

# Package

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**Title** Calculate Power and Sample Size with Beta Regression

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**Description** Power calculations are a critical component of any research study to determine the minimum sample size necessary to detect differences between multiple groups. Researchers often work with data taking the form of proportions that can be modeled with a beta distribution. Here we present an R package, BetaPASS, and analogous SAS macro, that perform power and sample size calculations for data following a beta distribution with comparative nonparametric output. This package allows flexibility with multiple options for link functions to fit the data and graphing functionality for visual comparisons.

**Depends** R ( $\geq 3.5$ )

**License** GPL ( $\geq 2$ )

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**Imports** betareg, ggplot2, Rcpp, stats

**Suggests** knitr,  
rmarkdown

**VignetteBuilder** knitr

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betapower

*Find Power with Beta distribution***Description**

Find the power for a given sample size when testing the null hypothesis that the means for the control and treatment groups are equal against a two-sided alternative.

**Usage**

```
betapower(mu0, sd0, mu1.start, mu1.end = NULL, mu1.by = NULL,
ss.start, ss.end = NULL, ss.by = NULL, sig.level = 0.05,
trials = 100, seed = 1, link.type="logit",
equal.precision=TRUE, sd1 = NULL)
```

**Arguments**

mu0	mean for the control group
sd0	standard deviation for the control group
mu1.start	starting value of mean for the treatment group under the alternative mu1
mu1.end	ending value of mean for the treatment group under the alternative mu1
mu1.by	step length of mean for the treatment group under the alternative mu1
ss.start	starting value of sample size
ss.end	ending value of sample size
ss.by	step length of sample size
sig.level	significant level of test; default value is 0.05
trials	number of trials
seed	seed used in the simulation
link.type	type of link used in the beta regression. Default value is "logit", or you can use "all" or choose one or more of the following: "logit", "probit", "cloglog", "cauchit", "log", "loglog"
equal.precision	equal dispersion parameter assumption in simulation
sd1	standard deviation for the treatment group. Only applicable when equal.precision = FALSE

**Details**

betapower function allows you to control the number of trials in the simulation, the sample sizes used, and the alternative means. You can fix the alternative and vary sample size to match a desired power; You can fix the sample size and vary the alternative to see which will match a desired power; You can vary both; Start with a small number of trials (say 100) to determine the rough range of sample sizes or alternatives; Use a larger number of trials (say 1000) to get better estimates.

**Value**

Return a betapower object including basic settings (mean and standard deviation for the control group, significant level, number of trials and link types), and a matrix of estimated power with given sample size and mu1.

power.of.GLM: link name  
 estimated power using beta regression method; it will return the power with every links if you use link.type = "all" statement.

power.of.Wilcoxon.test  
 estimated power from Wilcoxon Rank sum test.

sample size  
 sample size.

mu1  
 mean for the treatment group under the alternative.

**Examples**

```
betapower(mu0 = 0.56, sd0 = 0.255, mu1.start = .70, mu1.end = .75, mu1.by = .05,
ss.start = 30, ss.end = 50, ss.by = 20, trials = 100)
```

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plot.betapower	<i>Plot function of betapower</i>
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**Description**

Generate several comparison plots of power.

**Usage**

```
plot(object, link.type, by)
```

**Arguments**

link.type      the type of link used in the beta regression. You can choose one or more of the following: "logit", "probit", "cloglog", "cauchit", "log", "loglog", "all"

by              the type of plot. see details.

object         a betapower object obtained from function betapower()

**Details**

The plot function will returns different plots depends on by

by = "linktype": return graphs that plot power against mu1, where mu1 is the mean for the treatment group under the alternative. The number of plots will vary depending on the number of link types selected with the last plot showing power based on Wilcoxon Rank Sum Test. The first one or several plots show comparisons of power with different sample size, using GLM method with one or several link types. The last plot shows a comparison of the power with different sample size using Wilcoxon Rank Sum Test. Y-axis denotes power and X-axis denotes mu1, the mean for the treatment group under the alternative.

by = "samplesize": return a number of plots equal to the number of sample sizes tested. Each plot compares power calculated with different link types and the Wilcoxon Rank Sum Test. Y-axis denotes power and X-axis denotes mu1, the mean for the treatment group under the alternative.

by = "mu1": return a number of plots equal to the number of mu1 used in the procedure. Each plot compares power calculated with different link types and the Wilcoxon Rank Sum Test. Y-axis denotes power and X-axis denotes sample size.

## Examples

```
## generate the power table with betapower
BPmat <- betapower(mu0 = 0.56, sd0 = 0.255, mu1.start = .70, mu1.end = .80, mu1.by = .10,
  ss.start = 30, ss.end = 50, ss.by = 20, trials = 50, link.type = c("logit","log"))
## plot by link types
plot(BPmat,link.type = c("logit","log"),by="linktype")
## plot by sample size
plot(BPmat,link.type = c("logit","log"),by="samplesize")
```

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plot.samplesize	<i>Plot function of samplesize</i>
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## Description

Generate the comparison plots using GLM method and Wilcoxon Rank Sum Test with different  $\mu_1$ .

## Usage

```
plot(SS.matrix,link.type)
```

## Arguments

link.type	the type of link used in the beta regression(or Wilcoxon Rank Sum Test). You can choose one or more of the following: "logit", "probit", "cloglog", "cauchit", "log", "loglog", "wilcoxon", "all"
SS.matrix	the matrix obtained by the function samplesize.(the formula was described as the output formula in the function samplesize)

## Details

The plot function will return a series of plots equal to the number of  $\mu_1$  used in the procedure. Y-axis denotes minimum sample size and X-axis denotes minimum power.

## Examples

```
## use a greater number of trials, e.g. 1000, to get accurate result
## generate sample size matrix
SSmat <- samplesize(mu0=0.56, sd0=0.255, mu1.start = 0.75,
  power.start = 0.8, power.end = 0.9, power.by = 0.1,
  trials = 50, link.type = c("log","wilcoxon"))
## plot with parametric and nonparametric methods
plot(SSmat, c("log","wilcoxon"))
```

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samplesize

Find minimum sample size with Beta distribution

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## Description

Find minimum sample sizes with Beta distribution and given mu0,sd0,mu1 and target powers.

## Usage

```
samplesize(mu0, sd0, mu1.start, mu1.end = NULL, mu1.by = NULL,
power.start, power.end = NULL, power.by = NULL, sig.level = 0.05,
trials = 100, delta = 1, seed = 1, link.type = "logit",
equal.precision = TRUE, sd1 = NULL)
```

## Arguments

mu0	mean for the control group
sd0	standard deviation for the control group
mu1.start	starting value of mean for the treatment group under the alternative mu1
mu1.end	ending value of mean for the treatment group under the alternative mu1
mu1.by	step length of mean for the treatment group under the alternative mu1
power.start	starting value of target power
power.end	ending value of target power
power.by	step length of target power
sig.level	significant level; default value is 0.05
trials	number of trials; default value is 100
delta	accuracy of the result; must be integer
seed	seed used in the simulation
link.type	type of link used in the beta regression. Default link is "logit". Other link options include: "logit", "probit", "cloglog", "log", "loglog", "wilcoxon", or you can use "all" for all types of link
equal.precision	equal dispersion parameter assumption in simulation
sd1	standard deviation for the treatment group. Only applicable when equal.precision = FALSE

## Details

The samplesize function allows you to control the number of trials in the simulation, the target power, delta, and the alternative means. You can fix the alternative and vary power to match a desired sample size; Use default values for the number of trials for a quick view; Use a larger number of trials (say 1000) and a smaller delta (say 1) to get better estimates.

**Value**

Return a samplesize object including basic settings (mean and standard deviation for the control group, significant level, number of trials and link types), and a matrix of estimated power with given mu1 and target power.

minimum sample size: link type:

minimum sample size for given given mu0, sd0, mu1, target power and type of link.

minimum power: link type:

the minimum power greater than or equal to target power.

target power: target power.

mu1: mean for the treatment group under the alternative.

**Examples**

```
samplesize(mu0=0.56, sd0=0.255, mu1.start = 0.8, power.start = 0.9, trials = 50,  
link.type = c("logit","wilcoxon"))
```

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