Statistical Analysis

# Revised model.

#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"

## 2c. Remember to run the interaction effect between AS and period. Can you carry out some sort of 2-step model, model one includes all the control, and the main predictors, and model two adds the interaction effect. And then compare the significant changes between model one and model using R-squared change.

Here the same Multivariate Regression Model with the AS and Key.period interaction

|  |  |  |  |
| --- | --- | --- | --- |
| Coefficients | LC1 | LC2 | LC3 |
| (Intercept) | 0.2273652 | 0.7803261 | 0.2141936 |
| appropriability\_strategyfree-riding | -0.2747957 | -0.1883040 | -0.1052224 |
| appropriability\_strategyfree-riding:key.event2 | 0.4282741 | 0.2444475 | 0.1093692 |
| appropriability\_strategyfree-riding:key.event3 | 0.3758630 | 0.3431657 | 0.1295406 |
| appropriability\_strategyprivate-collective | 0.1525079 | 1.8380252 | 1.0595465 |
| appropriability\_strategyprivate-collective:key.event2 | 0.2877397 | 0.4723982 | -1.0404081 |
| appropriability\_strategyprivate-collective:key.event3 | 0.3261281 | 0.0253851 | -1.0211698 |
| collection\_count | 0.0014377 | 0.0021286 | 0.0002010 |
| files\_count | 0.0224097 | 0.0728597 | 0.0069264 |
| key.event2 | -0.1199208 | 0.2926598 | -0.1984992 |
| key.event3 | -0.0993302 | 0.2847950 | -0.2152881 |
| made\_count | 0.0093649 | -0.0052294 | 0.0147405 |
| thing\_like\_count | -0.0000953 | -0.0006353 | -0.0003691 |

|  |  |  |  |
| --- | --- | --- | --- |
| Std. Error | LC1 | LC2 | LC3 |
| (Intercept) | 0.0261908 | 0.0351046 | 0.0138330 |
| appropriability\_strategyfree-riding | 0.0919041 | 0.1231826 | 0.0485404 |
| appropriability\_strategyfree-riding:key.event2 | 0.0958657 | 0.1284925 | 0.0506328 |
| appropriability\_strategyfree-riding:key.event3 | 0.0949372 | 0.1272479 | 0.0501423 |
| appropriability\_strategyprivate-collective | 0.0573513 | 0.0768702 | 0.0302909 |
| appropriability\_strategyprivate-collective:key.event2 | 0.0675472 | 0.0905361 | 0.0356760 |
| appropriability\_strategyprivate-collective:key.event3 | 0.0676475 | 0.0906705 | 0.0357289 |
| collection\_count | 0.0002372 | 0.0003179 | 0.0001253 |
| files\_count | 0.0004433 | 0.0005941 | 0.0002341 |
| key.event2 | 0.0333111 | 0.0446481 | 0.0175937 |
| key.event3 | 0.0321258 | 0.0430595 | 0.0169677 |
| made\_count | 0.0012630 | 0.0016928 | 0.0006671 |
| thing\_like\_count | 0.0002811 | 0.0003767 | 0.0001484 |

|  |  |  |  |
| --- | --- | --- | --- |
| Z-value | LC1 | LC2 | LC3 |
| (Intercept) | 8.6810984 | 22.2286262 | 15.484204 |
| appropriability\_strategyfree-riding | -2.9900256 | -1.5286576 | -2.167729 |
| appropriability\_strategyfree-riding:key.event2 | 4.4674368 | 1.9024273 | 2.160048 |
| appropriability\_strategyfree-riding:key.event3 | 3.9590700 | 2.6968280 | 2.583457 |
| appropriability\_strategyprivate-collective | 2.6591864 | 23.9107741 | 34.979062 |
| appropriability\_strategyprivate-collective:key.event2 | 4.2598295 | 5.2177875 | -29.162711 |
| appropriability\_strategyprivate-collective:key.event3 | 4.8209921 | 0.2799707 | -28.581027 |
| collection\_count | 6.0621897 | 6.6966118 | 1.604717 |
| files\_count | 50.5539418 | 122.6288881 | 29.584005 |
| key.event2 | -3.6000219 | 6.5548034 | -11.282397 |
| key.event3 | -3.0919096 | 6.6139920 | -12.688117 |
| made\_count | 7.4150049 | -3.0892016 | 22.098046 |
| thing\_like\_count | -0.3389817 | -1.6863999 | -2.486497 |

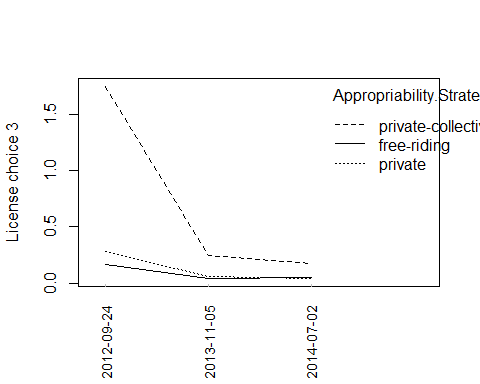
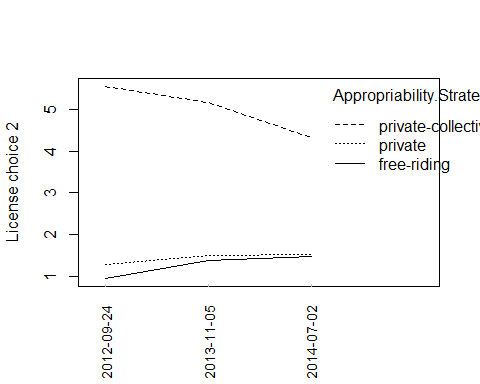
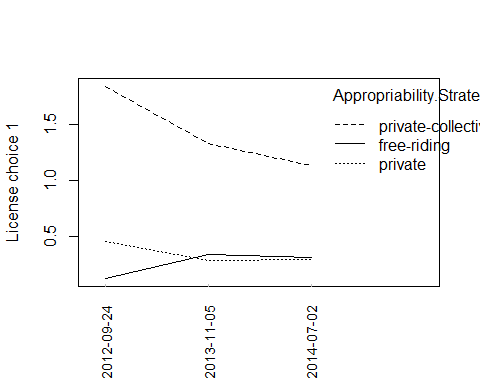
|  |  |  |  |
| --- | --- | --- | --- |
| P-value | LC1 | LC2 | LC3 |
| (Intercept) | 0.0000000 | 0.0000000 | 0.0000000 |
| appropriability\_strategyfree-riding | 0.0027910 | 0.1263561 | 0.0301844 |
| appropriability\_strategyfree-riding:key.event2 | 0.0000079 | 0.0571215 | 0.0307741 |
| appropriability\_strategyfree-riding:key.event3 | 0.0000754 | 0.0070029 | 0.0097846 |
| appropriability\_strategyprivate-collective | 0.0078356 | 0.0000000 | 0.0000000 |
| appropriability\_strategyprivate-collective:key.event2 | 0.0000205 | 0.0000002 | 0.0000000 |
| appropriability\_strategyprivate-collective:key.event3 | 0.0000014 | 0.7795013 | 0.0000000 |
| collection\_count | 0.0000000 | 0.0000000 | 0.1085630 |
| files\_count | 0.0000000 | 0.0000000 | 0.0000000 |
| key.event2 | 0.0003185 | 0.0000000 | 0.0000000 |
| key.event3 | 0.0019899 | 0.0000000 | 0.0000000 |
| made\_count | 0.0000000 | 0.0020081 | 0.0000000 |
| thing\_like\_count | 0.7346250 | 0.0917255 | 0.0129042 |

The **LC1** model presents Multiple R-squared: 0.248 and Adjusted R-squared: 0.248. The **LC2** model presents Multiple R-squared: 0.541, Adjusted R-squared: 0.54 and finally, the **LC3** model presents Multiple R-squared: 0.192, Adjusted R-squared: 0.192.

The Manova results are:

## Df Pillai approx F num Df den Df  
## appropriability\_strategy 2 0.33557 3130.9 6 93176  
## key.event 2 0.03445 272.2 6 93176  
## collection\_count 1 0.37409 9281.3 3 46587  
## files\_count 1 0.34763 8275.0 3 46587  
## thing\_like\_count 1 0.00030 4.7 3 46587  
## made\_count 1 0.01532 241.7 3 46587  
## appropriability\_strategy:key.event 4 0.02399 93.9 12 139767  
## Residuals 46589   
## Pr(>F)   
## appropriability\_strategy < 2.2e-16 \*\*\*  
## key.event < 2.2e-16 \*\*\*  
## collection\_count < 2.2e-16 \*\*\*  
## files\_count < 2.2e-16 \*\*\*  
## thing\_like\_count 0.002807 \*\*   
## made\_count < 2.2e-16 \*\*\*  
## appropriability\_strategy:key.event < 2.2e-16 \*\*\*  
## Residuals   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

2d. because one of the research hypotheses is about private-collective is more likely to sustain contribution. it’ll be useful to plot the interaction effects (see the attached for an illustration of the interaction between LC and period)



# 4. Use the zero inflated neg binomial (zinb) for modelling the effects on “out”.

## 4a. Model 1: the usual control variables (files count, likes, period and perhaps collection)

library(pscl)  
m1 <- zeroinfl(out ~ files\_count+thing\_like\_count+collection\_count+key.event | files\_count+thing\_like\_count+collection\_count,   
 data = license.df, dist = "negbin", EM = TRUE)  
summary(m1)

##   
## Call:  
## zeroinfl(formula = out ~ files\_count + thing\_like\_count + collection\_count +   
## key.event | files\_count + thing\_like\_count + collection\_count,   
## data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.47803 -0.14326 -0.06922 -0.06432 158.39286   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -0.2264755 0.0482500 -4.694 2.68e-06 \*\*\*  
## files\_count 0.0046594 0.0010903 4.273 1.92e-05 \*\*\*  
## thing\_like\_count -0.0020017 0.0004312 -4.642 3.45e-06 \*\*\*  
## collection\_count 0.0051365 0.0003851 13.337 < 2e-16 \*\*\*  
## key.event2 0.9936287 0.0517996 19.182 < 2e-16 \*\*\*  
## key.event3 0.3515670 0.0569374 6.175 6.63e-10 \*\*\*  
## Log(theta) -1.4761534 0.0208207 -70.898 < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 3.629907 0.060899 59.605 <2e-16 \*\*\*  
## files\_count 0.002651 0.002227 1.190 0.234   
## thing\_like\_count -0.004026 0.009903 -0.407 0.684   
## collection\_count -0.149796 0.009650 -15.524 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.2285   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -2.376e+04 on 11 Df

## 4b. Model 2: the main effects of AS and LC: Private-collective

#Define the reference (Private-collective)  
license.df <- within(license.df, appropriability\_strategy <- relevel(appropriability\_strategy, ref = "private"))  
m2 <- zeroinfl(out ~ files\_count+thing\_like\_count+collection\_count+key.event+appropriability\_strategy+LC1+LC2+LC3  
 | files\_count+thing\_like\_count+collection\_count+appropriability\_strategy+LC1+LC2+LC3,   
 data = license.df, dist = "negbin", EM = TRUE)  
save.image("Chunk24.RData")  
summary(m2)

##   
## Call:  
## zeroinfl(formula = out ~ files\_count + thing\_like\_count + collection\_count +   
## key.event + appropriability\_strategy + LC1 + LC2 + LC3 | files\_count +   
## thing\_like\_count + collection\_count + appropriability\_strategy +   
## LC1 + LC2 + LC3, data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.49246 -0.15714 -0.07589 -0.05398 243.88040   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value  
## (Intercept) -0.5492876 0.0504337 -10.891  
## files\_count -0.0020798 0.0005739 -3.624  
## thing\_like\_count -0.0010001 0.0004070 -2.457  
## collection\_count 0.0038386 0.0003583 10.713  
## key.event2 0.9092912 0.0520353 17.475  
## key.event3 0.2129819 0.0573437 3.714  
## appropriability\_strategyprivate-collective 0.7228030 0.0513235 14.083  
## appropriability\_strategyfree-riding 0.7999438 0.0771704 10.366  
## LC1 0.0073229 0.0082917 0.883  
## LC2 0.0388829 0.0069505 5.594  
## LC3 0.0553565 0.0169970 3.257  
## Log(theta) -1.4166905 0.0211327 -67.038  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 0.000290 \*\*\*  
## thing\_like\_count 0.014009 \*   
## collection\_count < 2e-16 \*\*\*  
## key.event2 < 2e-16 \*\*\*  
## key.event3 0.000204 \*\*\*  
## appropriability\_strategyprivate-collective < 2e-16 \*\*\*  
## appropriability\_strategyfree-riding < 2e-16 \*\*\*  
## LC1 0.377151   
## LC2 2.22e-08 \*\*\*  
## LC3 0.001127 \*\*   
## Log(theta) < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value  
## (Intercept) 3.083548 0.081511 37.830  
## files\_count -0.012483 0.009017 -1.384  
## thing\_like\_count 0.006521 0.009669 0.674  
## collection\_count -0.141851 0.009546 -14.860  
## appropriability\_strategyprivate-collective -0.632493 0.128386 -4.926  
## appropriability\_strategyfree-riding 0.870606 0.096429 9.028  
## LC1 0.214228 0.058718 3.648  
## LC2 0.137243 0.033424 4.106  
## LC3 -0.225214 0.121872 -1.848  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 0.166242   
## thing\_like\_count 0.500041   
## collection\_count < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective 8.37e-07 \*\*\*  
## appropriability\_strategyfree-riding < 2e-16 \*\*\*  
## LC1 0.000264 \*\*\*  
## LC2 4.02e-05 \*\*\*  
## LC3 0.064609 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.2425   
## Number of iterations in BFGS optimization: 26   
## Log-likelihood: -2.349e+04 on 21 Df

## 4c. Model 3: testing the following two sets of interaction effects (H4, H5)

Appropriability strategy x Period (or key events):

m3 <- zeroinfl(out ~ files\_count+thing\_like\_count+collection\_count+key.event+appropriability\_strategy+LC1+LC2+LC3+(appropriability\_strategy\*key.event)  
 | files\_count+thing\_like\_count+collection\_count+appropriability\_strategy+LC1+LC2+LC3+(appropriability\_strategy\*key.event),   
 data = license.df, dist = "negbin", EM = TRUE)  
summary(m3)  
save.image("Chunk25.RData")

##   
## Call:  
## zeroinfl(formula = out ~ files\_count + thing\_like\_count + collection\_count +   
## key.event + appropriability\_strategy + LC1 + LC2 + LC3 + (appropriability\_strategy \*   
## key.event) | files\_count + thing\_like\_count + collection\_count +   
## appropriability\_strategy + LC1 + LC2 + LC3 + (appropriability\_strategy \*   
## key.event), data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.51007 -0.15609 -0.07448 -0.04400 224.99150   
##   
## Count model coefficients (negbin with log link):  
## Estimate  
## (Intercept) -0.5166138  
## files\_count -0.0017963  
## thing\_like\_count -0.0011687  
## collection\_count 0.0038456  
## key.event2 1.0151602  
## key.event3 0.2914234  
## appropriability\_strategyprivate-collective 0.5722076  
## appropriability\_strategyfree-riding 0.5537701  
## LC1 0.0052407  
## LC2 0.0330537  
## LC3 0.0559474  
## key.event2:appropriability\_strategyprivate-collective 0.1697188  
## key.event3:appropriability\_strategyprivate-collective 0.2015455  
## key.event2:appropriability\_strategyfree-riding -0.2901013  
## key.event3:appropriability\_strategyfree-riding 0.8679578  
## Log(theta) -1.3464212  
## Std. Error z value  
## (Intercept) 0.0587445 -8.794  
## files\_count 0.0005272 -3.407  
## thing\_like\_count 0.0004036 -2.896  
## collection\_count 0.0003555 10.816  
## key.event2 0.0734884 13.814  
## key.event3 0.0830252 3.510  
## appropriability\_strategyprivate-collective 0.0855202 6.691  
## appropriability\_strategyfree-riding 0.1583092 3.498  
## LC1 0.0080469 0.651  
## LC2 0.0067462 4.900  
## LC3 0.0162491 3.443  
## key.event2:appropriability\_strategyprivate-collective 0.1078763 1.573  
## key.event3:appropriability\_strategyprivate-collective 0.1198982 1.681  
## key.event2:appropriability\_strategyfree-riding 0.1925613 -1.507  
## key.event3:appropriability\_strategyfree-riding 0.2150336 4.036  
## Log(theta) 0.0217050 -62.033  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 0.000656 \*\*\*  
## thing\_like\_count 0.003783 \*\*   
## collection\_count < 2e-16 \*\*\*  
## key.event2 < 2e-16 \*\*\*  
## key.event3 0.000448 \*\*\*  
## appropriability\_strategyprivate-collective 2.22e-11 \*\*\*  
## appropriability\_strategyfree-riding 0.000469 \*\*\*  
## LC1 0.514868   
## LC2 9.60e-07 \*\*\*  
## LC3 0.000575 \*\*\*  
## key.event2:appropriability\_strategyprivate-collective 0.115656   
## key.event3:appropriability\_strategyprivate-collective 0.092768 .   
## key.event2:appropriability\_strategyfree-riding 0.131929   
## key.event3:appropriability\_strategyfree-riding 5.43e-05 \*\*\*  
## Log(theta) < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error  
## (Intercept) 2.074705 0.124218  
## files\_count -0.015311 0.007966  
## thing\_like\_count 0.001355 0.007770  
## collection\_count -0.105986 0.007626  
## appropriability\_strategyprivate-collective -2.071877 0.749794  
## appropriability\_strategyfree-riding -0.765662 0.334808  
## LC1 0.184946 0.051255  
## LC2 0.080959 0.030138  
## LC3 -0.180608 0.111558  
## key.event2 1.027434 0.140113  
## key.event3 1.224256 0.150174  
## appropriability\_strategyprivate-collective:key.event2 1.327792 0.763169  
## appropriability\_strategyfree-riding:key.event2 1.343055 0.360724  
## appropriability\_strategyprivate-collective:key.event3 1.517553 0.766239  
## appropriability\_strategyfree-riding:key.event3 2.014602 0.369689  
## z value Pr(>|z|)   
## (Intercept) 16.702 < 2e-16 \*\*\*  
## files\_count -1.922 0.054600 .   
## thing\_like\_count 0.174 0.861595   
## collection\_count -13.898 < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective -2.763 0.005723 \*\*   
## appropriability\_strategyfree-riding -2.287 0.022203 \*   
## LC1 3.608 0.000308 \*\*\*  
## LC2 2.686 0.007225 \*\*   
## LC3 -1.619 0.105455   
## key.event2 7.333 2.25e-13 \*\*\*  
## key.event3 8.152 3.57e-16 \*\*\*  
## appropriability\_strategyprivate-collective:key.event2 1.740 0.081887 .   
## appropriability\_strategyfree-riding:key.event2 3.723 0.000197 \*\*\*  
## appropriability\_strategyprivate-collective:key.event3 1.981 0.047645 \*   
## appropriability\_strategyfree-riding:key.event3 5.449 5.05e-08 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.2602   
## Number of iterations in BFGS optimization: 36   
## Log-likelihood: -2.336e+04 on 31 Df

Note that by definition **Appropriability strategy = Design Strategy** so it does not make sense to test this interaction.

# Repeat the above steps with the outcome measure: “made”.

## 4a. Model 1: the usual control variables (files count, likes, period and perhaps collection)

library(pscl)  
m1 <- zeroinfl(made\_count ~ files\_count+thing\_like\_count+collection\_count+key.event | files\_count+thing\_like\_count+collection\_count,   
 data = license.df, dist = "negbin", EM = TRUE)  
summary(m1)

##   
## Call:  
## zeroinfl(formula = made\_count ~ files\_count + thing\_like\_count +   
## collection\_count + key.event | files\_count + thing\_like\_count +   
## collection\_count, data = license.df, dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.8593 -0.1892 -0.1105 -0.1044 65.9352   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 0.6937510 0.0278813 24.882 < 2e-16 \*\*\*  
## files\_count 0.0001200 0.0004587 0.262 0.79356   
## thing\_like\_count 0.0008525 0.0002712 3.144 0.00167 \*\*   
## collection\_count 0.0029192 0.0002267 12.876 < 2e-16 \*\*\*  
## key.event2 -0.4858659 0.0290356 -16.733 < 2e-16 \*\*\*  
## key.event3 -0.8226681 0.0317544 -25.907 < 2e-16 \*\*\*  
## Log(theta) -0.3033358 0.0208003 -14.583 < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 3.245318 0.048673 66.676 < 2e-16 \*\*\*  
## files\_count -0.004969 0.004739 -1.049 0.294   
## thing\_like\_count -0.057521 0.009561 -6.016 1.78e-09 \*\*\*  
## collection\_count -0.157825 0.009180 -17.193 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.7384   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.17e+04 on 11 Df

## 4b. Model 2: the main effects of AS and LC: Private-collective

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

##   
## Call:  
## zeroinfl(formula = made\_count ~ files\_count + thing\_like\_count +   
## collection\_count + key.event + appropriability\_strategy + LC1 +   
## LC2 + LC3 | files\_count + thing\_like\_count + collection\_count +   
## appropriability\_strategy + LC1 + LC2 + LC3, data = license.df,   
## dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.88451 -0.20776 -0.10319 -0.08937 53.11975   
##   
## Count model coefficients (negbin with log link):  
## Estimate Std. Error z value  
## (Intercept) 0.6133874 0.0295837 20.734  
## files\_count -0.0035167 0.0004329 -8.124  
## thing\_like\_count 0.0009032 0.0002618 3.449  
## collection\_count 0.0024625 0.0002155 11.429  
## key.event2 -0.5207655 0.0293719 -17.730  
## key.event3 -0.8649279 0.0320503 -26.987  
## appropriability\_strategyprivate-collective 0.2759914 0.0282519 9.769  
## appropriability\_strategyfree-riding -0.0652943 0.0452781 -1.442  
## LC1 0.0276079 0.0051827 5.327  
## LC2 0.0284849 0.0038047 7.487  
## LC3 0.0255503 0.0083627 3.055  
## Log(theta) -0.2454437 0.0211201 -11.621  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 4.53e-16 \*\*\*  
## thing\_like\_count 0.000562 \*\*\*  
## collection\_count < 2e-16 \*\*\*  
## key.event2 < 2e-16 \*\*\*  
## key.event3 < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective < 2e-16 \*\*\*  
## appropriability\_strategyfree-riding 0.149282   
## LC1 9.99e-08 \*\*\*  
## LC2 7.06e-14 \*\*\*  
## LC3 0.002249 \*\*   
## Log(theta) < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error z value  
## (Intercept) 2.817178 0.062520 45.061  
## files\_count 0.001912 0.001561 1.225  
## thing\_like\_count -0.038727 0.008672 -4.466  
## collection\_count -0.137379 0.008372 -16.409  
## appropriability\_strategyprivate-collective -0.066172 0.102533 -0.645  
## appropriability\_strategyfree-riding 0.786521 0.075531 10.413  
## LC1 0.075211 0.042050 1.789  
## LC2 -0.082558 0.019708 -4.189  
## LC3 -0.049608 0.090966 -0.545  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 0.2205   
## thing\_like\_count 7.99e-06 \*\*\*  
## collection\_count < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective 0.5187   
## appropriability\_strategyfree-riding < 2e-16 \*\*\*  
## LC1 0.0737 .   
## LC2 2.80e-05 \*\*\*  
## LC3 0.5855   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.7824   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.145e+04 on 21 Df

## 4c. Model 3: testing the following two sets of interaction effects (H4, H5)

Appropriability strategy x Period (or key events):

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

##   
## Call:  
## zeroinfl(formula = made\_count ~ files\_count + thing\_like\_count +   
## collection\_count + key.event + appropriability\_strategy + LC1 +   
## LC2 + LC3 + (appropriability\_strategy \* key.event) | files\_count +   
## thing\_like\_count + collection\_count + appropriability\_strategy +   
## LC1 + LC2 + LC3 + (appropriability\_strategy \* key.event), data = license.df,   
## dist = "negbin", EM = TRUE)  
##   
## Pearson residuals:  
## Min 1Q Median 3Q Max   
## -0.88740 -0.21059 -0.10078 -0.08695 51.79349   
##   
## Count model coefficients (negbin with log link):  
## Estimate  
## (Intercept) 0.6033531  
## files\_count -0.0035284  
## thing\_like\_count 0.0008786  
## collection\_count 0.0024716  
## key.event2 -0.4806974  
## key.event3 -0.8601009  
## appropriability\_strategyprivate-collective 0.3034403  
## appropriability\_strategyfree-riding 0.0285335  
## LC1 0.0274812  
## LC2 0.0285044  
## LC3 0.0254089  
## key.event2:appropriability\_strategyprivate-collective -0.0778679  
## key.event3:appropriability\_strategyprivate-collective 0.0131456  
## key.event2:appropriability\_strategyfree-riding -0.0697664  
## key.event3:appropriability\_strategyfree-riding -0.2484336  
## Log(theta) -0.2389270  
## Std. Error z value  
## (Intercept) 0.0335769 17.969  
## files\_count 0.0004325 -8.157  
## thing\_like\_count 0.0002622 3.351  
## collection\_count 0.0002158 11.454  
## key.event2 0.0412807 -11.645  
## key.event3 0.0443898 -19.376  
## appropriability\_strategyprivate-collective 0.0492415 6.162  
## appropriability\_strategyfree-riding 0.0949439 0.301  
## LC1 0.0051730 5.312  
## LC2 0.0038030 7.495  
## LC3 0.0083778 3.033  
## key.event2:appropriability\_strategyprivate-collective 0.0624075 -1.248  
## key.event3:appropriability\_strategyprivate-collective 0.0675540 0.195  
## key.event2:appropriability\_strategyfree-riding 0.1157990 -0.602  
## key.event3:appropriability\_strategyfree-riding 0.1264622 -1.964  
## Log(theta) 0.0212353 -11.251  
## Pr(>|z|)   
## (Intercept) < 2e-16 \*\*\*  
## files\_count 3.43e-16 \*\*\*  
## thing\_like\_count 0.000805 \*\*\*  
## collection\_count < 2e-16 \*\*\*  
## key.event2 < 2e-16 \*\*\*  
## key.event3 < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective 7.17e-10 \*\*\*  
## appropriability\_strategyfree-riding 0.763773   
## LC1 1.08e-07 \*\*\*  
## LC2 6.61e-14 \*\*\*  
## LC3 0.002422 \*\*   
## key.event2:appropriability\_strategyprivate-collective 0.212129   
## key.event3:appropriability\_strategyprivate-collective 0.845711   
## key.event2:appropriability\_strategyfree-riding 0.546856   
## key.event3:appropriability\_strategyfree-riding 0.049473 \*   
## Log(theta) < 2e-16 \*\*\*  
##   
## Zero-inflation model coefficients (binomial with logit link):  
## Estimate Std. Error  
## (Intercept) 2.948726 0.100441  
## files\_count 0.001929 0.001542  
## thing\_like\_count -0.035735 0.008498  
## collection\_count -0.134059 0.008387  
## appropriability\_strategyprivate-collective -0.320867 0.360669  
## appropriability\_strategyfree-riding -0.863688 0.286768  
## LC1 0.061127 0.041957  
## LC2 -0.086632 0.019887  
## LC3 -0.066792 0.090670  
## key.event2 -0.092649 0.109979  
## key.event3 -0.310389 0.108586  
## appropriability\_strategyprivate-collective:key.event2 0.123445 0.389177  
## appropriability\_strategyfree-riding:key.event2 1.681483 0.308132  
## appropriability\_strategyprivate-collective:key.event3 0.502463 0.385416  
## appropriability\_strategyfree-riding:key.event3 1.827560 0.308522  
## z value Pr(>|z|)   
## (Intercept) 29.358 < 2e-16 \*\*\*  
## files\_count 1.251 0.21098   
## thing\_like\_count -4.205 2.61e-05 \*\*\*  
## collection\_count -15.985 < 2e-16 \*\*\*  
## appropriability\_strategyprivate-collective -0.890 0.37366   
## appropriability\_strategyfree-riding -3.012 0.00260 \*\*   
## LC1 1.457 0.14515   
## LC2 -4.356 1.32e-05 \*\*\*  
## LC3 -0.737 0.46134   
## key.event2 -0.842 0.39955   
## key.event3 -2.858 0.00426 \*\*   
## appropriability\_strategyprivate-collective:key.event2 0.317 0.75110   
## appropriability\_strategyfree-riding:key.event2 5.457 4.84e-08 \*\*\*  
## appropriability\_strategyprivate-collective:key.event3 1.304 0.19234   
## appropriability\_strategyfree-riding:key.event3 5.924 3.15e-09 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1   
##   
## Theta = 0.7875   
## Number of iterations in BFGS optimization: 1   
## Log-likelihood: -3.142e+04 on 31 Df