Reggression

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March 28, 2017

## R Markdown

MasterData\_Sales <- read.csv(file = "C:/Users/Kristopher/odrive/Google Drive/Water Transfer Project/Modified\_Data\_Models/MasterData\_Sales.csv")  
# Removing the outliers  
MasterData\_Sales <- subset(MasterData\_Sales, ObsNumber != "719" & ObsNumber != "722" & ObsNumber != "706")

# Sales

sum(MasterData\_Sales$AgtoAg)

## [1] 194

sum(MasterData\_Sales$AgtoEnivo)

## [1] 55

sum(MasterData\_Sales$AgtoUrban)

## [1] 918

sum(MasterData\_Sales$UrbantoAg)

## [1] 8

sum(MasterData\_Sales$UrbantoEnviro)

## [1] 4

sum(MasterData\_Sales$UrbantoUrban)

## [1] 170

sum(MasterData\_Sales$EnvirotoAg)

## [1] 0

sum(MasterData\_Sales$EnvirotoUrban)

## [1] 0

sum(MasterData\_Sales$EnvirotoEnviro)

## [1] 0

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

## AgtoAg AgtoEnvio AgtoUrban EnvirotoEnviro UrbantoAg   
## 2723.7021 2917.1864 5135.3672 2407.8020 298.4463   
## UrbantoEnviro UrbantoUrban   
## 161.1661 2058.3235

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

## AZ CA CO ID MT NM   
## 1066.27442 1522.16317 5337.05774 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$InflationAdjustedPricePerAnnualAcreFoot ~ MasterData\_Sales$Type)

## AgtoAg AgtoEnvio AgtoUrban EnvirotoEnviro UrbantoAg   
## 3089.2018 4913.1470 4309.8446 3769.2113 401.7575   
## UrbantoEnviro UrbantoUrban   
## 216.7191 2893.5597

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

## AZ CA CO ID MT NM   
## 1537.05798 2517.70526 4188.52017 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   
## -8.5287 -0.7303 0.1942 0.6924 3.0535   
##   
## Coefficients:  
## Estimate Std. Error t value  
## (Intercept) 7.5187024549 0.1240604206 60.605  
## CommitedAverageAcreFeet -0.0000005615 0.0000001581 -3.552  
## AgtoUrban 0.7959809419 0.0859032702 9.266  
## AgtoEnivo 0.4495384962 0.1957946392 2.296  
## UrbantoAg -1.4269631584 0.4086367707 -3.492  
## UrbantoEnviro -1.0831368185 0.5617923296 -1.928  
## UrbantoUrban 0.6828325025 0.1303957132 5.237  
## PDSI -0.0869779571 0.0113932680 -7.634  
## Jan 0.0338903584 0.1337195369 0.253  
## Feb -0.2057485704 0.1364796859 -1.508  
## Mar 0.1176139067 0.1378946816 0.853  
## Apr -0.0681908516 0.1449099365 -0.471  
## May -0.2945214474 0.1370709729 -2.149  
## Jun -0.0071130195 0.1375170573 -0.052  
## Jul.Aug -0.1825999244 0.1272918457 -1.434  
## Oct -0.1122462649 0.1423910764 -0.788  
## Nov -0.0875232619 0.1537028668 -0.569  
## Dec -0.0604624785 0.1603563723 -0.377  
## AZ -1.8697176281 0.1448202162 -12.911  
## CA -1.4788090591 0.2022462484 -7.312  
## ID -3.0562541064 0.2841906005 -10.754  
## MT -1.8016941790 0.7656890226 -2.353  
## NM -0.8060181219 0.1534959118 -5.251  
## NV -0.4599324995 0.1395743531 -3.295  
## OR -3.6948024115 0.3646351467 -10.133  
## TX -2.1284565893 0.1629660528 -13.061  
## UT -1.7044037716 0.1698126296 -10.037  
## WA -2.1981005022 0.3376343024 -6.510  
## WY -1.5058697574 0.5458726029 -2.759  
## Pr(>|t|)   
## (Intercept) < 0.0000000000000002 \*\*\*  
## CommitedAverageAcreFeet 0.000395 \*\*\*  
## AgtoUrban < 0.0000000000000002 \*\*\*  
## AgtoEnivo 0.021833 \*   
## UrbantoAg 0.000495 \*\*\*  
## UrbantoEnviro 0.054068 .   
## UrbantoUrban 0.0000001900229910 \*\*\*  
## PDSI 0.0000000000000433 \*\*\*  
## Jan 0.799965   
## Feb 0.131911   
## Mar 0.393855   
## Apr 0.638022   
## May 0.031841 \*   
## Jun 0.958756   
## Jul.Aug 0.151666   
## Oct 0.430665   
## Nov 0.569160   
## Dec 0.706196   
## AZ < 0.0000000000000002 \*\*\*  
## CA 0.0000000000004541 \*\*\*  
## ID < 0.0000000000000002 \*\*\*  
## MT 0.018766 \*   
## NM 0.0000001759781148 \*\*\*  
## NV 0.001009 \*\*   
## OR < 0.0000000000000002 \*\*\*  
## TX < 0.0000000000000002 \*\*\*  
## UT < 0.0000000000000002 \*\*\*  
## WA 0.0000000001061626 \*\*\*  
## WY 0.005884 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.069 on 1325 degrees of freedom  
## Multiple R-squared: 0.4578, Adjusted R-squared: 0.4463   
## F-statistic: 39.95 on 28 and 1325 DF, p-value: < 0.00000000000000022

bptest(reg1)

##   
## studentized Breusch-Pagan test  
##   
## data: reg1  
## BP = 69.685, df = 28, p-value = 0.00002059

vif(reg1)

## CommitedAverageAcreFeet AgtoUrban AgtoEnivo   
## 1.117370 1.908611 1.769874   
## UrbantoAg UrbantoEnviro UrbantoUrban   
## 1.161927 1.101322 2.211547   
## PDSI Jan Feb   
## 1.065524 2.050138 1.954664   
## Mar Apr May   
## 1.955188 1.810570 1.958416   
## Jun Jul.Aug Oct   
## 1.957851 2.274709 1.837319   
## Nov Dec AZ   
## 1.646696 1.593944 1.557657   
## CA ID MT   
## 1.084055 1.186229 1.024425   
## NM NV OR   
## 1.068808 1.298056 1.269272   
## TX UT WA   
## 1.097412 1.026814 1.088255   
## WY   
## 1.039789

resettest(reg1)

##   
## RESET test  
##   
## data: reg1  
## RESET = 12.081, df1 = 2, df2 = 1323, p-value = 0.000006322

dwtest(reg1)

##   
## Durbin-Watson test  
##   
## data: reg1  
## DW = 1.2488, 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) 7.51870245494 0.13640973274 55.1185  
## CommitedAverageAcreFeet -0.00000056153 0.00000021241 -2.6436  
## AgtoUrban 0.79598094193 0.10187933180 7.8130  
## AgtoEnivo 0.44953849617 0.25441987509 1.7669  
## UrbantoAg -1.42696315840 0.58969521739 -2.4198  
## UrbantoEnviro -1.08313681853 0.69545544255 -1.5574  
## UrbantoUrban 0.68283250253 0.20114516638 3.3947  
## PDSI -0.08697795705 0.01095340864 -7.9407  
## Jan 0.03389035837 0.13569115039 0.2498  
## Feb -0.20574857042 0.13512468568 -1.5227  
## Mar 0.11761390672 0.12839779688 0.9160  
## Apr -0.06819085161 0.13186704992 -0.5171  
## May -0.29452144742 0.14830035568 -1.9860  
## Jun -0.00711301950 0.13251598789 -0.0537  
## Jul.Aug -0.18259992442 0.14112865134 -1.2939  
## Oct -0.11224626492 0.13712770566 -0.8186  
## Nov -0.08752326191 0.14591621513 -0.5998  
## Dec -0.06046247849 0.14503414065 -0.4169  
## AZ -1.86971762805 0.28955677791 -6.4572  
## CA -1.47880905908 0.27373958378 -5.4022  
## ID -3.05625410641 0.27135302072 -11.2630  
## MT -1.80169417899 1.28996160645 -1.3967  
## NM -0.80601812194 0.13150473842 -6.1292  
## NV -0.45993249949 0.14071834774 -3.2685  
## OR -3.69480241145 0.45502082571 -8.1201  
## TX -2.12845658925 0.13908496375 -15.3033  
## UT -1.70440377161 0.17473217928 -9.7544  
## WA -2.19810050216 0.23400085498 -9.3936  
## WY -1.50586975739 0.35341766947 -4.2609  
## Pr(>|t|)   
## (Intercept) < 0.00000000000000022 \*\*\*  
## CommitedAverageAcreFeet 0.0082986 \*\*   
## AgtoUrban 0.000000000000011298 \*\*\*  
## AgtoEnivo 0.0774725 .   
## UrbantoAg 0.0156615 \*   
## UrbantoEnviro 0.1196026   
## UrbantoUrban 0.0007073 \*\*\*  
## PDSI 0.000000000000004257 \*\*\*  
## Jan 0.8028109   
## Feb 0.1280831   
## Mar 0.3598273   
## Apr 0.6051600   
## May 0.0472414 \*   
## Jun 0.9572008   
## Jul.Aug 0.1959412   
## Oct 0.4131888   
## Nov 0.5487297   
## Dec 0.6768305   
## AZ 0.000000000149372510 \*\*\*  
## CA 0.000000077937942043 \*\*\*  
## ID < 0.00000000000000022 \*\*\*  
## MT 0.1627366   
## NM 0.000000001163029975 \*\*\*  
## NV 0.0011091 \*\*   
## OR 0.000000000000001056 \*\*\*  
## TX < 0.00000000000000022 \*\*\*  
## UT < 0.00000000000000022 \*\*\*  
## WA < 0.00000000000000022 \*\*\*  
## WY 0.000021801892436859 \*\*\*  
## ---  
## 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  
## (68 observations deleted due to missingness)  
## 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

sum(MasterData\_Leases$AgtoAg)

## [1] 213

sum(MasterData\_Leases$AgtoEnivo)

## [1] 187

sum(MasterData\_Leases$AgtoUrban)

## [1] 186

sum(MasterData\_Leases$UrbantoAg)

## [1] 19

sum(MasterData\_Leases$UrbantoEnviro)

## [1] 39

sum(MasterData\_Leases$UrbantoUrban)

## [1] 116

sum(MasterData\_Leases$EnvirotoAg)

## [1] 0

sum(MasterData\_Leases$EnvirotoUrban)

## [1] NA

sum(MasterData\_Leases$EnvirotoEnviro)

## [1] 4

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

## AgtoAg AgtoEnivo AgtoUrban EnvirotoEnviro UrbantoAg   
## 54.15063 83.54624 294.07350 22.74252 24.61166   
## UrbantoEnviro UrbantoUrban   
## 44.86851 744.98890

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

## AZ CA CO ID MT NM   
## 211.76593 326.17544 395.29461 19.12247 161.98486 110.90894   
## NV OR TX UT WA WY   
## 1837.41652 70.72935 198.81653 33.21538 68.50149 23.19546

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

## AgtoAg AgtoEnivo AgtoUrban EnvirotoEnviro UrbantoAg   
## 148.56098 252.74362 1153.09598 14.08963 44.60933   
## UrbantoEnviro UrbantoUrban   
## 71.10014 2595.94776

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

## AZ CA CO ID MT NM   
## 336.32856 1788.53843 1558.46021 56.30970 383.28474 291.17075   
## NV OR TX UT WA WY   
## 2002.54663 205.12353 352.66808 45.66607 94.36266 21.51588