Tobit v.s. Quantile Analysis

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Regressions and Correlation Matrices

```r
tobit_bias_regression <- lm(Coefficient ~ Alpha + Omega + Cutoff, data = tobit)
summary(tobit_bias_regression)
```

```
##
## Call:
## lm(formula = Coefficient ~ Alpha + Omega + Cutoff, data = tobit)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.68108 -0.09257  0.00007  0.09167  1.46015
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.502908   0.003904 128.813   <2e-16 ***
## Alpha       -0.009167   0.000235 -39.008   <2e-16 ***
## Omega        0.000299   0.000235   1.272    0.203
## Cutoff      -0.001002   0.004700  -0.213    0.831
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1946 on 171496 degrees of freedom
## Multiple R-squared:  0.008804,   Adjusted R-squared:  0.008787
## F-statistic: 507.8 on 3 and 171496 DF,  p-value: < 2.2e-16
```

```r
tobit_mse_regression <- lm((Coefficient - .5)^2 ~ Alpha + Omega + Cutoff, data = tobit)
summary(tobit_mse_regression)
```

```
##
## Call:
## lm(formula = (Coefficient - 0.5)^2 ~ Alpha + Omega + Cutoff,
##     data = tobit)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.09146 -0.03535 -0.00868  0.00997  2.74345
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -8.494e-03  1.525e-03  -5.571 2.53e-08 ***
## Alpha       -1.773e-03  9.177e-05 -19.324  < 2e-16 ***
## Omega        1.511e-02  9.177e-05 164.658  < 2e-16 ***
## Cutoff      -1.715e-02  1.835e-03  -9.342  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.07601 on 171496 degrees of freedom
## Multiple R-squared:  0.1385, Adjusted R-squared:  0.1385
## F-statistic:  9191 on 3 and 171496 DF,  p-value: < 2.2e-16
```

```r
quant_bias_regression <- lm(Coefficient ~ Alpha + Omega + Cutoff, data = quantile)
summary(quant_bias_regression)
```

```
##
## Call:
## lm(formula = Coefficient ~ Alpha + Omega + Cutoff, data = quantile)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -20.1601  -0.7958  -0.0005   0.8047  24.0574
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.760e-01  3.942e-02  12.074   <2e-16 ***
## Alpha        1.418e-05  2.373e-03   0.006    0.995
## Omega       -1.235e-03  2.373e-03  -0.520    0.603
## Cutoff       3.675e-02  4.745e-02   0.774    0.439
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.965 on 171496 degrees of freedom
## Multiple R-squared:  5.076e-06,  Adjusted R-squared:  -1.242e-05
## F-statistic: 0.2902 on 3 and 171496 DF,  p-value: 0.8325
```

```r
quant_mse_regression <- lm((Coefficient - .5)^2 ~ Alpha + Omega + Cutoff, data = quantile)
summary(quant_mse_regression)
```

```
##
## Call:
## lm(formula = (Coefficient - 0.5)^2 ~ Alpha + Omega + Cutoff,
##     data = quantile)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -10.96  -3.86  -1.32   1.09 570.33
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.44644    0.19141 -12.781   <2e-16 ***
## Alpha       -0.80995    0.01152 -70.299   <2e-16 ***
## Omega        1.55014    0.01152 134.544   <2e-16 ***
## Cutoff       0.13493    0.23043   0.586    0.558
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.543 on 171496 degrees of freedom
## Multiple R-squared:  0.1185, Adjusted R-squared:  0.1184
## F-statistic:  7681 on 3 and 171496 DF,  p-value: < 2.2e-16
```

```r
kable(cor(quantile))
```

	Alpha	Omega	Cutoff	Coefficient
Alpha	1.00e+00	0.0000000	0.0000000	0.0000144
Omega	0.00e+00	1.0000000	0.0000000	-0.0012564
Cutoff	0.00e+00	0.0000000	1.0000000	0.0018701
Coefficient	1.44e-05	-0.0012564	0.0018701	1.0000000

```r
kable(cor(tobit))
```

	Alpha	Omega	Cutoff	Coefficient
Alpha	1.0000000	0.0000000	0.0000000	-0.0937795
Omega	0.0000000	1.0000000	0.0000000	0.0030588
Cutoff	0.0000000	0.0000000	1.0000000	-0.0005127
Coefficient	-0.0937795	0.0030588	-0.0005127	1.0000000

Graphics:

Change in Alpha with cutoffs greater than or equal to top 75% of data

```r
# Calculate subsetted averages
tobit_alpha <- subset(tobit, tobit$Cutoff >= .75)
tob <- tapply(tobit_alpha$Coefficient, tobit_alpha$Alpha, mean)
quantile_alpha <- subset(quantile, quantile$Cutoff >= .75)
quant <- tapply(quantile_alpha$Coefficient, quantile_alpha$Alpha, mean)

# Create dataframe with bias and MSE
data <- data.frame(-3:3, tob - .5, (tob - .5)^2, "Tobit", row.names = 1:7)
data1 <- data.frame(-3:3, quant - .5, (quant - .5)^2, "Quantile", row.names = 1:nrow(data))
colnames(data) <- c("Alpha", "Bias", "MSE" , "Type")
colnames(data1) <- colnames(data)
final <- as.data.frame(rbind(data, data1))

# Bias graph
jpeg('alpha_bias.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Alpha, y = Bias, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.1, .1) +
  labs(title = "Tobit and Quantile Bias for levels of Skewness",
       subtitle = "Only Cutoffs above 75th percentile")
dev.off()
```

```
## pdf
##   2
```

```r
# MSE graph
jpeg('alpha_mse.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Alpha, y = MSE, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.005, .005) +
  labs(title = "Tobit and Quantile MSE for levels of Skewness",
       subtitle = "Only Cutoffs above 75th percentile")
dev.off()
```

```
## pdf
##   2
```

Change in Omega with 75th Percentile and Above and Base Alpha level

```r
# Calculate subsetted averages
tobit_alpha <- subset(tobit, tobit$Cutoff >= .75 & tobit$Alpha == 0)
tob <- tapply(tobit_alpha$Coefficient, tobit_alpha$Omega, mean)
quantile_alpha <- subset(quantile, quantile$Cutoff >= .75 & quantile$Alpha %in% c(-3,-2,-1))
quant <- tapply(quantile_alpha$Coefficient, quantile_alpha$Omega, mean)

# Create dataframe with bias and MSE
data <- data.frame(1:7, tob - .5, (tob - .5)^2, "Tobit", row.names = 1:nrow(data))
data1 <- data.frame(1:7, quant - .5, (quant - .5)^2, "Quantile", row.names = 1:nrow(data1))
colnames(data) <- c("Omega", "Bias", "MSE", "Type")
colnames(data1) <- colnames(data)
final <- as.data.frame(rbind(data, data1))

# Bias graph
jpeg('omega_bias.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Omega, y = Bias, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.1, .1) +
  labs(title = "Tobit and Quantile Bias for levels of Spread",
       subtitle = "Only Cutoffs above 75th percentile and Base Skewness")
dev.off()
```

```
## pdf
##   2
```

```r
# MSE graph
jpeg('omega_mse.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Omega, y = MSE, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.0005, .0005) +
  labs(title = "Tobit and Quantile MSE for levels of Spread",
       subtitle = "Only Cutoffs above 75th percentile and Base Skewness")
dev.off()
```

```
## pdf
##   2
```

Change in Cutoff with Base Alpha level

```r
# Calculate subsetted averages
tobit_alpha <- subset(tobit, tobit$Alpha == 0)
tob <- tapply(tobit_alpha$Coefficient, tobit_alpha$Cutoff, mean)
quantile_alpha <- subset(quantile, quantile$Alpha %in% c(-3,-2,-1))
quant <- tapply(quantile_alpha$Coefficient, quantile_alpha$Cutoff, mean)

# Create dataframe with bias and MSE
data <- data.frame(c(.65, .7, .75, .8, .85, .9, .95), tob - .5, (tob - .5)^2, "Tobit",
                   row.names = 1:nrow(data))
data1 <- data.frame(c(.65, .7, .75, .8, .85, .9, .95), quant - .5, (quant - .5)^2, "Quantile",
                    row.names = 1:nrow(data1))
colnames(data) <- c("Cutoff", "Bias", "MSE", "Type")
colnames(data1) <- colnames(data)
final <- as.data.frame(rbind(data, data1))

# Bias graph
jpeg('cutoff_bias.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Cutoff, y = Bias, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.1, .1) +
  labs(title = "Tobit and Quantile Bias for Percentile Cutoff Levels",
       subtitle = "Only Base Skewness")
dev.off()
```

```
## pdf
##   2
```

```r
# MSE graph
jpeg('cutoff_mse.jpg', quality = 100, width = 12, height = 8, units = "in", res = 300)
ggplot(final, aes(x = Cutoff, y = MSE, color = Type)) +
  geom_point() +
  geom_path() +
  geom_abline(mapping = aes(slope = 0, intercept = 0)) +
  ylim(-.0005, .0005) +
  labs(title = "Tobit and Quantile MSE for Percentile Cutoff Levels",
       subtitle = "Only Base Skewness")
dev.off()
```

```
## pdf
##   2
```