1.714  
## NV 1.8420587090 0.7995224548 2.304  
## OR -0.5427088075 0.2456836749 -2.209  
## TX -0.0121495947 0.2211241836 -0.055  
## UT -0.6419175918 0.3941383201 -1.629  
## WA 0.0982192100 0.3313236550 0.296  
## WY -1.1795692052 0.2987323947 -3.949  
## Pr(>|t|)   
## (Intercept) < 0.0000000000000002 \*\*\*  
## AgtoUrban 0.000000000034613977 \*\*\*  
## AgtoEnivo 0.036827 \*   
## UrbantoAg 0.087580 .   
## UrbantoEnviro 0.881087   
## UrbantoUrban 0.000000000000000878 \*\*\*  
## EnvirotoEnviro 0.890909   
## CommitedAverageAcreFeet 0.299183   
## LeaseDuration < 0.0000000000000002 \*\*\*  
## PDSI 0.029001 \*   
## Jan 0.615534   
## Feb 0.712012   
## Mar 0.620917   
## Apr 0.879431   
## May 0.113008   
## Jun 0.197113   
## Jul.Aug 0.320228   
## Oct 0.933280   
## Nov 0.100064   
## Dec 0.411156   
## AZ 0.051694 .   
## CA 0.000866 \*\*\*  
## ID 0.000000000000000970 \*\*\*  
## MT 0.898785   
## NM 0.087049 .   
## NV 0.021533 \*   
## OR 0.027517 \*   
## TX 0.956199   
## UT 0.103859   
## WA 0.766983   
## WY 0.000087011994028711 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.331 on 664 degrees of freedom  
## Multiple R-squared: 0.4733, Adjusted R-squared: 0.4495   
## F-statistic: 19.89 on 30 and 664 DF, p-value: < 0.00000000000000022

leasereg2.1

##   
## t test of coefficients:  
##   
## Estimate Std. Error t value  
## (Intercept) 2.82088737296 0.19300676779 14.6155  
## AgtoUrban 1.04044914966 0.13295129450 7.8258  
## AgtoEnivo 0.32088032775 0.19301626059 1.6625  
## UrbantoAg -0.59166728498 0.25962412041 -2.2789  
## UrbantoEnviro -0.04117890363 0.24903449986 -0.1654  
## UrbantoUrban 1.45802766418 0.16922377388 8.6160  
## EnvirotoEnviro -0.10866348901 0.35182606704 -0.3089  
## CommitedAverageAcreFeet -0.00000022207 0.00000017324 -1.2819  
## LeaseDuration 0.04021961034 0.01564455501 2.5708  
## PDSI -0.05129056957 0.02519288784 -2.0359  
## Jan 0.11501150430 0.26647400607 0.4316  
## Feb 0.08482909215 0.29755598575 0.2851  
## Mar -0.12941051657 0.31655001912 -0.4088  
## Apr 0.03453628252 0.25998142686 0.1328  
## May -0.39385776782 0.25642807909 -1.5359  
## Jun -0.28822229723 0.27755890567 -1.0384  
## Jul.Aug 0.23474534216 0.26941502885 0.8713  
## Oct 0.01724519850 0.28961066781 0.0595  
## Nov -0.43972160501 0.30005070492 -1.4655  
## Dec 0.19238540010 0.30237111603 0.6363  
## AZ 0.56769310102 0.28095543500 2.0206  
## CA 0.60690147482 0.20171828612 3.0087  
## ID -1.87500573528 0.24772534237 -7.5689  
## MT -0.03652928123 0.34978311589 -0.1044  
## NM 0.43982707022 0.23650485684 1.8597  
## NV 1.84205870901 0.73618281172 2.5022  
## OR -0.54270880749 0.34883954526 -1.5558  
## TX -0.01214959466 0.22173797191 -0.0548  
## UT -0.64191759176 0.27960673446 -2.2958  
## WA 0.09821920995 0.26080735684 0.3766  
## WY -1.17956920517 0.26894246005 -4.3860  
## Pr(>|t|)   
## (Intercept) < 0.00000000000000022 \*\*\*  
## AgtoUrban 0.00000000000001995 \*\*\*  
## AgtoEnivo 0.096894 .   
## UrbantoAg 0.022987 \*   
## UrbantoEnviro 0.868716   
## UrbantoUrban < 0.00000000000000022 \*\*\*  
## EnvirotoEnviro 0.757528   
## CommitedAverageAcreFeet 0.200334   
## LeaseDuration 0.010362 \*   
## PDSI 0.042155 \*   
## Jan 0.666169   
## Feb 0.775667   
## Mar 0.682807   
## Apr 0.894359   
## May 0.125030   
## Jun 0.299453   
## Jul.Aug 0.383897   
## Oct 0.952535   
## Nov 0.143260   
## Dec 0.524829   
## AZ 0.043724 \*   
## CA 0.002723 \*\*   
## ID 0.00000000000012623 \*\*\*  
## MT 0.916856   
## NM 0.063371 .   
## NV 0.012583 \*   
## OR 0.120243   
## TX 0.956320   
## UT 0.021999 \*   
## WA 0.706594   
## WY 0.00001342618365423 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

table(MasterData\_Leases$Type)

##   
## AgtoAg AgtoEnivo AgtoUrban EnvirotoEnviro UrbantoAg   
## 186 176 169 3 18   
## UrbantoEnviro UrbantoUrban   
## 38 106

mean(MasterData\_Leases$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Leases$Type)

## AgtoAg AgtoEnivo AgtoUrban EnvirotoEnviro UrbantoAg   
## 53.33864 86.51594 315.74080 28.51805 23.80605   
## UrbantoEnviro UrbantoUrban   
## 45.26804 785.24465

sd(MasterData\_Leases$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Leases$Type)

## AgtoAg AgtoEnivo AgtoUrban EnvirotoEnviro UrbantoAg   
## 157.682002 260.165260 1207.786081 9.881087 45.760183   
## UrbantoEnviro UrbantoUrban   
## 72.010168 2711.654035

table(MasterData\_Leases$State)

##   
## AZ CA CO ID MT NM NV OR TX UT WA WY   
## 33 202 91 76 35 53 3 53 86 14 21 29

mean(MasterData\_Leases$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Leases$State)

## AZ CA CO ID MT NM   
## 204.64118 384.81845 402.10230 18.11057 166.55586 112.44144   
## NV OR TX UT WA WY   
## 1837.41652 70.72935 207.49377 33.21538 68.50149 25.04151

sd(MasterData\_Leases$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Leases$State)

## AZ CA CO ID MT NM   
## 342.03068 1977.80598 1615.44874 55.97467 387.88359 293.73719   
## NV OR TX UT WA WY   
## 2002.54663 205.12353 358.48793 45.66607 94.36266 21.89055