

# Package ‘saeHB.ZIB’

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**Type** Package

**Title** Small Area Estimation using Hierarchical Bayesian under Zero Inflated Binomial Distribution

**Version** 0.1.1

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**Description** Provides function for area level of small area estimation using hierarchical Bayesian (HB) method with Zero-Inflated Binomial distribution for variables of interest. Some dataset produced by a data generation are also provided. The 'rjags' package is employed to obtain parameter estimates. Model-based estimators involves the HB estimators which include the mean and the variation of mean.

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.1.2

**Imports** stringr, coda, rjags, stats, grDevices, graphics

**Suggests** rmarkdown, knitr

**VignetteBuilder** knitr

**Depends** R (>= 2.10)

**NeedsCompilation** no

**Repository** CRAN

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dataZIB	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method under Zero-Inflated Binomial Distribution</i>
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### Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Zero-Inflated Binomial distribution

This data is generated by these following steps:

1. Generate sampling random area effect  $u.Z$  and  $u.nZ$  with  $(u.Z \sim N(0, 1))$  and  $(u.nZ \sim N(0, 1))$ .  
The auxiliary variables are generated by Uniform distribution with  $(x1 \sim U(0, 1))$  and  $(x2 \sim U(1, 5))$ .  
The coefficient parameters  $\alpha_0, \alpha_1, \alpha_2, \beta_0, \beta_1, \beta_2$  are set as 0.
2. Calculate  $\text{logit}(p) = \alpha_0 + \alpha_1 * x1 + \alpha_2 * x2 + u.Z$  and  $\text{logit}(\pi) = \beta_0 + \beta_1 * x1 + \beta_2 * x2 + u.nZ$
3. Generate number of sample with  $n.samp \sim U(10, 30)$
4. Generate  $\text{delta} \sim \text{bernoulli}(p)$  and  $y_{star} \sim \text{binomial}(s, \pi)$
5. calculate  $y = \text{delta} * y_{star}$
6. Calculate variance of direct estimates (vardir) with  $\text{var}(y) = (1-p) * s * pi * (1 - pi * (1 - p * s))$
7. Auxiliary variables  $x1, x2$ , direct estimation ( $y$ ), vardir, and  $s$  are combined in a dataframe called dataZIB

### Usage

```
data(dataZIB)
```

### Format

A data frame with 64 observations on the following 4 variables:

**y** Direct Estimation of y

**X1** Auxiliary variable of x1

**X2** Auxiliary variable of x2

**vardir** sampling variance of y

**s** number of sample

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dataZIBns	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method under Zero-Inflated Binomial Distribution</i>
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**Description**

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Zero-Inflated Binomial distribution with non-sampled areas

This data contains NA values that indicates no sampled at one or more small areas. It uses the dataZIB.ns with the direct estimates and the related variances in 3 small areas are missing.

**Usage**

```
data(dataZIBns)
```

**Format**

A data frame with 30 rows and 4 variables :

**y** Direct Estimation of y

**X1** Auxiliary variable of x1

**X2** Auxiliary variable of x2

**vardir** sampling variance of y

**s** number of sample

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ziBinomial	<i>Small Area Estimation using Hierarchical Bayesian under Zero Inflated Binomial Distribution</i>
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**Description**

This function is implemented to variable of interest ( $y$ ) that assumed to be a Zero Inflated Binomial Distribution. The range of data is  $(0 < y < \infty)$ . This model can be used to handle overdispersion caused by excess zero in data.

**Usage**

```
ziBinomial(
  formula,
  n.samp,
  iter.update = 3,
  iter.mcmc = 10000,
  coef.nonzero,
  var.coef.nonzero,
```

```

coef.zero,
var.coef.zero,
thin = 2,
burn.in = 2000,
tau.u.nZ = 1,
data
)

```

### Arguments

formula	Formula that describe the fitted model
n.samp	Number of sample in each area
iter.update	Number of updates with default 3
iter.mcmc	Number of total iterations per chain with default 2000
coef.nonzero	Optional argument for mean on coefficient's prior distribution or $\beta$ 's prior distribution which value is non-zero
var.coef.nonzero	Optional argument for the variances of the prior distribution of the model coefficients ( $\beta$ )
coef.zero	Optional argument for mean on coefficient's prior distribution or $\alpha$ 's prior distribution which value is non-zero
var.coef.zero	Optional argument for the variances of the prior distribution of the model coefficients ( $\alpha$ )
thin	Thinning rate, must be a positive integer with default 1
burn.in	Number of iterations to discard at the beginning with default 1000
tau.u.nZ	Variance of random effect area for non-zero of variable interest ( $y$ ) with default 1
data	The data frame

### Value

This function returns a list of the following objects:

Est	A vector with the values of Small Area mean Estimates using Hierarchical bayesian method
refVar	Estimated random effect variances
coefficient	A dataframe with the estimated model coefficient
plot_alpha	Trace, Density, Autocorrelation Function Plot of MCMC samples
plot_beta	Trace, Density, Autocorrelation Function Plot of MCMC samples

**Examples**

```

#Compute Fitted Model
y ~ X1 +X2

# For data without any nonsampled area
# Load Dataset
data(dataZIB)
saeHB.ZIB <- ziBinomial(formula = y~X1+X2, "s", iter.update=3, iter.mcmc = 1000,
                        burn.in = 200,data = dataZIB)
#the setting of iter.update, iter.mcmc, and burn.in in this example
#is considered to make the example execution time be faster.
#Result
saeHB.ZIB$Est                                #Small Area mean Estimates
saeHB.ZIB$Est$SD                             #Standard deviation of Small Area Mean Estimates
saeHB.ZIB$refVar                             #refVar
saeHB.ZIB$coefficient                        #coefficient
#Load Library 'coda' to execute the plot
#autocorr.plot(saeHB.ZIB$plot_alpha[[3]]) is used to #ACF Plot for alpha
#autocorr.plot(saeHB.ZIB$plot_beta[[3]]) is used to #ACF Plot for beta
#plot(saeHB.ZIB$plot_alpha[[3]]) is used to #Dencity and trace plot for alpha
#plot(saeHB.ZIB$plot_beta[[3]]) is used to #Dencity and trace plot for beta

```

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