Statistical Analysis

# Revised model.

library(xtable)  
library(MASS)  
library(knitr)  
library(pscl)  
library(stargazer)  
library(tidyverse)  
library(pastecs)  
library(gmodels)  
library(pscl)  
  
#Read the dataset  
license.df<-read.csv("Data/AggreatedData.csv")  
license.df<-na.omit(license.df)  
license.df$key.event<-as.factor(license.df$key.event)  
license.df <- within(license.df, key.event <- relevel(key.event, ref = "1"))  
  
#1. Rename ES to “license\_choice” and then recode ES1 & ES3 as LC1 (label: no\_derivative), ES2 as LC2 (attribution), ES4 as LC3 (antibusiness)  
license.df <- license.df %>%   
 mutate(LC1 = ES1+ES3,  
 LC2 = ES2,  
 LC3 = ES4) %>%   
 select(-ES1,-ES2,-ES3,-ES4)  
  
  
#2. Rename design\_strategy as “appropriability\_strategy” and recode blended strategy as “private-collective”, and the others remain the same.   
license.df <- license.df %>%   
 rename(appropriability\_strategy = design.strategy)  
levels(license.df$appropriability\_strategy)[levels(license.df$appropriability\_strategy)=="blended"] <- "private-collective"

# Model 1: controls:

#model 1: controls  
m1 <- zeroinfl(out ~ files\_count+thing\_like\_count, data = license.df, dist = "negbin", EM = TRUE)  
save.image("outModel1.RData")

##   
## Call:  
## zeroinfl(formula = out ~ files\_count + thing\_like\_count, data = license.df,   
## dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.44900 -0.15814 -0.07117 -0.06485 226.88401   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 0.3939640 0.0356924 11.038 < 2e-16 \*\*\*  
## files\_count 0.0064517 0.0012261 5.262 1.43e-07 \*\*\*  
## thing\_like\_count 0.0042903 0.0001696 25.292 < 2e-16 \*\*\*  
## Log(theta) -1.6014818 0.0204767 -78.210 < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 3.561777 0.061739 57.691 <2e-16 \*\*\*  
## files\_count -0.005954 0.005505 -1.082 0.279   
## thing\_like\_count -0.190564 0.007525 -25.324 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.2016   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -2.431e+04 on 7 Df

m1 <- zeroinfl(made\_count ~ files\_count+thing\_like\_count, data = license.df, dist = "negbin", EM = TRUE)  
save.image("madeModel1.RData")

##   
## Call:  
## zeroinfl(formula = made\_count ~ files\_count + thing\_like\_count,   
## data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.8097 -0.1969 -0.1094 -0.1087 30.3985   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 2.245e-01 2.064e-02 10.874 <2e-16 \*\*\*  
## files\_count -6.387e-04 4.888e-04 -1.307 0.191   
## thing\_like\_count 4.863e-03 9.575e-05 50.786 <2e-16 \*\*\*  
## Log(theta) -4.221e-01 2.051e-02 -20.586 <2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 3.212230 0.047338 67.857 <2e-16 \*\*\*  
## files\_count -0.003389 0.004994 -0.679 0.497   
## thing\_like\_count -0.248668 0.008620 -28.849 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.6556   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.24e+04 on 7 Df

# Model 2: main effects all the independent variables:

m2 <- zeroinfl(out ~ appropriability\_strategy+ key.event+LC1+LC2+LC3+ files\_count+thing\_like\_count, data = license.df, dist = "negbin", EM = TRUE)  
save.image("outModel2.RData")

##   
## Call:  
## zeroinfl(formula = out ~ appropriability\_strategy + key.event +   
## LC1 + LC2 + LC3 + files\_count + thing\_like\_count, data = license.df,   
## dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.49896 -0.16538 -0.07011 -0.05060 228.89979   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) 0.1862947 0.0642163 2.901 0.003719  
## appropriability\_strategyfree-riding 0.0027848 0.0827994 0.034 0.973170  
## appropriability\_strategyprivate -0.7852073 0.0515564 -15.230 < 2e-16  
## key.event2 1.1188096 0.0528081 21.186 < 2e-16  
## key.event3 0.3042144 0.0587165 5.181 2.21e-07  
## LC1 0.0138061 0.0086386 1.598 0.109999  
## LC2 0.0441007 0.0069077 6.384 1.72e-10  
## LC3 0.0692520 0.0170182 4.069 4.72e-05  
## files\_count -0.0025402 0.0006815 -3.727 0.000194  
## thing\_like\_count 0.0032692 0.0001313 24.901 < 2e-16  
## Log(theta) -1.3904602 0.0212573 -65.411 < 2e-16  
##   
## (Intercept) \*\*   
## appropriability\_strategyfree-riding   
## appropriability\_strategyprivate \*\*\*  
## key.event2 \*\*\*  
## key.event3 \*\*\*  
## LC1   
## LC2 \*\*\*  
## LC3 \*\*\*  
## files\_count \*\*\*  
## thing\_like\_count \*\*\*  
## Log(theta) \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) 0.884669 0.166055 5.328 9.95e-08  
## appropriability\_strategyfree-riding 1.466531 0.121774 12.043 < 2e-16  
## appropriability\_strategyprivate 0.813272 0.117442 6.925 4.36e-12  
## key.event2 1.308460 0.118064 11.083 < 2e-16  
## key.event3 1.791083 0.125552 14.266 < 2e-16  
## LC1 0.248884 0.052544 4.737 2.17e-06  
## LC2 0.120876 0.031681 3.815 0.000136  
## LC3 -0.070116 0.116031 -0.604 0.545657  
## files\_count -0.023484 0.008133 -2.888 0.003882  
## thing\_like\_count -0.137939 0.005983 -23.056 < 2e-16  
##   
## (Intercept) \*\*\*  
## appropriability\_strategyfree-riding \*\*\*  
## appropriability\_strategyprivate \*\*\*  
## key.event2 \*\*\*  
## key.event3 \*\*\*  
## LC1 \*\*\*  
## LC2 \*\*\*  
## LC3   
## files\_count \*\*   
## thing\_like\_count \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.249   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -2.361e+04 on 21 Df

m2 <- zeroinfl(made\_count ~ appropriability\_strategy+ key.event+LC1+LC2+LC3+ files\_count+thing\_like\_count, data = license.df, dist = "negbin", EM = TRUE)  
save.image("madeModel2.RData")

##   
## Call:  
## zeroinfl(formula = made\_count ~ appropriability\_strategy + key.event +   
## LC1 + LC2 + LC3 + files\_count + thing\_like\_count, data = license.df,   
## dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.87685 -0.21718 -0.10656 -0.09198 43.18899   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) 0.9448357 0.0366908 25.751 < 2e-16  
## appropriability\_strategyfree-riding -0.3637244 0.0484138 -7.513 5.79e-14  
## appropriability\_strategyprivate -0.3156289 0.0284210 -11.105 < 2e-16  
## key.event2 -0.4951672 0.0304882 -16.241 < 2e-16  
## key.event3 -0.9576447 0.0331098 -28.923 < 2e-16  
## LC1 0.0259691 0.0053057 4.895 9.85e-07  
## LC2 0.0296851 0.0038554 7.700 1.36e-14  
## LC3 0.0252201 0.0084611 2.981 0.00288  
## files\_count -0.0036270 0.0004505 -8.051 8.22e-16  
## thing\_like\_count 0.0038240 0.0000823 46.462 < 2e-16  
## Log(theta) -0.2628330 0.0212264 -12.382 < 2e-16  
##   
## (Intercept) \*\*\*  
## appropriability\_strategyfree-riding \*\*\*  
## appropriability\_strategyprivate \*\*\*  
## key.event2 \*\*\*  
## key.event3 \*\*\*  
## LC1 \*\*\*  
## LC2 \*\*\*  
## LC3 \*\*   
## files\_count \*\*\*  
## thing\_like\_count \*\*\*  
## Log(theta) \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) 2.584899 0.139182 18.572 < 2e-16  
## appropriability\_strategyfree-riding 0.925539 0.105741 8.753 < 2e-16  
## appropriability\_strategyprivate 0.108403 0.101130 1.072 0.2838  
## key.event2 0.028131 0.092404 0.304 0.7608  
## key.event3 0.002228 0.093823 0.024 0.9811  
## LC1 0.076796 0.041842 1.835 0.0665  
## LC2 -0.080705 0.020043 -4.027 5.66e-05  
## LC3 -0.082102 0.089642 -0.916 0.3597  
## files\_count 0.003276 0.001760 1.861 0.0627  
## thing\_like\_count -0.198957 0.007540 -26.387 < 2e-16  
##   
## (Intercept) \*\*\*  
## appropriability\_strategyfree-riding \*\*\*  
## appropriability\_strategyprivate   
## key.event2   
## key.event3   
## LC1 .   
## LC2 \*\*\*  
## LC3   
## files\_count .   
## thing\_like\_count \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.7689   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.17e+04 on 21 Df

# Model 3: interaction effects: Appropriation Strategy x Licence Choice (Hypothesis 3)

m3 <- zeroinfl(out ~ appropriability\_strategy+ key.event+LC1+LC2+LC3+ files\_count+thing\_like\_count+  
 (LC1\*key.event+LC2\*key.event+LC3\*key.event)+(appropriability\_strategy\*key.event), data = license.df, dist = "negbin", EM = TRUE)  
save.image("outModel3.RData")

##   
## Call:  
## zeroinfl(formula = out ~ appropriability\_strategy + key.event +   
## LC1 + LC2 + LC3 + files\_count + thing\_like\_count + (LC1 \* key.event +   
## LC2 \* key.event + LC3 \* key.event) + (appropriability\_strategy \*   
## key.event), data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.50432 -0.16141 -0.07468 -0.04481 235.05104   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error  
## (Intercept) 0.3378292 0.0910070  
## appropriability\_strategyfree-riding -0.2169601 0.1701570  
## appropriability\_strategyprivate -0.7517917 0.0912510  
## key.event2 1.1187121 0.1167945  
## key.event3 -0.1941173 0.1263862  
## LC1 -0.0173742 0.0133496  
## LC2 0.0267680 0.0104126  
## LC3 0.0271215 0.0165088  
## files\_count -0.0036436 0.0009166  
## thing\_like\_count 0.0032735 0.0001298  
## key.event2:LC1 0.0481847 0.0176649  
## key.event3:LC1 0.0536148 0.0175020  
## key.event2:LC2 0.0072551 0.0124255  
## key.event3:LC2 0.0465195 0.0134179  
## key.event2:LC3 0.1277827 0.0470708  
## key.event3:LC3 0.2553683 0.0639730  
## appropriability\_strategyfree-riding:key.event2 -0.4495855 0.2068141  
## appropriability\_strategyprivate:key.event2 -0.1878705 0.1213677  
## appropriability\_strategyfree-riding:key.event3 0.9884924 0.2251660  
## appropriability\_strategyprivate:key.event3 0.1618142 0.1305695  
## Log(theta) -1.3690965 0.0212539  
## z value Pr(>|z|)   
## (Intercept) 3.712 0.000206 \*\*\*  
## appropriability\_strategyfree-riding -1.275 0.202289   
## appropriability\_strategyprivate -8.239 < 2e-16 \*\*\*  
## key.event2 9.578 < 2e-16 \*\*\*  
## key.event3 -1.536 0.124562   
## LC1 -1.301 0.193098   
## LC2 2.571 0.010149 \*   
## LC3 1.643 0.100413   
## files\_count -3.975 7.04e-05 \*\*\*  
## thing\_like\_count 25.227 < 2e-16 \*\*\*  
## key.event2:LC1 2.728 0.006378 \*\*   
## key.event3:LC1 3.063 0.002189 \*\*   
## key.event2:LC2 0.584 0.559292   
## key.event3:LC2 3.467 0.000526 \*\*\*  
## key.event2:LC3 2.715 0.006634 \*\*   
## key.event3:LC3 3.992 6.56e-05 \*\*\*  
## appropriability\_strategyfree-riding:key.event2 -2.174 0.029715 \*   
## appropriability\_strategyprivate:key.event2 -1.548 0.121636   
## appropriability\_strategyfree-riding:key.event3 4.390 1.13e-05 \*\*\*  
## appropriability\_strategyprivate:key.event3 1.239 0.215236   
## Log(theta) -64.416 < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error  
## (Intercept) 1.767633 0.708461  
## appropriability\_strategyfree-riding -0.015650 0.690321  
## appropriability\_strategyprivate 1.094343 0.610654  
## key.event2 0.235340 0.725697  
## key.event3 0.902221 0.733516  
## LC1 0.144028 0.203083  
## LC2 -0.601578 0.191360  
## LC3 -0.830125 0.307190  
## files\_count -0.024072 0.008238  
## thing\_like\_count -0.132571 0.005867  
## key.event2:LC1 0.075134 0.212010  
## key.event3:LC1 0.058608 0.217512  
## key.event2:LC2 0.791350 0.193432  
## key.event3:LC2 0.693216 0.193942  
## key.event2:LC3 0.957277 0.353057  
## key.event3:LC3 0.864301 0.345934  
## appropriability\_strategyfree-riding:key.event2 1.448890 0.709105  
## appropriability\_strategyprivate:key.event2 -0.255819 0.630051  
## appropriability\_strategyfree-riding:key.event3 1.835453 0.718380  
## appropriability\_strategyprivate:key.event3 -0.465718 0.639977  
## z value Pr(>|z|)   
## (Intercept) 2.495 0.012595 \*   
## appropriability\_strategyfree-riding -0.023 0.981913   
## appropriability\_strategyprivate 1.792 0.073120 .   
## key.event2 0.324 0.745714   
## key.event3 1.230 0.218699   
## LC1 0.709 0.478196   
## LC2 -3.144 0.001668 \*\*   
## LC3 -2.702 0.006886 \*\*   
## files\_count -2.922 0.003476 \*\*   
## thing\_like\_count -22.596 < 2e-16 \*\*\*  
## key.event2:LC1 0.354 0.723047   
## key.event3:LC1 0.269 0.787586   
## key.event2:LC2 4.091 4.29e-05 \*\*\*  
## key.event3:LC2 3.574 0.000351 \*\*\*  
## key.event2:LC3 2.711 0.006700 \*\*   
## key.event3:LC3 2.498 0.012474 \*   
## appropriability\_strategyfree-riding:key.event2 2.043 0.041026 \*   
## appropriability\_strategyprivate:key.event2 -0.406 0.684721   
## appropriability\_strategyfree-riding:key.event3 2.555 0.010619 \*   
## appropriability\_strategyprivate:key.event3 -0.728 0.466790   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.2543   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -2.352e+04 on 41 Df

m3 <- zeroinfl(made\_count ~ appropriability\_strategy+ key.event+LC1+LC2+LC3+ files\_count+thing\_like\_count+  
 (LC1\*key.event+LC2\*key.event+LC3\*key.event)+(appropriability\_strategy\*key.event), data = license.df, dist = "negbin", EM = TRUE)  
save.image("madeModel3.RData")

##   
## Call:  
## zeroinfl(formula = made\_count ~ appropriability\_strategy + key.event +   
## LC1 + LC2 + LC3 + files\_count + thing\_like\_count + (LC1 \* key.event +   
## LC2 \* key.event + LC3 \* key.event) + (appropriability\_strategy \*   
## key.event), data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.88456 -0.21882 -0.10366 -0.08642 45.41340   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error  
## (Intercept) 1.116e+00 5.302e-02  
## appropriability\_strategyfree-riding -3.996e-01 1.029e-01  
## appropriability\_strategyprivate -4.196e-01 5.251e-02  
## key.event2 -6.674e-01 6.755e-02  
## key.event3 -1.296e+00 7.246e-02  
## LC1 -3.029e-03 8.134e-03  
## LC2 1.312e-02 5.848e-03  
## LC3 1.440e-02 9.102e-03  
## files\_count -4.676e-03 5.447e-04  
## thing\_like\_count 3.868e-03 8.308e-05  
## key.event2:LC1 3.208e-02 1.098e-02  
## key.event3:LC1 6.023e-02 1.148e-02  
## key.event2:LC2 1.548e-02 6.942e-03  
## key.event3:LC2 4.199e-02 7.440e-03  
## key.event2:LC3 5.573e-02 2.542e-02  
## key.event3:LC3 7.922e-02 2.831e-02  
## appropriability\_strategyfree-riding:key.event2 7.774e-02 1.248e-01  
## appropriability\_strategyprivate:key.event2 1.252e-01 6.887e-02  
## appropriability\_strategyfree-riding:key.event3 1.230e-02 1.360e-01  
## appropriability\_strategyprivate:key.event3 1.850e-01 7.362e-02  
## Log(theta) -2.453e-01 2.127e-02  
## z value Pr(>|z|)   
## (Intercept) 21.043 < 2e-16 \*\*\*  
## appropriability\_strategyfree-riding -3.882 0.000103 \*\*\*  
## appropriability\_strategyprivate -7.992 1.33e-15 \*\*\*  
## key.event2 -9.880 < 2e-16 \*\*\*  
## key.event3 -17.884 < 2e-16 \*\*\*  
## LC1 -0.372 0.709593   
## LC2 2.244 0.024816 \*   
## LC3 1.582 0.113664   
## files\_count -8.586 < 2e-16 \*\*\*  
## thing\_like\_count 46.559 < 2e-16 \*\*\*  
## key.event2:LC1 2.922 0.003473 \*\*   
## key.event3:LC1 5.245 1.56e-07 \*\*\*  
## key.event2:LC2 2.230 0.025738 \*   
## key.event3:LC2 5.644 1.66e-08 \*\*\*  
## key.event2:LC3 2.192 0.028382 \*   
## key.event3:LC3 2.798 0.005145 \*\*   
## appropriability\_strategyfree-riding:key.event2 0.623 0.533327   
## appropriability\_strategyprivate:key.event2 1.818 0.069116 .   
## appropriability\_strategyfree-riding:key.event3 0.090 0.927903   
## appropriability\_strategyprivate:key.event3 2.513 0.011957 \*   
## Log(theta) -11.536 < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error  
## (Intercept) 2.678117 0.408867  
## appropriability\_strategyfree-riding -0.533470 0.437893  
## appropriability\_strategyprivate 0.305444 0.358507  
## key.event2 -0.396558 0.442944  
## key.event3 -0.063074 0.432301  
## LC1 0.353342 0.142285  
## LC2 -0.255986 0.104059  
## LC3 -0.261248 0.188448  
## files\_count 0.003256 0.001676  
## thing\_like\_count -0.191105 0.007231  
## key.event2:LC1 -0.290500 0.157081  
## key.event3:LC1 -0.333490 0.153196  
## key.event2:LC2 0.237663 0.110241  
## key.event3:LC2 0.180171 0.106694  
## key.event2:LC3 0.569649 0.244692  
## key.event3:LC3 0.120208 0.232564  
## appropriability\_strategyfree-riding:key.event2 1.698241 0.466434  
## appropriability\_strategyprivate:key.event2 0.028620 0.391982  
## appropriability\_strategyfree-riding:key.event3 1.490691 0.465025  
## appropriability\_strategyprivate:key.event3 -0.421285 0.387618  
## z value Pr(>|z|)   
## (Intercept) 6.550 5.75e-11 \*\*\*  
## appropriability\_strategyfree-riding -1.218 0.223122   
## appropriability\_strategyprivate 0.852 0.394221   
## key.event2 -0.895 0.370638   
## key.event3 -0.146 0.883999   
## LC1 2.483 0.013016 \*   
## LC2 -2.460 0.013893 \*   
## LC3 -1.386 0.165653   
## files\_count 1.942 0.052078 .   
## thing\_like\_count -26.427 < 2e-16 \*\*\*  
## key.event2:LC1 -1.849 0.064405 .   
## key.event3:LC1 -2.177 0.029490 \*   
## key.event2:LC2 2.156 0.031096 \*   
## key.event3:LC2 1.689 0.091283 .   
## key.event2:LC3 2.328 0.019911 \*   
## key.event3:LC3 0.517 0.605238   
## appropriability\_strategyfree-riding:key.event2 3.641 0.000272 \*\*\*  
## appropriability\_strategyprivate:key.event2 0.073 0.941796   
## appropriability\_strategyfree-riding:key.event3 3.206 0.001348 \*\*   
## appropriability\_strategyprivate:key.event3 -1.087 0.277100   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.7824   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.162e+04 on 41 Df