

Supplement for: countfitter: efficient selection of count distributions to assess DNA damage

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08 September, 2020

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Abstract: Count data, one of the most common data types in many fields. In personalized medicine and pharmacology, the analysis is relevant for numerous applications, such as cancer and ageing research and in the evaluation of drug efficacy [1–5]. By default it is assumed to follow the Poisson distribution. This assumption, however, may lead to biased results and faulty conclusions in data bodies with excess zero values (zero-inflation [6,7]), a variance larger than the mean (overdispersion), or both. In such cases, the standard assumption of a Poisson distribution would skew the estimation of mean and variance, and other models like the negative binomial (NB), zero-inflated Poisson or zero-inflated NB distributions should be employed. The model chosen has an influence on the parameter estimation (mean value and confidence interval). Yet the choice of the most suitable distribution model is not trivial. To support and simplify this process, we have implemented the countfitter software, which is provided as an R package and a web server. We show the application of our software based on examples of count data from phenotypic imaging as used in radiomics and precision medicine: DNA double-strand breaks (DSBs) [8]. DSBs are a highly specific and sensitive molecular biomarker for monitoring DNA damage in cancer, aging research and the evaluation of drug efficacy, and are detected and quantified by foci formation in fluorescence microscopy. In analyzing a large number of datasets of a molecular pharmacological markers (phosphorylated Histone H2AX and p53 binding protein [9,10]), countfitter demonstrated an equal or superior statistical performance compared to the usually employed two-step procedure, with an overall power of up to 98 %. In addition, it still gave information in cases with no result at all from the two-step procedure. In our data sample we found that the NB distribution was the most frequent, with the Poisson distribution taking second place. Originally designed for the analysis of foci in biomedical image data, countfitter can be used in a variety of areas where non-Poisson distributed counting data is prevalent.

1 General information about the countfitter graphical user interface

1.1 Charts

Each chart may be saved in the `.svg` (Scalable Vector Graphic) format. A download button is always located at the top of a chart.

1.2 Tables

Tables may be downloaded in a specified format or printed using the buttons at the top of the table.

1.3 Data upload

The data format suitable for upload is the `.csv` file, where a single column corresponds to a single count (Note: example files are included in the package). **Use raw counts instead a pivot table!** If your document does not have headers, specify it using the “Header” checkbox. In this case, **countfitter** will automatically name your counts with the index number of a count prefixed by ‘C’.

1.4 Count data

This panel contains descriptive statistics and summaries of the input data. It consists of three subpanels:

1. *Count table*: the input dataset in the tabular format allowing sanity checks and manual modification.
2. *Summary*: summary statistics of the input data (respectively mean, standard deviation, median, median absolute deviate, minimum, maximum, number of elements).
3. *Distribution*: a bar chart of the counts distribution followed by a pivot table.

1.5 Fitted models

1. *Mean value estimates*: the estimated value of mean (λ) and its confidence intervals. The BIC indicates the most appropriate distribution.
2. *Coefficients*: coefficients of fitted models.
3. *Decision*: the most appropriate model and the strength of the evidence [11].

1.6 Compare distributions

The bar charts represent theoretical counts depending on the chosen distribution. Red dots describe the real number of counts. The visualized data is also available in the tabular format.

1.7 Settings

Separate experiments: if this checkbox is marked, the **countfitter** assumes that experiments are separate and fits the distribution to each individually and independently. Otherwise, all counts are simultaneously fitted to a single model. It is more appropriate for situations, where there is assumption that all samples may be describe by the same distribution, for example in case of technical replicates.

Confidence level: the confidence level of confidence intervals.

Count distributions: count distributions fitted to data: Poisson, Negative Binomial, Zero-Inflated Poisson, Zero-Inflated Negative Binomial. Possible distributions are described further in the manual.

2 Usage of the countfitter software via the R console

```
# Generate poisson (Poisson_data) and negative binomial (nBinomial_data)
# distributed count data in silico. Here 200 random integer numbers
# (= 200 cells) were generated for both distributions.
# The simulation was set to mimic data with a low number of counts (low number
# of foci per cell in average).

set.seed(007)
df <- data.frame(Poisson_data = rpois(200, 1.85),
                 nBinomial_data = rnbinom(200, 8.5, 0.8))

# Inspect the first 10 and last 10 data points via the head() and tail()
# functions, respectively.

head(df, n = 10)

##      Poisson_data nBinomial_data
## 1              6              3
## 2              1              0
## 3              0              0
## 4              0              3
## 5              1              2
## 6              3              2
## 7              1              1
## 8              5              1
## 9              1              7
## 10             2              1

tail(df, n = 10)

##      Poisson_data nBinomial_data
## 191              1              3
## 192              2              1
## 193              3              1
## 194              2              0
## 195              0              2
## 196              1              2
## 197              1              3
## 198              4              1
## 199              1              0
## 200              1              1

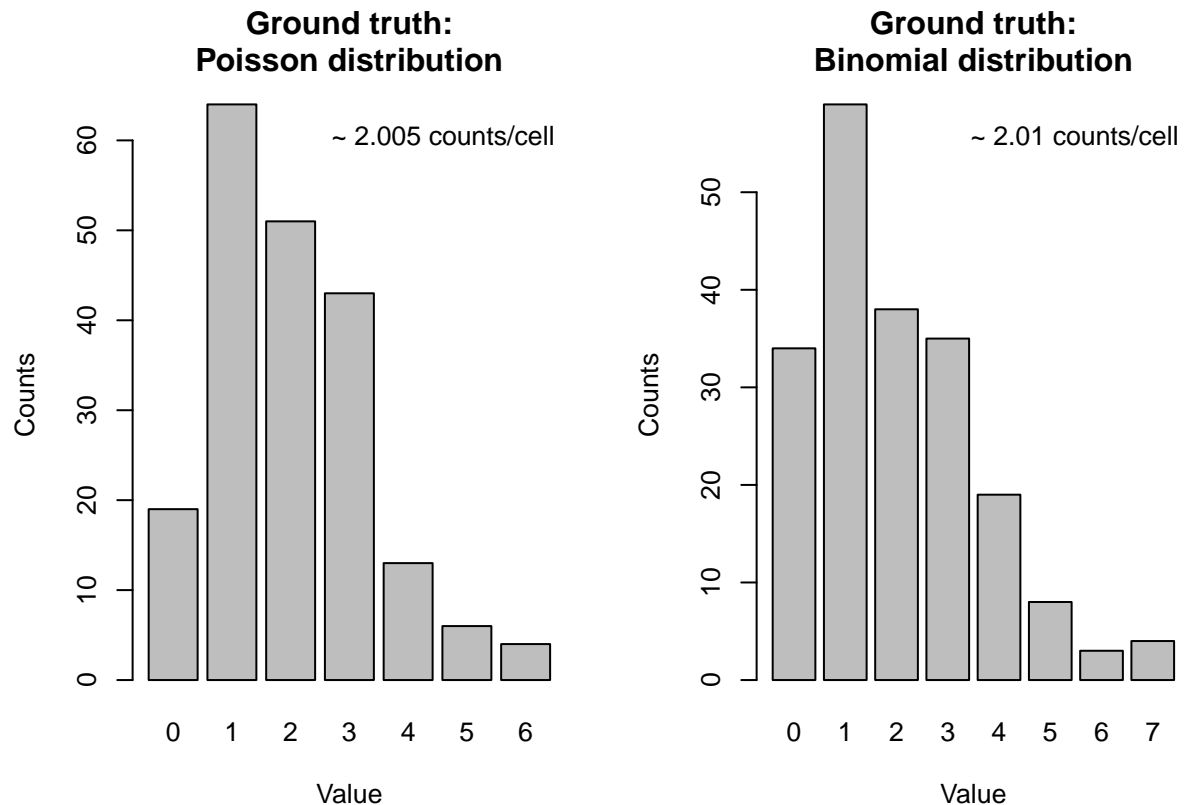
# Visualize the count data after tabulation of the frequencies of both data sets.
# The red vertical lines indicate the arithmetic means of the data samples.

mean_poisson <- mean(df[, "Poisson_data"])
mean_binomial <- mean(df[, "nBinomial_data"])

par(mfrow = c(1,2), cex = 0.8)

# Plot for the data with a Poisson distribution
barplot(table(df[, "Poisson_data"]), main = "Ground truth:\nPoisson distribution",
        xlab = "Value", ylab = "Counts")
legend("topright", paste("~", mean_poisson, "counts/cell"), bty = "n")
```

```
# Plot for the data with a negative binomial distribution
barplot(table(df[, "nBinomial_data"]), main = "Ground truth:\nBinomial distribution",
        xlab = "Value", ylab = "Counts")
legend("topright", paste("~", mean_binomial, "counts/cell"), bty = "n")
```



*# Note the arithmetic means (Mean ~ 2) and median (Median ~ 2) of the samples
are very similar, as determined by the summary() function.*

```
summary(df)
```

```
##   Poisson_data  nBinomial_data
##   Min.   :0.000   Min.   :0.00
##   1st Qu.:1.000   1st Qu.:1.00
##   Median :2.000   Median :2.00
##   Mean   :2.005   Mean   :2.01
##   3rd Qu.:3.000   3rd Qu.:3.00
##   Max.   :6.000   Max.   :7.00
```

For the analysis the countfitterR package is loaded

```
library(countfitterR)
```

*# Next we use the fit_counts() function to fit counts to distributions. In our
case the data are fitted to the Poisson, Negative Binomial (NB), Zero-Inflated
Poisson (ZIP) and the Zero-Inflated Negative Binomial (ZINB) distributions.*

```
fc <- fit_counts(df, model = "all")
summ <- summary_fitlist(fc)
```

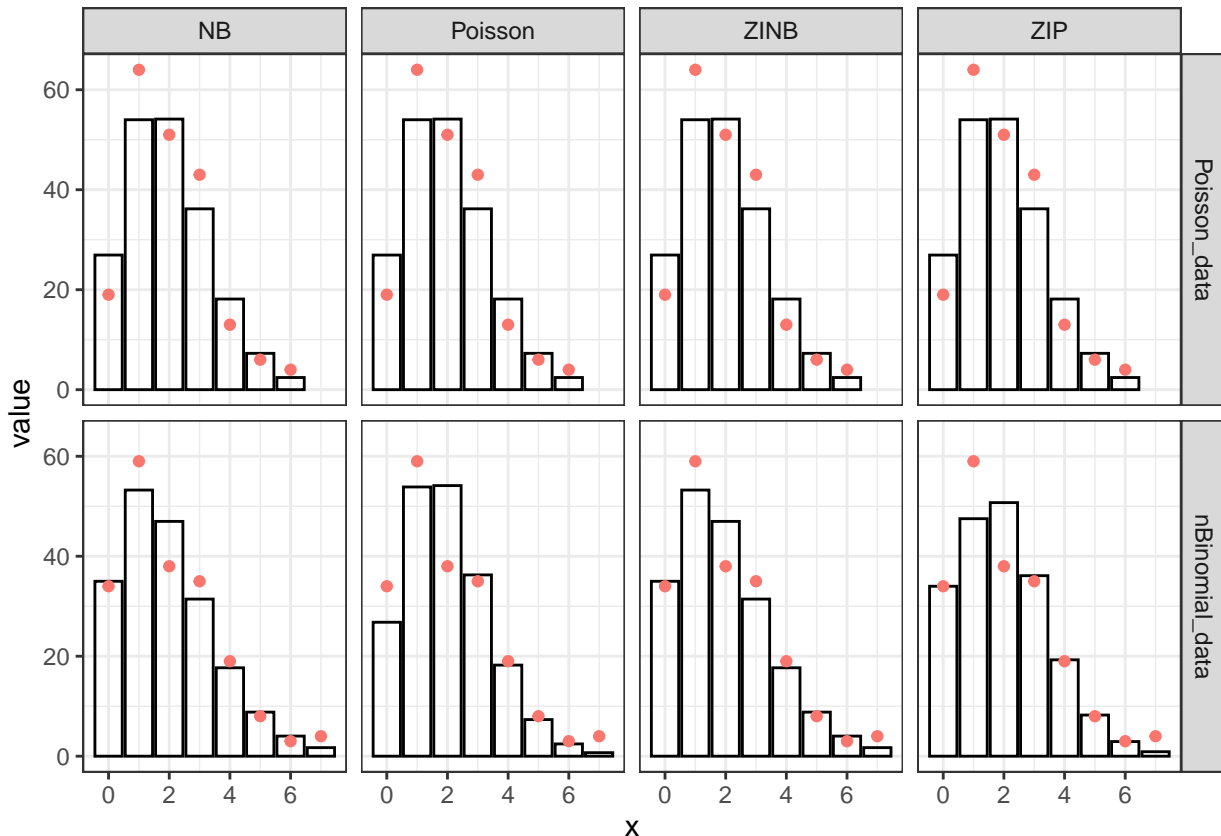
Next, the decide() function is used to select the most appropriate distribution for the count data in the html-friendly format.

```
decide(summ, separate = TRUE)
```

```
## [1] "Count name: nBinomial_data<br/>The most appropriate model (model with the lowest BIC value): NB"
```

Next, the empirical distribution of counts with the distribution defined by the model fitted to counts are compared. The bar charts represent theoretical counts depending on the chosen distribution. Red dots describe the real number of counts.

```
fitcmp <- compare_fit(df, fitlist = fit_counts(df, model = "all"))
plot_fitcmp(fitcmp)
```



Finally, the counts are fitted to model(s) using the count name as the explanatory variable. Estimates are presented in the table below along with the BIC values of their models from the summary_fitlist() function. Estimated coefficients of models (lambda for all distributions, theta for NB and ZINB, r for ZIP and ZINB).

```
results <- summary_fitlist(fc)
```

Sort the dataset according to their BIC values and print them as table.

```
knitr::kable(results[order (results[["BIC"]]),])
```

| | count | lambda | lower | upper | BIC | theta | r | model |
|---|----------------|----------|----------|----------|----------|--------------|-----------|---------|
| 1 | Poisson_data | 2.005000 | 1.818057 | 2.211166 | 666.8974 | NA | NA | Poisson |
| 3 | Poisson_data | 2.005010 | 1.818064 | 2.211179 | 672.1961 | NA | 0.0000034 | ZIP |
| 5 | Poisson_data | 2.005000 | 1.818050 | 2.211174 | 672.1975 | 2.715018e+04 | NA | NB |
| 7 | Poisson_data | 2.004999 | 1.818052 | 2.211171 | 677.4951 | 2.836674e+05 | 0.0000078 | ZINB |
| 6 | nBinomial_data | 2.010000 | 1.796391 | 2.249009 | 728.5517 | 6.261040e+00 | NA | NB |
| 2 | nBinomial_data | 2.010000 | 1.822812 | 2.216410 | 731.1431 | NA | NA | Poisson |
| 4 | nBinomial_data | 2.135487 | 1.902169 | 2.397424 | 733.3299 | NA | 0.0587695 | ZIP |
| 8 | nBinomial_data | 2.010036 | 1.796331 | 2.249165 | 733.8502 | 6.261978e+00 | 0.0000182 | ZINB |

3 Overdispersion of count data

One of the important features of the Poisson distribution is the equality of variance and expected value. Although count data is commonly assumed to be Poisson-distributed, we often encounter overdispersed datasets, when the variance is bigger than the mean. Three distributions included in **countfitteR**: Zero-Inflated Poisson (ZIP), Negative Binomial (NB) and Zero-negative Binomial (ZINB) model overdispersed counts.

Overdispersion may be caused by the increased variability of counts, for example when a counting algorithm under- and overcounts. In such situation the data might have the NB distribution. The other cause of overdispersion is called zero-inflation and occurs in datasets, where some factor introduced faulty zeros. That means that some counts, regardless of their real state, are treated as zeros. In this case, data has the ZIP distribution. If both faulty zeros and increased variance affect the data, the ZINB distribution is the most appropriate.

3.1 Overdispersed count data distribution

Poisson and Negative Binomial distributions have the same expected value. In case of ZIP and ZINB, the expected value is smaller than the real average number of foci per cell.

Table S1: Expected value and variance of Poisson, ZIP, NB and ZINB distributions. λ : Poisson parameter (number of occurrences, e.g., average number of foci per cell). r : zero inflation (fraction of occurrences treated as zeros, e.g., fraction of cells treated by system as having no foci regardless of their real state). θ : dispersion parameter.

| Distribution name | Expected value | Variance |
|-------------------|-------------------------|--|
| Poisson | $E(X) = \lambda$ | $\text{var}(X) = \lambda$ |
| ZIP | $E(X) = (1 - r)\lambda$ | $\text{var}(X) = \lambda(1 - r)(1 + \lambda r)$ |
| NB | $E(X) = \lambda$ | $\text{var}(X) = \lambda + \frac{\lambda^2}{\theta}$ |

| Distribution name | Expected value | Variance |
|-------------------|-------------------------|---|
| ZINB | $E(X) = (1 - r)\lambda$ | $\text{var}(X) = (1 - r)\lambda \left(1 + r\lambda + \frac{1}{\theta}\right)$ |

Depending on the value of r the variance of ZIP and ZINB may be smaller or bigger than the variance of Poisson distribution. In case of the NB distribution, the variance is always bigger than for the Poisson distribution, although the difference becomes negligible, when the θ is much bigger than λ^2 .

Parameters:

- λ - Poisson parameter (average number of foci per cell).
- r - zero inflation (fraction of cells treated by system as having no foci regardless of their real state).
- θ - dispersion parameter.

Usually the NB distribution is parameterized using μ and θ , but to make comparison clearer, we use λ instead of μ . In this parameterization, NB and ZINB are treated as the mixture of Poisson and Gamma (Γ) distributions.

Table S2: Probability mass functions of Poisson, ZIP, NB and ZINB distributions. λ : Poisson parameter (number of occurrences, e.g., average number of foci per cell). r : zero inflation (fraction of occurrences treated as zeros, e.g., fraction of cells treated by system as having no foci regardless of their real state). θ : dispersion parameter.

| Distribution name | pmf |
|---------------------------------|--|
| Poisson | $P\{X = k\} = \frac{\lambda^k \exp^{-\lambda}}{k!}$ |
| Zero-inflated Poisson | $P\{X = k\} = \begin{cases} r + (1 - r) \exp^{-\lambda}, & \text{if } k = 0 \\ r \frac{\lambda^k \exp^{-\lambda}}{k!}, & \text{if } k = 1, 2, \dots \end{cases}$ |
| Negative Binomial | $P\{X = k\} = \frac{\Gamma(\theta + k)}{\Gamma(\theta)k!} \left(\left(\frac{\theta}{\theta + \lambda} \right)^\theta \left(\frac{\lambda}{\theta + \lambda} \right) \right)^k$ |
| Zero-inflated Negative Binomial | $P\{X = k\} = \begin{cases} r + (1 - r) \left(\frac{\theta}{\theta + \lambda} \right)^\theta, & \text{if } k = 0 \\ (1 - r) \frac{\Gamma(\theta + k)}{\Gamma(\theta)k!} \left(\left(\frac{\theta}{\theta + \lambda} \right)^\theta \left(\frac{\lambda}{\theta + \lambda} \right) \right)^k, & \text{if } k = 1, 2, \dots \end{cases}$ |

3.2 Results of the simulation

Figure S1: Empirical power of countfitter and two-step test for Poisson distribution. n : number of counts in the sample. λ : Poisson parameter (number of occurrences, e.g., average number of foci per cell).

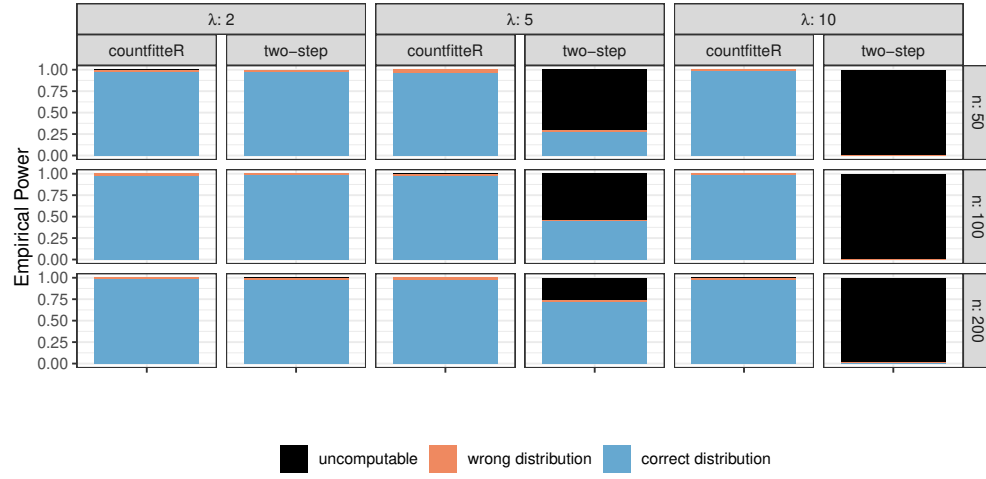


Figure S2: Empirical power of countfitter and two-step test for NB distribution. λ : Poisson parameter (number of occurrences, e.g., average number of foci per cell). θ : dispersion parameter.

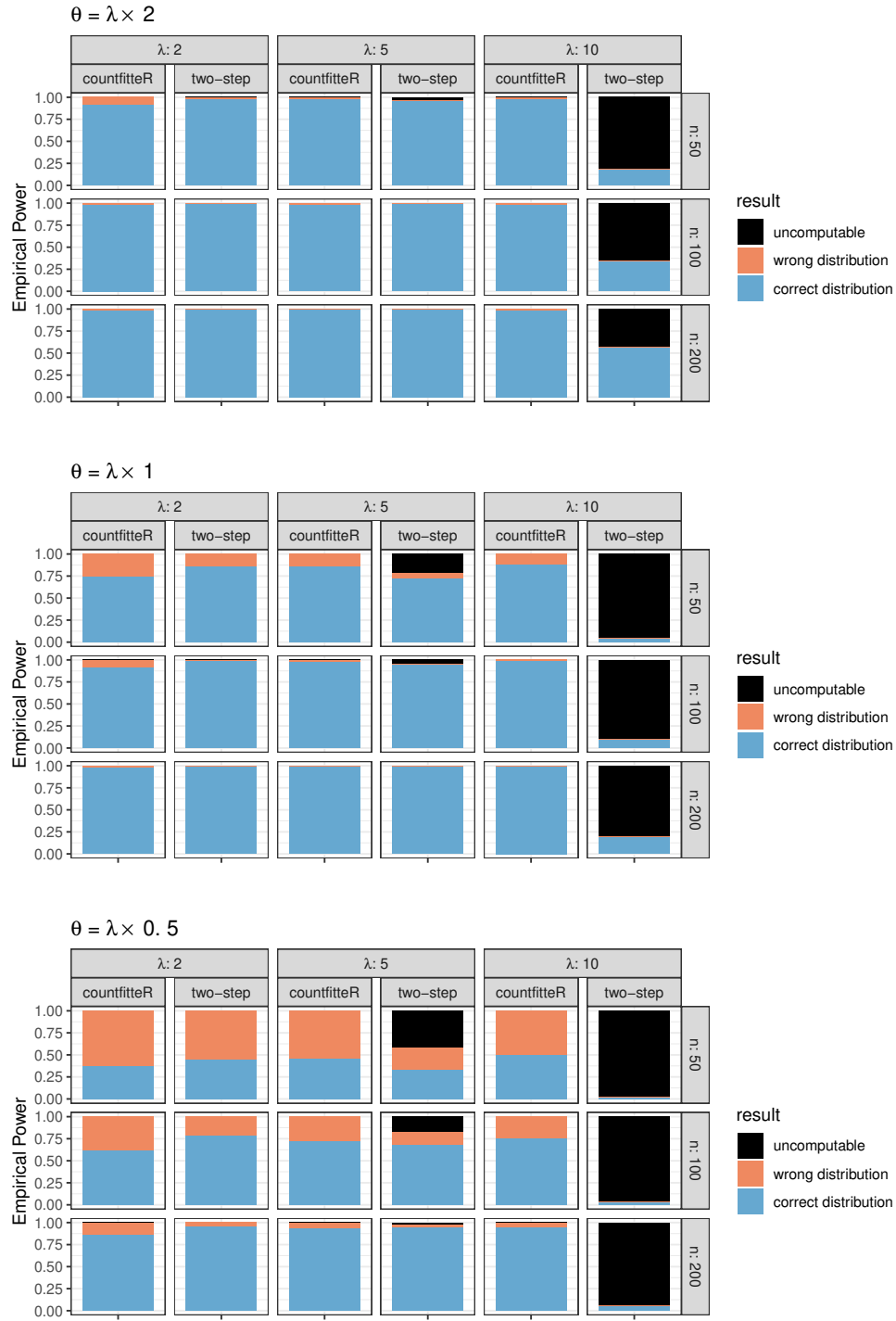


Table S3: Comparison of countfitteR empirical power with two-step procedure for Poisson distribution with three possible sample sizes ($n = 50, 100, 200$) and three possible means ($\lambda = 2, 5, 10$).

| model | method | n | lambda | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|-----------|-----------|--------------|
| pois | countfitteR | 50 | 2 | 0.9780000 | 0.1467567 | 0 |
| pois | countfitteR | 100 | 2 | 0.9760000 | 0.1531256 | 0 |
| pois | countfitteR | 200 | 2 | 0.9850000 | 0.1216133 | 0 |
| pois | countfitteR | 50 | 5 | 0.9600000 | 0.1960572 | 0 |
| pois | countfitteR | 100 | 5 | 0.9770000 | 0.1499783 | 0 |
| pois | countfitteR | 200 | 5 | 0.9720000 | 0.1650553 | 0 |
| pois | countfitteR | 50 | 10 | 0.9840000 | 0.1255379 | 0 |
| pois | countfitteR | 100 | 10 | 0.9880000 | 0.1089397 | 0 |
| pois | countfitteR | 200 | 10 | 0.9800000 | 0.1400701 | 0 |
| pois | two-step | 50 | 2 | 0.9808468 | 0.1371326 | 8 |
| pois | two-step | 100 | 2 | 0.9880000 | 0.1089397 | 0 |
| pois | two-step | 200 | 2 | 0.9800000 | 0.1400701 | 0 |
| pois | two-step | 50 | 5 | 0.9595960 | 0.1972373 | 703 |
| pois | two-step | 100 | 5 | 0.9759825 | 0.1532707 | 542 |
| pois | two-step | 200 | 5 | 0.9690860 | 0.1732011 | 256 |
| pois | two-step | 50 | 10 | 1.0000000 | 0.0000000 | 998 |
| pois | two-step | 100 | 10 | 0.3333333 | 0.5773503 | 997 |
| pois | two-step | 200 | 10 | 0.8571429 | 0.3631365 | 986 |

Table S4: Comparison of countfitteR and two-step procedure empirical power for ZIP distribution with three possible sample sizes ($n = 50, 100, 200$), three possible means ($\lambda = 2, 5, 10$), and dispersion parameter r ranging from 0.1 to 0.9.

| model | method | n | lambda | size | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----------|-----------|--------------|
| nb | countfitteR | 50 | 2 | 1.0 | 0.9150000 | 0.2790212 | 0 |
| nb | countfitteR | 100 | 2 | 1.0 | 0.9800000 | 0.1400701 | 0 |
| nb | countfitteR | 200 | 2 | 1.0 | 0.9890000 | 0.1043546 | 0 |
| nb | countfitteR | 50 | 2 | 2.0 | 0.7410000 | 0.4383048 | 0 |
| nb | countfitteR | 100 | 2 | 2.0 | 0.9210000 | 0.2698737 | 0 |
| nb | countfitteR | 200 | 2 | 2.0 | 0.9820000 | 0.1330176 | 0 |
| nb | countfitteR | 50 | 2 | 4.0 | 0.3760000 | 0.4846224 | 0 |
| nb | countfitteR | 100 | 2 | 4.0 | 0.6200000 | 0.4856293 | 0 |
| nb | countfitteR | 200 | 2 | 4.0 | 0.8650000 | 0.3418946 | 0 |
| nb | countfitteR | 50 | 5 | 2.5 | 0.9790000 | 0.1434558 | 0 |
| nb | countfitteR | 100 | 5 | 2.5 | 0.9850000 | 0.1216133 | 0 |
| nb | countfitteR | 200 | 5 | 2.5 | 0.9920000 | 0.0891288 | 0 |
| nb | countfitteR | 50 | 5 | 5.0 | 0.8590000 | 0.3481957 | 0 |
| nb | countfitteR | 100 | 5 | 5.0 | 0.9800000 | 0.1400701 | 0 |
| nb | countfitteR | 200 | 5 | 5.0 | 0.9930000 | 0.0834144 | 0 |
| nb | countfitteR | 50 | 5 | 10.0 | 0.4610000 | 0.4987261 | 0 |
| nb | countfitteR | 100 | 5 | 10.0 | 0.7240000 | 0.4472405 | 0 |
| nb | countfitteR | 200 | 5 | 10.0 | 0.9410000 | 0.2357426 | 0 |
| nb | countfitteR | 50 | 10 | 5.0 | 0.9840000 | 0.1255379 | 0 |
| nb | countfitteR | 100 | 10 | 5.0 | 0.9860000 | 0.1175492 | 0 |
| nb | countfitteR | 200 | 10 | 5.0 | 0.9890000 | 0.1043546 | 0 |
| nb | countfitteR | 50 | 10 | 10.0 | 0.8840000 | 0.3203852 | 0 |
| nb | countfitteR | 100 | 10 | 10.0 | 0.9880000 | 0.1089397 | 0 |
| nb | countfitteR | 200 | 10 | 10.0 | 0.9900000 | 0.0995485 | 0 |
| nb | countfitteR | 50 | 10 | 20.0 | 0.4980000 | 0.5002462 | 0 |
| nb | countfitteR | 100 | 10 | 20.0 | 0.7520000 | 0.4320679 | 0 |
| nb | countfitteR | 200 | 10 | 20.0 | 0.9490000 | 0.2201078 | 0 |
| nb | two-step | 50 | 2 | 1.0 | 0.9870000 | 0.1133307 | 0 |
| nb | two-step | 100 | 2 | 1.0 | 0.9980000 | 0.0446990 | 0 |
| nb | two-step | 200 | 2 | 1.0 | 1.0000000 | 0.0000000 | 0 |
| nb | two-step | 50 | 2 | 2.0 | 0.8610000 | 0.3461196 | 0 |
| nb | two-step | 100 | 2 | 2.0 | 0.9900000 | 0.0995485 | 0 |
| nb | two-step | 200 | 2 | 2.0 | 0.9990000 | 0.0316228 | 0 |
| nb | two-step | 50 | 2 | 4.0 | 0.4490000 | 0.4976411 | 0 |
| nb | two-step | 100 | 2 | 4.0 | 0.7820000 | 0.4130940 | 0 |
| nb | two-step | 200 | 2 | 4.0 | 0.9550000 | 0.2074079 | 0 |
| nb | two-step | 50 | 5 | 2.5 | 0.9968944 | 0.0556700 | 34 |
| nb | two-step | 100 | 5 | 2.5 | 0.9990000 | 0.0316228 | 0 |
| nb | two-step | 200 | 5 | 2.5 | 1.0000000 | 0.0000000 | 0 |
| nb | two-step | 50 | 5 | 5.0 | 0.9210191 | 0.2698809 | 215 |
| nb | two-step | 100 | 5 | 5.0 | 0.9958159 | 0.0645829 | 44 |
| nb | two-step | 200 | 5 | 5.0 | 1.0000000 | 0.0000000 | 3 |
| nb | two-step | 50 | 5 | 10.0 | 0.5684932 | 0.4957111 | 416 |
| nb | two-step | 100 | 5 | 10.0 | 0.8250905 | 0.3801190 | 171 |
| nb | two-step | 200 | 5 | 10.0 | 0.9753846 | 0.1550294 | 25 |
| nb | two-step | 50 | 10 | 5.0 | 1.0000000 | 0.0000000 | 811 |
| nb | two-step | 100 | 10 | 5.0 | 1.0000000 | 0.0000000 | 657 |
| nb | two-step | 200 | 10 | 5.0 | 1.0000000 | 0.0000000 | 438 |
| nb | two-step | 50 | 10 | 10.0 | 1.0000000 | 0.0000000 | 959 |

| model | method | n | lambda | size | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----------|-----------|--------------|
| nb | two-step | 100 | 10 | 10.0 | 1.0000000 | 0.0000000 | 899 |
| nb | two-step | 200 | 10 | 10.0 | 1.0000000 | 0.0000000 | 801 |
| nb | two-step | 50 | 10 | 20.0 | 0.7000000 | 0.4701623 | 980 |
| nb | two-step | 100 | 10 | 20.0 | 0.8666667 | 0.3457459 | 970 |
| nb | two-step | 200 | 10 | 20.0 | 0.9833333 | 0.1290994 | 940 |

Table S5: Comparison of countfitteR empirical and two-step procedure empirical power for NB distribution with three possible sample sizes ($n = 50, 100, 200$), three possible means ($\lambda = 2, 5, 10$), and three possible sizes ($\theta = \frac{\lambda}{2}, \lambda, 2\lambda$).

| model | method | n | lambda | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|-----|-----------|-----------|--------------|
| zip | countfitteR | 50 | 2 | 0.1 | 0.7970000 | 0.4024338 | 0 |
| zip | countfitteR | 100 | 2 | 0.1 | 0.8830000 | 0.3215811 | 0 |
| zip | countfitteR | 200 | 2 | 0.1 | 0.9370000 | 0.2430845 | 0 |
| zip | countfitteR | 50 | 5 | 0.1 | 0.9610000 | 0.1936918 | 0 |
| zip | countfitteR | 100 | 5 | 0.1 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 200 | 5 | 0.1 | 0.9900000 | 0.0995485 | 0 |
| zip | countfitteR | 50 | 10 | 0.1 | 0.9930000 | 0.0834144 | 0 |
| zip | countfitteR | 100 | 10 | 0.1 | 0.9950000 | 0.0705690 | 0 |
| zip | countfitteR | 200 | 10 | 0.1 | 0.9960000 | 0.0631505 | 0 |
| zip | countfitteR | 50 | 2 | 0.2 | 0.8590000 | 0.3481957 | 0 |
| zip | countfitteR | 100 | 2 | 0.2 | 0.9280000 | 0.2586173 | 0 |
| zip | countfitteR | 200 | 2 | 0.2 | 0.9680000 | 0.1760881 | 0 |
| zip | countfitteR | 50 | 5 | 0.2 | 0.9930000 | 0.0834144 | 0 |
| zip | countfitteR | 100 | 5 | 0.2 | 0.9950000 | 0.0705690 | 0 |
| zip | countfitteR | 200 | 5 | 0.2 | 0.9920000 | 0.0891288 | 0 |
| zip | countfitteR | 50 | 10 | 0.2 | 0.9920000 | 0.0891288 | 0 |
| zip | countfitteR | 100 | 10 | 0.2 | 0.9960000 | 0.0631505 | 0 |
| zip | countfitteR | 200 | 10 | 0.2 | 0.9940000 | 0.0772656 | 0 |
| zip | countfitteR | 50 | 2 | 0.3 | 0.8920000 | 0.3105357 | 0 |
| zip | countfitteR | 100 | 2 | 0.3 | 0.9390000 | 0.2394501 | 0 |
| zip | countfitteR | 200 | 2 | 0.3 | 0.9800000 | 0.1400701 | 0 |
| zip | countfitteR | 50 | 5 | 0.3 | 0.9820000 | 0.1330176 | 0 |
| zip | countfitteR | 100 | 5 | 0.3 | 0.9840000 | 0.1255379 | 0 |
| zip | countfitteR | 200 | 5 | 0.3 | 0.9900000 | 0.0995485 | 0 |
| zip | countfitteR | 50 | 10 | 0.3 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 100 | 10 | 0.3 | 0.9890000 | 0.1043546 | 0 |
| zip | countfitteR | 200 | 10 | 0.3 | 0.9950000 | 0.0705690 | 0 |
| zip | countfitteR | 50 | 2 | 0.4 | 0.9000000 | 0.3001501 | 0 |
| zip | countfitteR | 100 | 2 | 0.4 | 0.9470000 | 0.2241456 | 0 |
| zip | countfitteR | 200 | 2 | 0.4 | 0.9900000 | 0.0995485 | 0 |
| zip | countfitteR | 50 | 5 | 0.4 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 100 | 5 | 0.4 | 0.9920000 | 0.0891288 | 0 |
| zip | countfitteR | 200 | 5 | 0.4 | 0.9890000 | 0.1043546 | 0 |
| zip | countfitteR | 50 | 10 | 0.4 | 0.9930000 | 0.0834144 | 0 |
| zip | countfitteR | 100 | 10 | 0.4 | 0.9950000 | 0.0705690 | 0 |
| zip | countfitteR | 200 | 10 | 0.4 | 0.9900000 | 0.0995485 | 0 |
| zip | countfitteR | 50 | 2 | 0.5 | 0.9230000 | 0.2667248 | 0 |
| zip | countfitteR | 100 | 2 | 0.5 | 0.9670000 | 0.1787259 | 0 |
| zip | countfitteR | 200 | 2 | 0.5 | 0.9860000 | 0.1175492 | 0 |
| zip | countfitteR | 50 | 5 | 0.5 | 0.9840000 | 0.1255379 | 0 |
| zip | countfitteR | 100 | 5 | 0.5 | 0.9830000 | 0.1293357 | 0 |
| zip | countfitteR | 200 | 5 | 0.5 | 0.9980000 | 0.0446990 | 0 |
| zip | countfitteR | 50 | 10 | 0.5 | 0.9890000 | 0.1043546 | 0 |
| zip | countfitteR | 100 | 10 | 0.5 | 0.9960000 | 0.0631505 | 0 |
| zip | countfitteR | 200 | 10 | 0.5 | 0.9930000 | 0.0834144 | 0 |
| zip | countfitteR | 50 | 2 | 0.6 | 0.8750000 | 0.3308844 | 0 |
| zip | countfitteR | 100 | 2 | 0.6 | 0.9470000 | 0.2241456 | 0 |
| zip | countfitteR | 200 | 2 | 0.6 | 0.9880000 | 0.1089397 | 0 |

| model | method | n | lambda | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|-----|-----------|-----------|--------------|
| zip | countfitteR | 50 | 5 | 0.6 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 100 | 5 | 0.6 | 0.9880000 | 0.1089397 | 0 |
| zip | countfitteR | 200 | 5 | 0.6 | 0.9880000 | 0.1089397 | 0 |
| zip | countfitteR | 50 | 10 | 0.6 | 0.9830000 | 0.1293357 | 0 |
| zip | countfitteR | 100 | 10 | 0.6 | 0.9910000 | 0.0944877 | 0 |
| zip | countfitteR | 200 | 10 | 0.6 | 0.9940000 | 0.0772656 | 0 |
| zip | countfitteR | 50 | 2 | 0.7 | 0.7820000 | 0.4130940 | 0 |
| zip | countfitteR | 100 | 2 | 0.7 | 0.9260000 | 0.2619019 | 0 |
| zip | countfitteR | 200 | 2 | 0.7 | 0.9810000 | 0.1365930 | 0 |
| zip | countfitteR | 50 | 5 | 0.7 | 0.9850000 | 0.1216133 | 0 |
| zip | countfitteR | 100 | 5 | 0.7 | 0.9880000 | 0.1089397 | 0 |
| zip | countfitteR | 200 | 5 | 0.7 | 0.9920000 | 0.0891288 | 0 |
| zip | countfitteR | 50 | 10 | 0.7 | 0.9900000 | 0.0995485 | 0 |
| zip | countfitteR | 100 | 10 | 0.7 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 200 | 10 | 0.7 | 0.9920000 | 0.0891288 | 0 |
| zip | countfitteR | 50 | 2 | 0.8 | 0.5350000 | 0.4990231 | 0 |
| zip | countfitteR | 100 | 2 | 0.8 | 0.8000000 | 0.4002002 | 0 |
| zip | countfitteR | 200 | 2 | 0.8 | 0.9480000 | 0.2221381 | 0 |
| zip | countfitteR | 50 | 5 | 0.8 | 0.9820000 | 0.1330176 | 0 |
| zip | countfitteR | 100 | 5 | 0.8 | 0.9890000 | 0.1043546 | 0 |
| zip | countfitteR | 200 | 5 | 0.8 | 0.9860000 | 0.1175492 | 0 |
| zip | countfitteR | 50 | 10 | 0.8 | 0.9880000 | 0.1089397 | 0 |
| zip | countfitteR | 100 | 10 | 0.8 | 0.9870000 | 0.1133307 | 0 |
| zip | countfitteR | 200 | 10 | 0.8 | 0.9940000 | 0.0772656 | 0 |
| zip | countfitteR | 50 | 2 | 0.9 | 0.2030000 | 0.4024338 | 0 |
| zip | countfitteR | 100 | 2 | 0.9 | 0.3130000 | 0.4639464 | 0 |
| zip | countfitteR | 200 | 2 | 0.9 | 0.5480000 | 0.4979397 | 0 |
| zip | countfitteR | 50 | 5 | 0.9 | 0.8980000 | 0.3027997 | 0 |
| zip | countfitteR | 100 | 5 | 0.9 | 0.9840000 | 0.1255379 | 0 |
| zip | countfitteR | 200 | 5 | 0.9 | 0.9940000 | 0.0772656 | 0 |
| zip | countfitteR | 50 | 10 | 0.9 | 0.9770000 | 0.1499783 | 0 |
| zip | countfitteR | 100 | 10 | 0.9 | 0.9860000 | 0.1175492 | 0 |
| zip | countfitteR | 200 | 10 | 0.9 | 0.9920000 | 0.0891288 | 0 |
| zip | two-step | 50 | 2 | 0.1 | 0.0000000 | 0.0000000 | 545 |
| zip | two-step | 100 | 2 | 0.1 | 0.0000000 | 0.0000000 | 660 |
| zip | two-step | 200 | 2 | 0.1 | 0.0000000 | 0.0000000 | 701 |
| zip | two-step | 50 | 5 | 0.1 | 0.0000000 | 0.0000000 | 907 |
| zip | two-step | 100 | 5 | 0.1 | 0.0000000 | 0.0000000 | 921 |
| zip | two-step | 200 | 5 | 0.1 | 0.0000000 | 0.0000000 | 998 |
| zip | two-step | 50 | 10 | 0.1 | NaN | NA | 1000 |
| zip | two-step | 100 | 10 | 0.1 | NaN | NA | 1000 |
| zip | two-step | 200 | 10 | 0.1 | NaN | NA | 1000 |
| zip | two-step | 50 | 2 | 0.2 | 0.0000000 | 0.0000000 | 208 |
| zip | two-step | 100 | 2 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 2 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.2 | 0.0870000 | 0.2819761 | 0 |
| zip | two-step | 100 | 5 | 0.2 | 0.1540000 | 0.3611294 | 0 |
| zip | two-step | 200 | 5 | 0.2 | 0.6920000 | 0.4618976 | 0 |
| zip | two-step | 50 | 10 | 0.2 | 0.2900000 | 0.4539891 | 0 |
| zip | two-step | 100 | 10 | 0.2 | 0.6990000 | 0.4589222 | 0 |
| zip | two-step | 200 | 10 | 0.2 | 0.9990000 | 0.0316228 | 0 |
| zip | two-step | 50 | 2 | 0.3 | 0.0000000 | 0.0000000 | 0 |

| model | method | n | lambda | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|-----|-----------|-----------|--------------|
| zip | two-step | 100 | 2 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 2 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.3 | 0.0880000 | 0.2834367 | 0 |
| zip | two-step | 100 | 5 | 0.3 | 0.4500000 | 0.4977427 | 0 |
| zip | two-step | 200 | 5 | 0.3 | 0.6060000 | 0.4888793 | 0 |
| zip | two-step | 50 | 10 | 0.3 | 0.7590000 | 0.4279043 | 0 |
| zip | two-step | 100 | 10 | 0.3 | 0.9950000 | 0.0705690 | 0 |
| zip | two-step | 200 | 10 | 0.3 | 1.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 2 | 0.4 | 0.0010000 | 0.0316228 | 0 |
| zip | two-step | 100 | 2 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 2 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.4 | 0.0650000 | 0.2466492 | 0 |
| zip | two-step | 100 | 5 | 0.4 | 0.3620000 | 0.4808193 | 0 |
| zip | two-step | 200 | 5 | 0.4 | 0.2910000 | 0.4544508 | 0 |
| zip | two-step | 50 | 10 | 0.4 | 0.9410000 | 0.2357426 | 0 |
| zip | two-step | 100 | 10 | 0.4 | 1.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 10 | 0.4 | 1.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 2 | 0.5 | 0.0060000 | 0.0772656 | 0 |
| zip | two-step | 100 | 2 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 2 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.5 | 0.0180000 | 0.1330176 | 0 |
| zip | two-step | 100 | 5 | 0.5 | 0.1060000 | 0.3079917 | 0 |
| zip | two-step | 200 | 5 | 0.5 | 0.0470000 | 0.2117447 | 0 |
| zip | two-step | 50 | 10 | 0.5 | 0.6480000 | 0.4778329 | 0 |
| zip | two-step | 100 | 10 | 0.5 | 0.9990000 | 0.0316228 | 0 |
| zip | two-step | 200 | 10 | 0.5 | 1.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 2 | 0.6 | 0.0100000 | 0.0995485 | 0 |
| zip | two-step | 100 | 2 | 0.6 | 0.0010000 | 0.0316228 | 0 |
| zip | two-step | 200 | 2 | 0.6 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.6 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 100 | 5 | 0.6 | 0.0080000 | 0.0891288 | 0 |
| zip | two-step | 200 | 5 | 0.6 | 0.0010000 | 0.0316228 | 0 |
| zip | two-step | 50 | 10 | 0.6 | 0.1860000 | 0.3893014 | 0 |
| zip | two-step | 100 | 10 | 0.6 | 0.8428428 | 0.3641312 | 1 |
| zip | two-step | 200 | 10 | 0.6 | 1.0000000 | 0.0000000 | 1 |
| zip | two-step | 50 | 2 | 0.7 | 0.0300000 | 0.1706726 | 0 |
| zip | two-step | 100 | 2 | 0.7 | 0.0070000 | 0.0834144 | 0 |
| zip | two-step | 200 | 2 | 0.7 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 5 | 0.7 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 100 | 5 | 0.7 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 200 | 5 | 0.7 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 10 | 0.7 | 0.0270000 | 0.1621644 | 0 |
| zip | two-step | 100 | 10 | 0.7 | 0.1251251 | 0.3310265 | 1 |
| zip | two-step | 200 | 10 | 0.7 | 0.9660000 | 0.1813198 | 0 |
| zip | two-step | 50 | 2 | 0.8 | 0.0130000 | 0.1133307 | 0 |
| zip | two-step | 100 | 2 | 0.8 | 0.0360000 | 0.1863833 | 0 |
| zip | two-step | 200 | 2 | 0.8 | 0.0150000 | 0.1216133 | 0 |
| zip | two-step | 50 | 5 | 0.8 | 0.0160000 | 0.1255379 | 0 |
| zip | two-step | 100 | 5 | 0.8 | 0.0030000 | 0.0547174 | 0 |
| zip | two-step | 200 | 5 | 0.8 | 0.0000000 | 0.0000000 | 0 |
| zip | two-step | 50 | 10 | 0.8 | 0.0560000 | 0.2300368 | 0 |
| zip | two-step | 100 | 10 | 0.8 | 0.0000000 | 0.0000000 | 0 |

| model | method | n | lambda | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|-----|-----------|-----------|--------------|
| zip | two-step | 200 | 10 | 0.8 | 0.0670000 | 0.2501471 | 0 |
| zip | two-step | 50 | 2 | 0.9 | 0.0050000 | 0.0705690 | 0 |
| zip | two-step | 100 | 2 | 0.9 | 0.0100000 | 0.0995485 | 0 |
| zip | two-step | 200 | 2 | 0.9 | 0.0300000 | 0.1706726 | 0 |
| zip | two-step | 50 | 5 | 0.9 | 0.0370741 | 0.1890383 | 2 |
| zip | two-step | 100 | 5 | 0.9 | 0.0730000 | 0.2602667 | 0 |
| zip | two-step | 200 | 5 | 0.9 | 0.0180000 | 0.1330176 | 0 |
| zip | two-step | 50 | 10 | 0.9 | 0.0050251 | 0.0707453 | 5 |
| zip | two-step | 100 | 10 | 0.9 | 0.0080000 | 0.0891288 | 0 |
| zip | two-step | 200 | 10 | 0.9 | 0.0000000 | 0.0000000 | 0 |

Table S6: Comparison of countfitteR and two-step 2procedure empirical power for ZINB distribution with three possible sample sizes ($n = 50, 100, 200$), three possible means ($\lambda = 2, 5, 10$), three possible sizes ($\theta = \frac{\lambda}{2}, \lambda, 2\lambda$), and dispersion parameter r ranging from 0.1 to 0.9.

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | countfitteR | 50 | 2 | 1.0 | 0.1 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.1 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.1 | 0.0040000 | 0.0631505 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.1 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.1 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.1 | 0.0470000 | 0.2117447 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.1 | 0.1720000 | 0.3775693 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.1 | 0.5190000 | 0.4998889 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.1 | 0.0180000 | 0.1330176 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.1 | 0.0740000 | 0.2619019 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.1 | 0.3160000 | 0.4651455 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.1 | 0.0160000 | 0.1255379 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.1 | 0.0460000 | 0.2095899 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.1 | 0.1230000 | 0.3286016 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.1 | 0.2640000 | 0.4410198 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.1 | 0.4980000 | 0.5002462 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.1 | 0.7720000 | 0.4197525 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.1 | 0.1070000 | 0.3092679 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.1 | 0.2360000 | 0.4248347 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.1 | 0.4250000 | 0.4945904 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.1 | 0.0420000 | 0.2006895 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.1 | 0.0950000 | 0.2933617 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.1 | 0.1420000 | 0.3492248 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.2 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.2 | 0.0080000 | 0.0891288 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.2 | 0.0680000 | 0.2518719 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.2 | 0.0030000 | 0.0547174 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.2 | 0.0250000 | 0.1562031 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.2 | 0.0060000 | 0.0772656 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.2 | 0.1690000 | 0.3749394 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.2 | 0.5580000 | 0.4968731 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.2 | 0.9250000 | 0.2635231 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.2 | 0.1110000 | 0.3142893 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.2 | 0.3580000 | 0.4796520 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.2 | 0.6670000 | 0.4715224 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.2 | 0.0500000 | 0.2180540 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.2 | 0.1350000 | 0.3418946 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.2 | 0.2500000 | 0.4332294 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.2 | 0.5650000 | 0.4960051 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.2 | 0.8300000 | 0.3758208 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.2 | 0.9660000 | 0.1813198 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | countfitter | 50 | 10 | 10.0 | 0.2 | 0.2930000 | 0.4553662 | 0 |
| zinb | countfitter | 100 | 10 | 10.0 | 0.2 | 0.4550000 | 0.4982201 | 0 |
| zinb | countfitter | 200 | 10 | 10.0 | 0.2 | 0.7070000 | 0.4553662 | 0 |
| zinb | countfitter | 50 | 10 | 20.0 | 0.2 | 0.0940000 | 0.2919747 | 0 |
| zinb | countfitter | 100 | 10 | 20.0 | 0.2 | 0.1750000 | 0.3801572 | 0 |
| zinb | countfitter | 200 | 10 | 20.0 | 0.2 | 0.2700000 | 0.4441816 | 0 |
| zinb | countfitter | 50 | 2 | 1.0 | 0.3 | 0.0060000 | 0.0772656 | 0 |
| zinb | countfitter | 100 | 2 | 1.0 | 0.3 | 0.0250000 | 0.1562031 | 0 |
| zinb | countfitter | 200 | 2 | 1.0 | 0.3 | 0.1430000 | 0.3502480 | 0 |
| zinb | countfitter | 50 | 2 | 2.0 | 0.3 | 0.0030000 | 0.0547174 | 0 |
| zinb | countfitter | 100 | 2 | 2.0 | 0.3 | 0.0130000 | 0.1133307 | 0 |
| zinb | countfitter | 200 | 2 | 2.0 | 0.3 | 0.1400000 | 0.3471607 | 0 |
| zinb | countfitter | 50 | 2 | 4.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitter | 100 | 2 | 4.0 | 0.3 | 0.0030000 | 0.0547174 | 0 |
| zinb | countfitter | 200 | 2 | 4.0 | 0.3 | 0.0430000 | 0.2029586 | 0 |
| zinb | countfitter | 50 | 5 | 2.5 | 0.3 | 0.3930000 | 0.4886612 | 0 |
| zinb | countfitter | 100 | 5 | 2.5 | 0.3 | 0.8010000 | 0.3994478 | 0 |
| zinb | countfitter | 200 | 5 | 2.5 | 0.3 | 0.9880000 | 0.1089397 | 0 |
| zinb | countfitter | 50 | 5 | 5.0 | 0.3 | 0.2680000 | 0.4431392 | 0 |
| zinb | countfitter | 100 | 5 | 5.0 | 0.3 | 0.5570000 | 0.4969889 | 0 |
| zinb | countfitter | 200 | 5 | 5.0 | 0.3 | 0.8500000 | 0.3572501 | 0 |
| zinb | countfitter | 50 | 5 | 10.0 | 0.3 | 0.1060000 | 0.3079917 | 0 |
| zinb | countfitter | 100 | 5 | 10.0 | 0.3 | 0.2420000 | 0.4285086 | 0 |
| zinb | countfitter | 200 | 5 | 10.0 | 0.3 | 0.3770000 | 0.4848774 | 0 |
| zinb | countfitter | 50 | 10 | 5.0 | 0.3 | 0.7520000 | 0.4320679 | 0 |
| zinb | countfitter | 100 | 10 | 5.0 | 0.3 | 0.9500000 | 0.2180540 | 0 |
| zinb | countfitter | 200 | 10 | 5.0 | 0.3 | 0.9820000 | 0.1330176 | 0 |
| zinb | countfitter | 50 | 10 | 10.0 | 0.3 | 0.4050000 | 0.4911377 | 0 |
| zinb | countfitter | 100 | 10 | 10.0 | 0.3 | 0.6630000 | 0.4729214 | 0 |
| zinb | countfitter | 200 | 10 | 10.0 | 0.3 | 0.7590000 | 0.4279043 | 0 |
| zinb | countfitter | 50 | 10 | 20.0 | 0.3 | 0.1750000 | 0.3801572 | 0 |
| zinb | countfitter | 100 | 10 | 20.0 | 0.3 | 0.2770000 | 0.4477404 | 0 |
| zinb | countfitter | 200 | 10 | 20.0 | 0.3 | 0.4110000 | 0.4922614 | 0 |
| zinb | countfitter | 50 | 2 | 1.0 | 0.4 | 0.0070000 | 0.0834144 | 0 |
| zinb | countfitter | 100 | 2 | 1.0 | 0.4 | 0.0500000 | 0.2180540 | 0 |
| zinb | countfitter | 200 | 2 | 1.0 | 0.4 | 0.2350000 | 0.4242110 | 0 |
| zinb | countfitter | 50 | 2 | 2.0 | 0.4 | 0.0020000 | 0.0446990 | 0 |
| zinb | countfitter | 100 | 2 | 2.0 | 0.4 | 0.0260000 | 0.1592148 | 0 |
| zinb | countfitter | 200 | 2 | 2.0 | 0.4 | 0.2590000 | 0.4383048 | 0 |
| zinb | countfitter | 50 | 2 | 4.0 | 0.4 | 0.0020000 | 0.0446990 | 0 |
| zinb | countfitter | 100 | 2 | 4.0 | 0.4 | 0.0060000 | 0.0772656 | 0 |
| zinb | countfitter | 200 | 2 | 4.0 | 0.4 | 0.1260000 | 0.3320154 | 0 |
| zinb | countfitter | 50 | 5 | 2.5 | 0.4 | 0.5420000 | 0.4984822 | 0 |
| zinb | countfitter | 100 | 5 | 2.5 | 0.4 | 0.9140000 | 0.2805043 | 0 |
| zinb | countfitter | 200 | 5 | 2.5 | 0.4 | 0.9990000 | 0.0316228 | 0 |
| zinb | countfitter | 50 | 5 | 5.0 | 0.4 | 0.3980000 | 0.4897304 | 0 |
| zinb | countfitter | 100 | 5 | 5.0 | 0.4 | 0.6920000 | 0.4618976 | 0 |
| zinb | countfitter | 200 | 5 | 5.0 | 0.4 | 0.9450000 | 0.2280943 | 0 |
| zinb | countfitter | 50 | 5 | 10.0 | 0.4 | 0.1600000 | 0.3667895 | 0 |
| zinb | countfitter | 100 | 5 | 10.0 | 0.4 | 0.3070000 | 0.4614802 | 0 |
| zinb | countfitter | 200 | 5 | 10.0 | 0.4 | 0.5260000 | 0.4995734 | 0 |
| zinb | countfitter | 50 | 10 | 5.0 | 0.4 | 0.8620000 | 0.3450726 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | countfitteR | 100 | 10 | 5.0 | 0.4 | 0.9720000 | 0.1650553 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.4 | 0.9880000 | 0.1089397 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.4 | 0.5280000 | 0.4994652 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.4 | 0.7510000 | 0.4326502 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.4 | 0.8460000 | 0.3611294 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.4 | 0.2020000 | 0.4016931 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.4 | 0.3590000 | 0.4799472 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.4 | 0.5320000 | 0.4992246 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.5 | 0.0100000 | 0.0995485 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.5 | 0.0720000 | 0.2586173 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.5 | 0.2820000 | 0.4501985 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.5 | 0.0040000 | 0.0631505 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.5 | 0.0440000 | 0.2051977 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.5 | 0.3060000 | 0.4610603 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.5 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.5 | 0.0130000 | 0.1133307 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.5 | 0.1910000 | 0.3932857 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.5 | 0.6640000 | 0.4725752 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.5 | 0.9510000 | 0.2159760 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.5 | 1.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.5 | 0.5130000 | 0.5000811 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.5 | 0.7830000 | 0.4124089 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.5 | 0.9740000 | 0.1592148 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.5 | 0.2190000 | 0.4137756 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.5 | 0.3770000 | 0.4848774 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.5 | 0.6330000 | 0.4822277 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.5 | 0.9260000 | 0.2619019 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.5 | 0.9740000 | 0.1592148 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.5 | 0.9970000 | 0.0547174 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.5 | 0.6280000 | 0.4835802 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.5 | 0.7390000 | 0.4393997 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.5 | 0.8720000 | 0.3342570 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.5 | 0.2910000 | 0.4544508 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.5 | 0.3480000 | 0.4765744 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.5 | 0.6580000 | 0.4746170 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.6 | 0.0250000 | 0.1562031 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.6 | 0.0880000 | 0.2834367 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.6 | 0.2210000 | 0.4151281 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.6 | 0.0040000 | 0.0631505 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.6 | 0.0530000 | 0.2241456 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.6 | 0.3260000 | 0.4689818 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.6 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.6 | 0.0120000 | 0.1089397 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.6 | 0.1790000 | 0.3835441 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.6 | 0.7060000 | 0.4558199 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.6 | 0.9580000 | 0.2006895 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.6 | 1.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.6 | 0.5890000 | 0.4922614 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.6 | 0.8600000 | 0.3471607 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.6 | 0.9850000 | 0.1216133 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.6 | 0.2910000 | 0.4544508 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.6 | 0.4470000 | 0.4974318 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | countfitteR | 200 | 5 | 10.0 | 0.6 | 0.6890000 | 0.4631344 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.6 | 0.9770000 | 0.1499783 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.6 | 0.9750000 | 0.1562031 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.6 | 0.9990000 | 0.0316228 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.6 | 0.6960000 | 0.4602128 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.6 | 0.7770000 | 0.4164666 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.6 | 0.8900000 | 0.3130463 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.6 | 0.3030000 | 0.4597852 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.6 | 0.4540000 | 0.4981286 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.6 | 0.7640000 | 0.4248347 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.7 | 0.0160000 | 0.1255379 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.7 | 0.0690000 | 0.2535810 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.7 | 0.1890000 | 0.3917045 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.7 | 0.0060000 | 0.0772656 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.7 | 0.0470000 | 0.2117447 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.7 | 0.2790000 | 0.4487319 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.7 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.7 | 0.0090000 | 0.0944877 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.7 | 0.1620000 | 0.3686352 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.7 | 0.6810000 | 0.4663223 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.7 | 0.9250000 | 0.2635231 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.7 | 0.9950000 | 0.0705690 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.7 | 0.6370000 | 0.4811055 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.7 | 0.9280000 | 0.2586173 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.7 | 0.9950000 | 0.0705690 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.7 | 0.3090000 | 0.4623124 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.7 | 0.5250000 | 0.4996245 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.7 | 0.7770000 | 0.4164666 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.7 | 0.9850000 | 0.1216133 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.7 | 0.9770000 | 0.1499783 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.7 | 0.9990000 | 0.0316228 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.7 | 0.7640000 | 0.4248347 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.7 | 0.8290000 | 0.3766974 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.7 | 0.9000000 | 0.3001501 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.7 | 0.3230000 | 0.4678567 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.7 | 0.5460000 | 0.4981286 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.7 | 0.8410000 | 0.3658591 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.8 | 0.0160000 | 0.1255379 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.8 | 0.0580000 | 0.2338604 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.8 | 0.1060000 | 0.3079917 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.8 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.8 | 0.0310000 | 0.1734044 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.8 | 0.1920000 | 0.3940702 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.8 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.8 | 0.0030000 | 0.0547174 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.8 | 0.0660000 | 0.2484063 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.8 | 0.5370000 | 0.4988786 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.8 | 0.7950000 | 0.4039036 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.8 | 0.9730000 | 0.1621644 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.8 | 0.5920000 | 0.4917090 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.8 | 0.9210000 | 0.2698737 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.8 | 0.9990000 | 0.0316228 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|-------------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | countfitteR | 50 | 5 | 10.0 | 0.8 | 0.3150000 | 0.4647483 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.8 | 0.5650000 | 0.4960051 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.8 | 0.8350000 | 0.3713663 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.8 | 0.9850000 | 0.1216133 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.8 | 0.9950000 | 0.0705690 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.8 | 1.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.8 | 0.7860000 | 0.4103320 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.8 | 0.8330000 | 0.3731625 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.8 | 0.8970000 | 0.3041110 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.8 | 0.4080000 | 0.4917090 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.8 | 0.6010000 | 0.4899378 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.8 | 0.8680000 | 0.3386601 | 0 |
| zinb | countfitteR | 50 | 2 | 1.0 | 0.9 | 0.0150000 | 0.1216133 | 0 |
| zinb | countfitteR | 100 | 2 | 1.0 | 0.9 | 0.0270000 | 0.1621644 | 0 |
| zinb | countfitteR | 200 | 2 | 1.0 | 0.9 | 0.0500000 | 0.2180540 | 0 |
| zinb | countfitteR | 50 | 2 | 2.0 | 0.9 | 0.0010000 | 0.0316228 | 0 |
| zinb | countfitteR | 100 | 2 | 2.0 | 0.9 | 0.0130000 | 0.1133307 | 0 |
| zinb | countfitteR | 200 | 2 | 2.0 | 0.9 | 0.0510000 | 0.2201078 | 0 |
| zinb | countfitteR | 50 | 2 | 4.0 | 0.9 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 100 | 2 | 4.0 | 0.9 | 0.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 200 | 2 | 4.0 | 0.9 | 0.0100000 | 0.0995485 | 0 |
| zinb | countfitteR | 50 | 5 | 2.5 | 0.9 | 0.2610000 | 0.4393997 | 0 |
| zinb | countfitteR | 100 | 5 | 2.5 | 0.9 | 0.4230000 | 0.4942826 | 0 |
| zinb | countfitteR | 200 | 5 | 2.5 | 0.9 | 0.6520000 | 0.4765744 | 0 |
| zinb | countfitteR | 50 | 5 | 5.0 | 0.9 | 0.3190000 | 0.4663223 | 0 |
| zinb | countfitteR | 100 | 5 | 5.0 | 0.9 | 0.7020000 | 0.4576084 | 0 |
| zinb | countfitteR | 200 | 5 | 5.0 | 0.9 | 0.9480000 | 0.2221381 | 0 |
| zinb | countfitteR | 50 | 5 | 10.0 | 0.9 | 0.1980000 | 0.3986916 | 0 |
| zinb | countfitteR | 100 | 5 | 10.0 | 0.9 | 0.5600000 | 0.4966353 | 0 |
| zinb | countfitteR | 200 | 5 | 10.0 | 0.9 | 0.8710000 | 0.3353677 | 0 |
| zinb | countfitteR | 50 | 10 | 5.0 | 0.9 | 0.8930000 | 0.3092679 | 0 |
| zinb | countfitteR | 100 | 10 | 5.0 | 0.9 | 0.9880000 | 0.1089397 | 0 |
| zinb | countfitteR | 200 | 10 | 5.0 | 0.9 | 1.0000000 | 0.0000000 | 0 |
| zinb | countfitteR | 50 | 10 | 10.0 | 0.9 | 0.7830000 | 0.4124089 | 0 |
| zinb | countfitteR | 100 | 10 | 10.0 | 0.9 | 0.8420000 | 0.3649235 | 0 |
| zinb | countfitteR | 200 | 10 | 10.0 | 0.9 | 0.9260000 | 0.2619019 | 0 |
| zinb | countfitteR | 50 | 10 | 20.0 | 0.9 | 0.4090000 | 0.4918953 | 0 |
| zinb | countfitteR | 100 | 10 | 20.0 | 0.9 | 0.6540000 | 0.4759312 | 0 |
| zinb | countfitteR | 200 | 10 | 20.0 | 0.9 | 0.9190000 | 0.2729716 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.1 | 0.0679916 | 0.2518633 | 44 |
| zinb | two-step | 100 | 2 | 1.0 | 0.1 | 0.0720000 | 0.2586173 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.1 | 0.0520000 | 0.2221381 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.1 | 0.1007121 | 0.3011003 | 17 |
| zinb | two-step | 100 | 2 | 2.0 | 0.1 | 0.1121121 | 0.3156624 | 1 |
| zinb | two-step | 200 | 2 | 2.0 | 0.1 | 0.1220000 | 0.3274496 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.1 | 0.1499493 | 0.3572028 | 13 |
| zinb | two-step | 100 | 2 | 4.0 | 0.1 | 0.1490000 | 0.3562667 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.1 | 0.2200000 | 0.4144536 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.1 | 0.1011122 | 0.3016298 | 11 |
| zinb | two-step | 100 | 5 | 2.5 | 0.1 | 0.1880000 | 0.3909077 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.1 | 0.4330000 | 0.4957386 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.1 | 0.1285141 | 0.3348294 | 4 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | two-step | 100 | 5 | 5.0 | 0.1 | 0.2270000 | 0.4191022 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.1 | 0.5500000 | 0.4977427 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.1 | 0.1440081 | 0.3512748 | 7 |
| zinb | two-step | 100 | 5 | 10.0 | 0.1 | 0.2350000 | 0.4242110 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.1 | 0.4780000 | 0.4997657 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.1 | 0.0170512 | 0.1295270 | 3 |
| zinb | two-step | 100 | 10 | 5.0 | 0.1 | 0.0230000 | 0.1499783 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.1 | 0.0170000 | 0.1293357 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.1 | 0.0030181 | 0.0548820 | 6 |
| zinb | two-step | 100 | 10 | 10.0 | 0.1 | 0.0070000 | 0.0834144 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.1 | 0.0000000 | 0.0000000 | 3 |
| zinb | two-step | 100 | 10 | 20.0 | 0.1 | 0.0010000 | 0.0316228 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.1 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.2 | 0.0760761 | 0.2652526 | 1 |
| zinb | two-step | 100 | 2 | 1.0 | 0.2 | 0.0770000 | 0.2667248 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.2 | 0.0780000 | 0.2683058 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.2 | 0.1130000 | 0.3167512 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.2 | 0.1000000 | 0.3001501 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.2 | 0.1900000 | 0.3924972 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.2 | 0.1661662 | 0.3724162 | 1 |
| zinb | two-step | 100 | 2 | 4.0 | 0.2 | 0.2030000 | 0.4024338 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.2 | 0.3480000 | 0.4765744 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.2 | 0.1750000 | 0.3801572 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.2 | 0.4450000 | 0.4972145 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.2 | 0.8530000 | 0.3542831 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.2 | 0.2170000 | 0.4124089 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.2 | 0.5180000 | 0.4999259 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.2 | 0.7700000 | 0.4210431 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.2 | 0.2280000 | 0.4197525 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.2 | 0.5230000 | 0.4997206 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.2 | 0.5080000 | 0.5001862 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.2 | 0.0310310 | 0.1734884 | 1 |
| zinb | two-step | 100 | 10 | 5.0 | 0.2 | 0.0190000 | 0.1365930 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.2 | 0.0050000 | 0.0705690 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.2 | 0.0090000 | 0.0944877 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.2 | 0.0010000 | 0.0316228 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.2 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.3 | 0.0680000 | 0.2518719 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.3 | 0.0660000 | 0.2484063 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.3 | 0.1080000 | 0.3105357 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.3 | 0.1030000 | 0.3041110 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.3 | 0.1420000 | 0.3492248 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.3 | 0.2400000 | 0.4272968 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.3 | 0.1580000 | 0.3649235 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.3 | 0.2260000 | 0.4184484 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.3 | 0.4730000 | 0.4995203 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.3 | 0.2740000 | 0.4462321 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.3 | 0.6640000 | 0.4725752 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | two-step | 200 | 5 | 2.5 | 0.3 | 0.9220000 | 0.2683058 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.3 | 0.4330000 | 0.4957386 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.3 | 0.7540000 | 0.4308940 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.3 | 0.5950000 | 0.4911377 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.3 | 0.4100000 | 0.4920794 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.3 | 0.6330000 | 0.4822277 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.3 | 0.2310000 | 0.4216833 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.3 | 0.0350000 | 0.1838717 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.3 | 0.0140000 | 0.1175492 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.3 | 0.0040000 | 0.0631505 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.3 | 0.0060000 | 0.0772656 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.3 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.4 | 0.0580000 | 0.2338604 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.4 | 0.0640000 | 0.2448754 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.4 | 0.0980000 | 0.2974634 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.4 | 0.1210000 | 0.3262905 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.4 | 0.1240000 | 0.3297465 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.4 | 0.2690000 | 0.4436618 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.4 | 0.1630000 | 0.3695505 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.4 | 0.2310000 | 0.4216833 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.4 | 0.4740000 | 0.4995734 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.4 | 0.3970000 | 0.4895208 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.4 | 0.7840000 | 0.4117202 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.4 | 0.8520000 | 0.3552777 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.4 | 0.5950000 | 0.4911377 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.4 | 0.8120000 | 0.3909077 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.4 | 0.3490000 | 0.4768925 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.4 | 0.6030000 | 0.4895208 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.4 | 0.5820000 | 0.4934770 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.4 | 0.0730000 | 0.2602667 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.4 | 0.0690000 | 0.2535810 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.4 | 0.0200000 | 0.1400701 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.4 | 0.0070000 | 0.0834144 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.4 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.5 | 0.0450000 | 0.2074079 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.5 | 0.0330000 | 0.1787259 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.5 | 0.1060000 | 0.3079917 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.5 | 0.1000000 | 0.3001501 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.5 | 0.1160000 | 0.3203852 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.5 | 0.2840000 | 0.4511624 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.5 | 0.1630000 | 0.3695505 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.5 | 0.2360000 | 0.4248347 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.5 | 0.5040000 | 0.5002342 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | two-step | 50 | 5 | 2.5 | 0.5 | 0.4840000 | 0.4999940 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.5 | 0.8100000 | 0.3924972 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.5 | 0.8370000 | 0.3695505 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.5 | 0.6790000 | 0.4670944 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.5 | 0.8090000 | 0.3932857 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.5 | 0.2410000 | 0.4279043 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.5 | 0.7000000 | 0.4584869 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.5 | 0.4960000 | 0.5002342 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.5 | 0.0120000 | 0.1089397 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.5 | 0.1320000 | 0.3386601 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.5 | 0.0300000 | 0.1706726 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.5 | 0.0060000 | 0.0772656 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.5 | 0.0010000 | 0.0316228 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.5 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.6 | 0.0380000 | 0.1912919 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.6 | 0.0390000 | 0.1936918 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.6 | 0.0720000 | 0.2586173 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.6 | 0.0700000 | 0.2552747 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.6 | 0.1060000 | 0.3079917 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.6 | 0.2100000 | 0.4075120 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.6 | 0.1370000 | 0.3440194 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.6 | 0.1960000 | 0.3971671 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.6 | 0.4550000 | 0.4982201 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.6 | 0.4780000 | 0.4997657 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.6 | 0.7910000 | 0.4067978 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.6 | 0.8690000 | 0.3375692 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.6 | 0.7110000 | 0.4535247 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.6 | 0.8270000 | 0.3784365 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.6 | 0.2020000 | 0.4016931 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.6 | 0.7600000 | 0.4272968 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.6 | 0.5090000 | 0.5001691 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.6 | 0.0150000 | 0.1216133 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.6 | 0.2650000 | 0.4415540 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.6 | 0.0370000 | 0.1888562 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.6 | 0.0180000 | 0.1330176 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.6 | 0.0270000 | 0.1621644 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.6 | 0.0010000 | 0.0316228 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.6 | 0.0020000 | 0.0446990 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.6 | 0.0060000 | 0.0772656 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.6 | 0.0020000 | 0.0446990 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.6 | 0.0000000 | 0.0000000 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.7 | 0.0270000 | 0.1621644 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.7 | 0.0290000 | 0.1678904 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.7 | 0.0490000 | 0.2159760 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.7 | 0.0670000 | 0.2501471 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.7 | 0.0660000 | 0.2484063 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.7 | 0.1310000 | 0.3375692 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.7 | 0.1010000 | 0.3014795 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | two-step | 100 | 2 | 4.0 | 0.7 | 0.1440000 | 0.3512654 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.7 | 0.3030000 | 0.4597852 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.7 | 0.3410000 | 0.4742826 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.7 | 0.7090000 | 0.4544508 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.7 | 0.9100000 | 0.2863250 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.7 | 0.6960000 | 0.4602128 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.7 | 0.8790000 | 0.3262905 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.7 | 0.3790000 | 0.4853809 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.7 | 0.7840000 | 0.4117202 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.7 | 0.6070000 | 0.4886612 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.7 | 0.0400000 | 0.1960572 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.7 | 0.4390000 | 0.4965134 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.7 | 0.0840000 | 0.2775266 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.7 | 0.1000000 | 0.3001501 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.7 | 0.1230000 | 0.3286016 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.7 | 0.0620000 | 0.2412762 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.7 | 0.2280000 | 0.4197525 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.7 | 0.0210000 | 0.1434558 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.7 | 0.0410000 | 0.1983894 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.7 | 0.0820000 | 0.2745020 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.8 | 0.0190000 | 0.1365930 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.8 | 0.0100000 | 0.0995485 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.8 | 0.0240000 | 0.1531256 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.8 | 0.0460000 | 0.2095899 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.8 | 0.0340000 | 0.1813198 | 0 |
| zinb | two-step | 200 | 2 | 2.0 | 0.8 | 0.0750000 | 0.2635231 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.8 | 0.0490000 | 0.2159760 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.8 | 0.0720000 | 0.2586173 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.8 | 0.1730000 | 0.3784365 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.8 | 0.1900000 | 0.3924972 | 0 |
| zinb | two-step | 100 | 5 | 2.5 | 0.8 | 0.4570000 | 0.4983968 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.8 | 0.8480000 | 0.3592005 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.8 | 0.4900000 | 0.5001501 | 0 |
| zinb | two-step | 100 | 5 | 5.0 | 0.8 | 0.8390000 | 0.3677149 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.8 | 0.7720000 | 0.4197525 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.8 | 0.6680000 | 0.4711666 | 0 |
| zinb | two-step | 100 | 5 | 10.0 | 0.8 | 0.8620000 | 0.3450726 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.8 | 0.3000000 | 0.4584869 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.8 | 0.7490000 | 0.4338055 | 0 |
| zinb | two-step | 100 | 10 | 5.0 | 0.8 | 0.3640000 | 0.4813894 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.8 | 0.0090000 | 0.0944877 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.8 | 0.4510000 | 0.4978422 | 0 |
| zinb | two-step | 100 | 10 | 10.0 | 0.8 | 0.1620000 | 0.3686352 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.8 | 0.3880000 | 0.4875384 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.8 | 0.2420000 | 0.4285086 | 0 |
| zinb | two-step | 100 | 10 | 20.0 | 0.8 | 0.0990000 | 0.2988115 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.8 | 0.7400000 | 0.4388537 | 0 |
| zinb | two-step | 50 | 2 | 1.0 | 0.9 | 0.0100000 | 0.0995485 | 0 |
| zinb | two-step | 100 | 2 | 1.0 | 0.9 | 0.0040000 | 0.0631505 | 0 |
| zinb | two-step | 200 | 2 | 1.0 | 0.9 | 0.0080000 | 0.0891288 | 0 |
| zinb | two-step | 50 | 2 | 2.0 | 0.9 | 0.0120000 | 0.1089397 | 0 |
| zinb | two-step | 100 | 2 | 2.0 | 0.9 | 0.0170000 | 0.1293357 | 0 |

| model | method | n | lambda | size | r | pow_mean | pow_sd | uncomputable |
|-------|----------|-----|--------|------|-----|-----------|-----------|--------------|
| zinb | two-step | 200 | 2 | 2.0 | 0.9 | 0.0150000 | 0.1216133 | 0 |
| zinb | two-step | 50 | 2 | 4.0 | 0.9 | 0.0170000 | 0.1293357 | 0 |
| zinb | two-step | 100 | 2 | 4.0 | 0.9 | 0.0300000 | 0.1706726 | 0 |
| zinb | two-step | 200 | 2 | 4.0 | 0.9 | 0.0260000 | 0.1592148 | 0 |
| zinb | two-step | 50 | 5 | 2.5 | 0.9 | 0.0570571 | 0.2320678 | 1 |
| zinb | two-step | 100 | 5 | 2.5 | 0.9 | 0.1180000 | 0.3227695 | 0 |
| zinb | two-step | 200 | 5 | 2.5 | 0.9 | 0.3230000 | 0.4678567 | 0 |
| zinb | two-step | 50 | 5 | 5.0 | 0.9 | 0.1301301 | 0.3366151 | 1 |
| zinb | two-step | 100 | 5 | 5.0 | 0.9 | 0.3400000 | 0.4739458 | 0 |
| zinb | two-step | 200 | 5 | 5.0 | 0.9 | 0.7610000 | 0.4266861 | 0 |
| zinb | two-step | 50 | 5 | 10.0 | 0.9 | 0.2352352 | 0.4243582 | 1 |
| zinb | two-step | 100 | 5 | 10.0 | 0.9 | 0.5900000 | 0.4920794 | 0 |
| zinb | two-step | 200 | 5 | 10.0 | 0.9 | 0.9250000 | 0.2635231 | 0 |
| zinb | two-step | 50 | 10 | 5.0 | 0.9 | 0.5533199 | 0.4973991 | 6 |
| zinb | two-step | 100 | 10 | 5.0 | 0.9 | 0.8690000 | 0.3375692 | 0 |
| zinb | two-step | 200 | 10 | 5.0 | 0.9 | 0.5660000 | 0.4958729 | 0 |
| zinb | two-step | 50 | 10 | 10.0 | 0.9 | 0.6723618 | 0.4695881 | 5 |
| zinb | two-step | 100 | 10 | 10.0 | 0.9 | 0.6410000 | 0.4799472 | 0 |
| zinb | two-step | 200 | 10 | 10.0 | 0.9 | 0.1480000 | 0.3552777 | 0 |
| zinb | two-step | 50 | 10 | 20.0 | 0.9 | 0.6844221 | 0.4649793 | 5 |
| zinb | two-step | 100 | 10 | 20.0 | 0.9 | 0.5200000 | 0.4998498 | 0 |
| zinb | two-step | 200 | 10 | 20.0 | 0.9 | 0.0690000 | 0.2535810 | 0 |

References

- [1] Schneider J, Weiss R, Ruhe M, Jung T, Roggenbuck D, Stohwasser R, et al. Open source bioimage informatics tools for the analysis of DNA damage and associated biomarkers. *Journal of Laboratory and Precision Medicine* 2019;4:1–27. doi:10.21037/jlpm.2019.04.05.
- [2] Redon CE, Nakamura AJ, Martin OA, Parekh PR, Weyemi US, Bonner WM. Recent developments in the use of γ -H2AX as a quantitative DNA double-strand break biomarker. *Aging (Albany NY)* 2011;3:168–74.
- [3] Lomax ME, Folkes LK, O’Neill P. Biological consequences of radiation-induced DNA damage: Relevance to radiotherapy. *Clinical Oncology (Royal College of Radiologists (Great Britain))* 2013;25:578–85. doi:10.1016/j.clon.2013.06.007.
- [4] Nikolova T, Dvorak M, Jung F, Adam I, Krämer E, Gerhold-Ay A, et al. The γ H2AX Assay for Genotoxic and Nongenotoxic Agents: Comparison of H2AX Phosphorylation with Cell Death Response. *Toxicological Sciences* 2014;140:103–17. doi:10.1093/toxsci/kfu066.
- [5] Martin OA, Ivashkevich A, Choo S, Woodbine L, Jeggo PA, Martin RF, et al. Statistical analysis of kinetics, distribution and co-localisation of DNA repair foci in irradiated cells: Cell cycle effect and implications for prediction of radiosensitivity. *DNA Repair* 2013;12:844–55. doi:10.1016/j.dnarep.2013.07.002.
- [6] Lim HK, Song J, Jung BC. Score tests for zero-inflation and overdispersion in two-level count data. *Computational Statistics & Data Analysis* 2013;61:67–82. doi:10.1016/j.csda.2012.11.006.
- [7] Yang Z, Hardin JW, Addy CL. Testing overdispersion in the zero-inflated Poisson model. *Journal of Statistical Planning and Inference* 2009;139:3340–53. doi:10.1016/j.jspi.2009.03.016.
- [8] Reddig A, Rube CE, Rödiger S, Schierack P, Reinhold D, Roggenbuck D. DNA damage assessment and potential applications in laboratory diagnostics and precision medicine. *Journal of Laboratory and Precision Medicine* 2018;3. doi:10.21037/jlpm.2018.03.06.
- [9] Ruhe M, Rabe D, Jurischka C, Schröder J, Schierack P, Deckert PM, et al. Molecular biomarkers of DNA damage in diffuse large-cell lymphoma: a review. *Journal of Laboratory and Precision Medicine* 2019;4:5–5. doi:10.21037/jlpm.2019.01.01.
- [10] Clingen PH, Wu JY-H, Miller J, Mistry N, Chin F, Wynne P, et al. Histone H2AX phosphorylation as a molecular pharmacological marker for DNA interstrand crosslink cancer chemotherapy. *Biochemical Pharmacology* 2008;76:19–27. doi:10.1016/j.bcp.2008.03.025.
- [11] Raftery AE. Bayesian Model Selection in Social Research. *Sociological Methodology* 1995;25:111–63. doi:10.2307/271063.