

Package ‘alphaN’

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Title Set Alpha Based on Sample Size Using Bayes Factors

Version 0.3.0

Description Sets the alpha level for coefficients in a regression model as a decreasing function of the sample size through the use of Jeffreys' Approximate Bayes factor. You tell alphaN() your sample size, and it tells you to which value you must lower alpha to avoid Lindley's Paradox. For details, see Wulff and Taylor (2024) <[doi:10.1177/14761270231214429](https://doi.org/10.1177/14761270231214429)>. Alpha can also be calibrated to the effect-size and moment Bayes factors of Klauer, Meyer-Grant, and Kellen (2025) <[doi:10.3758/s13423-024-02612-2](https://doi.org/10.3758/s13423-024-02612-2)>, which center the alternative hypothesis on an effect size of your choosing.

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URL <https://github.com/jespernwulff/alphaN>,
<https://jespernwulff.github.io/alphaN/>

BugReports <https://github.com/jespernwulff/alphaN/issues>

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alphaN	<i>Set the alpha level based on sample size for coefficients in a regression model</i>
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Description

Computes the alpha level required to achieve a desired level of evidence, expressed as a Bayes factor, when testing a coefficient in a regression model. The alpha level is a decreasing function of the sample size. Vectorized over n and BF.

Usage

```
alphaN(  
  n,  
  BF = 1,  
  method = "JAB",  
  upper = 1,  
  de = 0.5,  
  nu = NULL,  
  r = NULL,  
  q = 1,  
  p = 0  
)
```

Arguments

n	Sample size. A positive numeric vector.
BF	Bayes factor you would like to match. 1 to avoid Lindley’s Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.
method	Which Bayes factor to calibrate alpha to. The first four options invert Jeffreys’ approximate Bayes factor and differ in the choice of the prior fraction ‘b’; the last two invert the exact test-statistic Bayes factors of Klauer et al. (2025), whose priors center the alternative hypothesis on a prespecified effect size de. One of:

	• "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022) • "min": uses the minimal training sample for the prior (Gu et al., 2018) • "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995) • "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016) • "ES": calibrates α to the effect-size Bayes factor (Klauer et al., 2025) • "moment": calibrates α to the moment Bayes factor (Klauer et al., 2025), under which effects close to zero are a priori implausible
upper	The upper limit for the range of realistic effect sizes. Only relevant when <code>method="balanced"</code> . Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, $U(0,1)$. Conceptually, upper plays for the "balanced" method the role that <code>de</code> plays for "ES" and "moment": both declare which effect sizes the researcher deems realistic. upper treats them as a uniform band whose Type I and Type II error rates are then balanced, whereas <code>de</code> singles out a focal effect size on which the prior concentrates.
de	The prespecified (targeted) effect size in standardized units: Cohen's d for $q = 1$ and Cohen's f for joint tests (the scales coincide at $q = 1$). Only used by methods "ES" and "moment". Defaults to 0.5, a medium effect; use 0.2 for small and 0.8 for large effects (Cohen, 1988).
nu	Degrees of freedom of the prior t distribution for methods "ES" and "moment". The default, NULL, uses the values recommended by Klauer et al. (2025): 3 for "ES" and $5 + (q - 1)$ for "moment".
r	Scale of the two prior mixture components for method "ES". The default, NULL, uses the recommendation of Klauer et al. (2025), $r = \sqrt{t((nu - 2)/(nu * q))} * de$, which requires $nu > 2$ and $de > 0$; otherwise supply r explicitly.
q	Number of coefficients tested jointly. Only used by methods "ES" and "moment". The default, 1, is the test of a single coefficient; for $q > 1$ the alpha level is set for the F test of the joint null that all q coefficients are zero.
p	Number of parameters retained in the model under the null, including any intercept. Only used by methods "ES" and "moment". The effective sample size of Klauer et al. (2025) is $n - p$; the default, 0, reproduces the one-sample form, which treats the sample size as effective. For a regression coefficient in a small sample, setting p to the number of other estimated coefficients (including the intercept) gives the residual-degrees-of-freedom behavior of the exact regression case.

Details

For methods "ES" and "moment" with $q = 1$, the alpha level is found by solving for the critical t value at which the effect-size or moment Bayes factor equals BF, and converting that critical value to a two-sided p -value on the t distribution with $n - p - 1$ degrees of freedom. For $q > 1$, the same inversion runs through the noncentral-F form of the Bayes factors (Klauer et al., 2025, Table 4), and alpha is a p -value on the F distribution with $(q, n - p - q)$ degrees of freedom. The implementation is validated against the Bayes factors reported in Tables 7 and 8 of that paper.

Because the moment prior assigns effects near zero a priori density zero, the alpha level it implies decreases much faster with n than under JAB.

Klauer et al. (2025) derive these Bayes factors under the normal linear model (t tests, linear regression, ANOVA). For other generalized linear models, the "ES" and "moment" calibrations hold in the same asymptotic sense as the prior-fraction methods, whose Wald-based derivation covers any generalized linear model directly; for non-Gaussian models with modest n , prefer the prior-fraction methods.

As a special case, setting `method = "ES"`, `nu = 1`, `de = 0` with an explicit scale (e.g. `r = 1`) calibrates alpha to the default (Jeffreys-Zellner-Siow type) Bayes factor of Rouder et al. (2009).

For effective sample sizes greater than 50,000, methods "ES" and "moment" evaluate the noncentral density ratio in its normal (or chi-square) limit, which is accurate to a fraction of a percent there.

Value

Numeric alpha level required to achieve the desired level of evidence.

References

- Gu et al. (2016). Error probabilities in default Bayesian hypothesis testing. *Journal of Mathematical Psychology*, 72, 130–143.
- Gu et al. (2018). Approximated adjusted fractional Bayes factors: A general method for testing informative hypotheses. *The British Journal of Mathematical and Statistical Psychology*, 71(2).
- Klauer, K. C., Meyer-Grant, C. G., & Kellen, D. (2025). On Bayes factors for hypothesis tests. *Psychonomic Bulletin & Review*, 32, 1070–1094. doi:10.3758/s13423024026122
- O'Hagan, A. (1995). Fractional Bayes Factors for Model Comparison. *Journal of the Royal Statistical Society. Series B (Methodological)*, 57(1), 99–138.
- Rouder, J. N., Speckman, P. L., Sun, D., Morey, R. D., & Iverson, G. (2009). Bayesian t tests for accepting and rejecting the null hypothesis. *Psychonomic Bulletin & Review*, 16, 225–237.
- Wagenmakers, E.-J. (2022). Approximate objective Bayes factors from p-values and sample size: The $3p(\sqrt{n})$ rule. *PsyArXiv*.
- Wulff, J. N., & Taylor, L. (2024). How and why alpha should depend on sample size: A Bayesian-frequentist compromise for significance testing. *Strategic Organization*, 22(3), 550–581. doi:10.1177/14761270231214429

Examples

```
# Plot of alpha level as a function of n
seqN <- seq(50, 1000, 1)
plot(seqN, alphaN(seqN), type = "l")

# Alpha calibrated to the effect-size Bayes factor (Klauer et al., 2025),
# targeting moderate evidence for a medium-sized effect
alphaN(1000, BF = 3, method = "ES", de = 0.5)
```

```
# The same calibration under the moment Bayes factor
alphaN(1000, BF = 3, method = "moment", de = 0.5)

# Alpha for the joint F test of q = 2 coefficients in a model with an
# intercept and one further retained coefficient (p = 2), targeting a
# medium effect on Cohen's f scale
alphaN(200, BF = 3, method = "ES", q = 2, p = 2, de = sqrt(0.15))
```

alphaN_plot	<i>Creates a plot of alpha as function of sample size for the chosen methods</i>
-------------	--

Description

Draws alpha as a decreasing function of the sample size for any selection of the calibration methods offered by `alphaN()`. The prior-fraction curves ("JAB", "min", "robust", "balanced") are evaluated exactly at every sample size; the "ES" and "moment" curves are evaluated at twelve log-spaced sample sizes and interpolated by a spline on the log-log scale, which keeps the plot fast (expect roughly a second of computation per Klauer-type curve). Colors follow the colorblind-safe Okabe-Ito palette.

Usage

```
alphaN_plot(
  BF = 1,
  max = 10000,
  ylim = NULL,
  methods = c("JAB", "min", "robust", "balanced"),
  de = 0.5,
  log = ""
)
```

Arguments

BF	Bayes factor you would like to match. 1 to avoid Lindley's Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.
max	The maximum number of sample size. Defaults to 10,000.
ylim	Limits for the y-axis. The default, NULL, covers all requested curves. Set to e.g. <code>c(0, 0.05)</code> to zoom in on small alpha levels.
methods	Character vector with the methods to draw, any subset of <code>c("JAB", "min", "robust", "balanced", "ES", "moment")</code> . Defaults to the four prior-fraction methods, matching the behavior of earlier package versions.
de	The prespecified (targeted) effect size in standardized units: Cohen's d for $q = 1$ and Cohen's f for joint tests (the scales coincide at $q = 1$). Only used by methods "ES" and "moment". Defaults to 0.5, a medium effect; use 0.2 for small and 0.8 for large effects (Cohen, 1988).

log Passed to `plot()`: "" (default) for linear axes, "x", "y", or "xy" for logarithmic ones. Logarithmic axes are useful when the "moment" curve is included, since it falls much faster than the others.

Value

Prints a plot.

Examples

```
# Plot of alpha level as a function of n for a Bayes factor of 3
alphaN_plot(BF = 3)

# Compare JAB with the effect-size and moment calibrations
alphaN_plot(BF = 3, methods = c("JAB", "ES", "moment"), log = "xy")
```

alphaN_power	<i>Power at the calibrated alpha level</i>
--------------	--

Description

Computes the power of the two-sided coefficient test at the alpha level that `alphaN()` calibrates to a target Bayes factor, for a standardized effect of size d . Together with the calibrated alpha itself, this is the quantity worth preregistering: it shows what the chosen evidence target costs against the effects the researcher cares about. Vectorized over n and d (recycled).

Usage

```
alphaN_power(
  n,
  d,
  BF = 3,
  method = "JAB",
  upper = 1,
  de = 0.5,
  nu = NULL,
  r = NULL,
  q = 1,
  p = 0
)
```

Arguments

n Sample size. A positive numeric vector.

d The standardized effect size at which power is evaluated, on the same scale as d_e (Cohen's d for $q = 1$, Cohen's f for joint tests): what the coefficient's t statistic divided by the square root of the sample size estimates. For a regression coefficient this partial standardized effect already folds in the covariate's scale,

its correlation with the other covariates, and the residual or link-scale dispersion; see Details for effects stated on a model-specific scale. A non-negative numeric vector.

BF	Target Bayes factor for the calibration. Defaults to 3.
method	Which Bayes factor to calibrate alpha to. The first four options invert Jeffreys' approximate Bayes factor and differ in the choice of the prior fraction 'b'; the last two invert the exact test-statistic Bayes factors of Klauer et al. (2025), whose priors center the alternative hypothesis on a prespecified effect size de. One of: • "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022) • "min": uses the minimal training sample for the prior (Gu et al., 2018) • "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995) • "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016) • "ES": calibrates alpha to the effect-size Bayes factor (Klauer et al., 2025) • "moment": calibrates alpha to the moment Bayes factor (Klauer et al., 2025), under which effects close to zero are a priori implausible
upper	The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1). Conceptually, upper plays for the "balanced" method the role that de plays for "ES" and "moment": both declare which effect sizes the researcher deems realistic. upper treats them as a uniform band whose Type I and Type II error rates are then balanced, whereas de singles out a focal effect size on which the prior concentrates.
de	The prespecified (targeted) effect size in standardized units: Cohen's d for q = 1 and Cohen's f for joint tests (the scales coincide at q = 1). Only used by methods "ES" and "moment". Defaults to 0.5, a medium effect; use 0.2 for small and 0.8 for large effects (Cohen, 1988).
nu	Degrees of freedom of the prior t distribution for methods "ES" and "moment". The default, NULL, uses the values recommended by Klauer et al. (2025): 3 for "ES" and 5 + (q - 1) for "moment".
r	Scale of the two prior mixture components for method "ES". The default, NULL, uses the recommendation of Klauer et al. (2025), $r = \sqrt{(nu - 2) / (nu * q)}$ * de, which requires nu > 2 and de > 0; otherwise supply r explicitly.
q	Number of coefficients tested jointly. Only used by methods "ES" and "moment". The default, 1, is the test of a single coefficient; for q > 1 the alpha level is set for the F test of the joint null that all q coefficients are zero.
p	Number of parameters retained in the model under the null, including any intercept. Only used by methods "ES" and "moment". The effective sample size of Klauer et al. (2025) is n - p; the default, 0, reproduces the one-sample form, which treats the sample size as effective. For a regression coefficient in a small sample, setting p to the number of other estimated coefficients (including the intercept) gives the residual-degrees-of-freedom behavior of the exact regression case.

Details

The power computation is exact under the normal linear model and carries the usual Wald-asymptotic interpretation for other generalized linear models, mirroring the scope of the calibration itself. When the calibrated alpha is 1 (the evidence target is met vacuously), the power is 1 for every effect size.

Power against an effect stated on a model-specific scale (an odds ratio, a rate ratio, an R-squared increment) additionally depends on the design: the covariate's distribution, its correlation with the other covariates, and, in a logistic model, the baseline probability all enter the implied standardized effect. `alphaN_power()` takes `d` as given rather than deriving it from such design inputs. For those cases, combine the calibrated alpha with a model-specific power calculator instead: the functions of the **pwrss** package accept the significance level as an argument, so `alpha = alphaN(n, BF = 3)` plugs the calibration directly into, for example, `pwrss::power.z.logistic()`.

Value

A numeric vector with the power of the two-sided test (noncentral t for $q = 1$, noncentral F for $q > 1$, both at the residual degrees of freedom implied by n , p , and q) at the calibrated alpha.

See Also

[alphaN\(\)](#), [alphaN_power_plot\(\)](#), [alphaN_report\(\)](#)

Examples

```
# Power against a small effect at the JAB-calibrated alpha, n = 1,000
alphaN_power(n = 1000, d = 0.1, BF = 3)

# The same design under the balanced calibration keeps more power
alphaN_power(n = 1000, d = 0.1, BF = 3, method = "balanced")

# A power curve across sample sizes
alphaN_power(n = c(100, 500, 1000, 5000), d = 0.2, BF = 3)

# Model-specific power at the calibrated alpha via the pwrss package:
# a logistic-regression coefficient with odds ratio 1.5
pwrss::power.z.logistic(odds.ratio = 1.5, base.prob = 0.2,
  n = 1000, alpha = alphaN(1000, BF = 3),
  verbose = FALSE)$power
```

alphaN_power_plot

Plot power across sample sizes at the calibrated alpha

Description

Draws, for each requested effect size, the power of the two-sided single-coefficient test as a function of the sample size, where every calibration method is evaluated at its own alpha level for the given Bayes factor target. A fixed reference level (default 0.05) is drawn as a dashed curve. This is the design-time companion of [alphaN_plot\(\)](#): one figure shows what each calibration costs in power.

Colors follow the colorblind-safe Okabe-Ito palette; the effect-size and moment curves use the same log-spaced spline interpolation as [alphaN_plot\(\)](#).

Usage

```
alphaN_power_plot(
  d = c(0.1, 0.5),
  BF = 3,
  max = 10000,
  methods = c("JAB", "min", "robust", "balanced"),
  de = 0.5,
  ref = 0.05
)
```

Arguments

d	Standardized effect sizes to draw, one panel per element, on the scale of alphaN_power() 's d. Defaults to c(0.1, 0.5).
BF	Target Bayes factor for the calibration. Defaults to 3.
max	The maximum number of sample size. Defaults to 10,000.
methods	Character vector with the methods to draw, any subset of c("JAB", "min", "robust", "balanced", "ES", "moment"). Defaults to the four prior-fraction methods, matching the behavior of earlier package versions.
de	The prespecified (targeted) effect size in standardized units: Cohen's d for q = 1 and Cohen's f for joint tests (the scales coincide at q = 1). Only used by methods "ES" and "moment". Defaults to 0.5, a medium effect; use 0.2 for small and 0.8 for large effects (Cohen, 1988).
ref	A fixed significance level drawn as a dashed reference curve, or NULL to omit it. Defaults to 0.05.

Value

Prints a plot.

See Also

[alphaN_power\(\)](#), [alphaN_plot\(\)](#)

Examples

```
# The power cost of evidence calibration for a small and a medium effect
alphaN_power_plot(d = c(0.1, 0.5), BF = 3,
  methods = c("JAB", "balanced", "moment"), max = 2000)
```

alphaN_report

*Write a settings report for a calibrated alpha level***Description**

Generates a short, human-readable Markdown report that records every input behind a calibrated alpha level together with the result: the sample size, the evidence target, the calibration method and its prior settings, the resulting alpha, and the decision rule. The report is designed to be attached to a preregistration protocol or a supplementary appendix, so that an alpha level chosen before data collection leaves a citable trace. It mirrors the downloadable report of the package's companion Shiny application.

Usage

```
alphaN_report(
  n,
  BF = 1,
  method = "JAB",
  upper = 1,
  de = 0.5,
  nu = NULL,
  r = NULL,
  q = 1,
  p = 0,
  file = NULL,
  width = 72,
  power_at = NULL
)
```

Arguments

- | | |
|--------|---|
| n | Sample size. A single positive number (one report describes one design). |
| BF | Target Bayes factor. A single positive number. |
| method | <p>Which Bayes factor to calibrate alpha to. The first four options invert Jeffreys' approximate Bayes factor and differ in the choice of the prior fraction 'b'; the last two invert the exact test-statistic Bayes factors of Klauer et al. (2025), whose priors center the alternative hypothesis on a prespecified effect size de. One of:</p> <ul style="list-style-type: none"> • "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022) • "min": uses the minimal training sample for the prior (Gu et al., 2018) • "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995) • "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016) • "ES": calibrates alpha to the effect-size Bayes factor (Klauer et al., 2025) |

	• "moment": calibrates alpha to the moment Bayes factor (Klauer et al., 2025), under which effects close to zero are a priori implausible
upper	The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, $U(0,1)$. Conceptually, upper plays for the "balanced" method the role that de plays for "ES" and "moment": both declare which effect sizes the researcher deems realistic. upper treats them as a uniform band whose Type I and Type II error rates are then balanced, whereas de singles out a focal effect size on which the prior concentrates.
de	The prespecified (targeted) effect size in standardized units: Cohen's d for $q = 1$ and Cohen's f for joint tests (the scales coincide at $q = 1$). Only used by methods "ES" and "moment". Defaults to 0.5, a medium effect; use 0.2 for small and 0.8 for large effects (Cohen, 1988).
nu	Degrees of freedom of the prior t distribution for methods "ES" and "moment". The default, NULL, uses the values recommended by Klauer et al. (2025): 3 for "ES" and $5 + (q - 1)$ for "moment".
r	Scale of the two prior mixture components for method "ES". The default, NULL, uses the recommendation of Klauer et al. (2025), $r = \sqrt{t((nu - 2)/(nu * q))} * de$, which requires $nu > 2$ and $de > 0$; otherwise supply r explicitly.
q	Number of coefficients tested jointly. Only used by methods "ES" and "moment". The default, 1, is the test of a single coefficient; for $q > 1$ the alpha level is set for the F test of the joint null that all q coefficients are zero.
p	Number of parameters retained in the model under the null, including any intercept. Only used by methods "ES" and "moment". The effective sample size of Klauer et al. (2025) is $n - p$; the default, 0, reproduces the one-sample form, which treats the sample size as effective. For a regression coefficient in a small sample, setting p to the number of other estimated coefficients (including the intercept) gives the residual-degrees-of-freedom behavior of the exact regression case.
file	Optional path. If supplied, the report is also written to this file.
width	Maximum line width of the report; longer lines are wrapped with a hanging indent. Defaults to 72 characters.
power_at	Optional numeric vector of standardized effect sizes. If supplied, the report includes the power of the calibrated test against each of them (computed with alphaN_power()), so the preregistered alpha is documented together with what it costs.

Value

The report as a character vector of lines, invisibly. The report is printed to the console.

See Also

[alphaN\(\)](#), [alphaN_power\(\)](#)

Examples

```
alphaN_report(n = 1000, BF = 3, method = "JAB")

# Effect-size calibration with a power section, written to a file
f <- tempfile(fileext = ".md")
alphaN_report(n = 1000, BF = 3, method = "ES", de = 0.5,
              power_at = c(0.1, 0.2, 0.5), file = f)
```

JAB	<i>Transforms t-statistics from a glm or lm object into Jeffreys' approximate Bayes factors</i>
-----	---

Description

Extracts the test statistic of one coefficient, or of every coefficient, from a fitted model object and converts it into Jeffreys' approximate Bayes factor, given the sample size used in the fit.

Usage

```
JAB(glm_obj, covariate = NULL, method = "JAB", upper = 1)
```

Arguments

glm_obj	a glm or lm object.
covariate	the name of the covariate that you want a BF for, as a string. The default, NULL, returns a named vector with the Bayes factor of every coefficient except the intercept (request the intercept explicitly with covariate = "(Intercept)" if you need it).
method	Used for the choice of 'b'. Currently one of: "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022) "min": uses the minimal training sample for the prior (Gu et al., 2018) "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995) "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)
upper	The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

Value

A numeric value with the BF in favour of H1, or a named vector of BFs when covariate = NULL.

Examples

```
# Simulate data

## Sample size
n <- 200

## Regressors
Z1 <- runif(n, -1, 1)
Z2 <- runif(n, -1, 1)
Z3 <- runif(n, -1, 1)
Z4 <- runif(n, -1, 1)
X <- runif(n, -1, 1)

## Error term
U <- rnorm(n, 0, 0.5)

## Outcome
Y <- X/sqrt(n) + U

# Run a GLM
LM <- glm(Y ~ X + Z1 + Z2 + Z3 + Z4)

# Compute JAB for "X" based on the regression results
JAB(LM, "X")

# Compute JAB for every coefficient at once
JAB(LM)

# Compute JAB using the minimum prior
JAB(LM, "X", method = "min")
```

JABp

*Transforms a p-value into Jeffreys' approximate Bayes factor***Description**

Converts a two-sided p-value from a z- or t-test into Jeffreys' approximate Bayes factor, given the sample size.

Usage

```
JABp(n, p, z = TRUE, df = NULL, method = "JAB", upper = 1)
```

Arguments

n	Sample size. A positive numeric vector.
p	The two-sided p-value.
z	Is the p-value based on a z- or t-statistic? TRUE if z.

df	If z=FALSE, provide the degrees of freedom for the t-statistic.
method	Used for the choice of 'b'. Currently one of: • "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022) • "min": uses the minimal training sample for the prior (Gu et al., 2018) • "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995) • "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)
upper	The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, U(0,1).

Value

A numeric value for the BF in favour of H1.

Examples

```
# Transform a p-value of 0.007038863 from a z-test into JAB
# using a sample size of 200.
JABp(200, 0.007038863)

# Transform a p-value of 0.007038863 from a t-test with 190
# degrees of freedom into JAB using a sample size of 200.
JABp(200, 0.007038863, z=FALSE, df=190)
```

JABt

Transforms a t-statistic into Jeffreys' approximate Bayes factor

Description

Converts a t-statistic (or z-statistic) into Jeffreys' approximate Bayes factor, given the sample size. Vectorized over n and t.

Usage

```
JABt(n, t, method = "JAB", upper = 1)
```

Arguments

n	Sample size. A positive numeric vector.
t	The t-statistic.
method	Used for the choice of 'b'. Currently one of:

- "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022)
 - "min": uses the minimal training sample for the prior (Gu et al., 2018)
 - "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995)
 - "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)
- upper The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, $U(0,1)$.

Value

A numeric value for the BF in favour of H_1 .

Examples

```
# Transform a t-statistic of 2.695 computed based on a sample size of 200 into JAB
JABt(200, 2.695)
```

JAB_plot

Plots JAB as a function of the p-value

Description

Plots JAB as a function of the p-value

Usage

```
JAB_plot(n, BF = 1, method = "JAB", upper = 1)
```

Arguments

- n Sample size. A positive numeric vector.
- BF Bayes factor you would like to match. 1 to avoid the Lindley Paradox, 3 to achieve moderate evidence and 10 to achieve strong evidence.
- method Used for the choice of 'b'. Currently one of:
- "JAB": this choice of b produces Jeffreys' approximate BF (Wagenmakers, 2022)
 - "min": uses the minimal training sample for the prior (Gu et al., 2018)
 - "robust": a robust version of "min" that prevents too small b (O'Hagan, 1995)
 - "balanced": this choice of b balances the type I and type II errors (Gu et al., 2016)
- upper The upper limit for the range of realistic effect sizes. Only relevant when method="balanced". Defaults to 1 such that the range of realistic effect sizes is uniformly distributed between 0 and 1, $U(0,1)$.

Value

Prints a plot.

Examples

```
# Plot JAB as function of the p-value for a sample size of 2000
JAB_plot(2000)
```

klauerBF

Effect-size or moment Bayes factor from a t or F statistic

Description

Computes the effect-size or moment Bayes factor of Klauer, Meyer-Grant, and Kellen (2025) from a t statistic (one-sample test or single regression coefficient) or from an F statistic (joint test of q coefficients). These are the Bayes factors that [alphaN\(\)](#) inverts for method = "ES" and method = "moment", so a reported test statistic can be converted into evidence under the same prior used to set the alpha level. Vectorized over t (or Fstat) and n.

Usage

```
klauerBF(
  n,
  t = NULL,
  Fstat = NULL,
  q = 1,
  p = 0,
  method = "ES",
  de = 0.5,
  nu = NULL,
  r = NULL
)
```

Arguments

n	Sample size. A positive numeric vector.
t	The t-statistic. Used when q = 1; supply either t or Fstat (with Fstat read as the squared t-statistic).
Fstat	The F-statistic of the model comparison. Required when q > 1.
q	Number of coefficients tested jointly. The default, 1, covers the one-sample test and the test of a single regression coefficient.
p	Number of parameters retained in the reduced model, including any intercept. The effective sample size of Klauer et al. (2025) is $n - p$; the default, 0, is the one-sample case. For a test of a single coefficient in a regression model, p is the number of other estimated coefficients, including the intercept.

method	"ES" for the effect-size Bayes factor or "moment" for the moment Bayes factor.
de	The prespecified (targeted) effect size: Cohen's d for $q = 1$, and Cohen's f for joint tests (the two scales coincide at $q = 1$). Defaults to 0.5. For joint tests, Cohen (1988, Chapter 9) labels f^2 of 0.02, 0.15, and 0.35 as small, medium, and large, so $de = \sqrt{0.15}$ targets a medium effect.
nu	Degrees of freedom of the prior t distribution. The default, NULL, uses the recommendations of Klauer et al. (2025): 3 for "ES" and $5 + (q - 1)$ for "moment".
r	Scale of the prior mixture components for method "ES". The default, NULL, uses the recommendation of Klauer et al. (2025), $r = \sqrt{t((nu - 2)/(nu * q)) * de}$, which requires $nu > 2$ and $de > 0$; otherwise supply r explicitly.

Details

For $q = 1$ the Bayes factor is evaluated in its noncentral-t form with $n - p - 1$ degrees of freedom, and for $q > 1$ in its noncentral-F form with $(q, n - p - q)$ degrees of freedom (Table 4 of Klauer et al., 2025). The implementation is validated against all printed Bayes factors in Tables 7 and 8 of that paper.

As a special case, $q = 1$, $nu = 1$, $de = 0$ with an explicit scale (e.g. $r = 1$) gives the default (Jeffreys-Zellner-Siow type) Bayes factor of Rouder et al. (2009).

Value

A numeric vector with the Bayes factor in favour of H1.

References

- Cohen, J. (1988). Statistical power analysis for the behavioral sciences (second edition). Lawrence Erlbaum.
- Klauer, K. C., Meyer-Grant, C. G., & Kellen, D. (2025). On Bayes factors for hypothesis tests. *Psychonomic Bulletin & Review*, 32, 1070-1094. doi:10.3758/s13423024026122
- Rouder, J. N., Speckman, P. L., Sun, D., Morey, R. D., & Iverson, G. (2009). Bayesian t tests for accepting and rejecting the null hypothesis. *Psychonomic Bulletin & Review*, 16, 225-237.

See Also

[alphaN\(\)](#) for the inverse mapping from a target Bayes factor to an alpha level, and [JABt\(\)](#) for Jeffreys' approximate Bayes factor.

Examples

```
# Effect-size Bayes factor for  $t(79) = 2.24$  targeting a medium effect
# (Table 7 of Klauer et al., 2025)
klauerBF(n = 80, t = 2.24, de = 0.5)

# The moment Bayes factor for the same statistic
klauerBF(n = 80, t = 2.24, method = "moment", de = 0.5)
```

```
# Joint test of q = 2 coefficients in a regression with 3 retained
# parameters (Table 8 of Klauer et al., 2025, model M9)
klauerBF(n = 175, Fstat = 1.17, q = 2, p = 3, de = sqrt(0.15))
```

<code>n_effective</code>	<i>Effective sample size from cluster-robust standard errors</i>
--------------------------	--

Description

Computes the effective sample size recommended by Wulff and Taylor (2024) for calibrating alpha with clustered (panel) data, where observations are not independent and the nominal sample size overstates the information in the data: $n_e = n * (se / se_{robust})^2$, the total number of observations deflated by the squared ratio of the classical to the cluster-robust standard error. Vectorized over its arguments (recycled).

Usage

```
n_effective(n, se, se_robust)
```

Arguments

- `n` Total number of observations. A positive numeric vector.
- `se` The classical (non-robust) standard error of the coefficient.
- `se_robust` The cluster-robust standard error of the same coefficient.

Details

Wulff and Taylor (2024) recommend calibrating alpha with the total number of observations, which is the conservative choice, and then checking whether conclusions survive when alpha and the Bayes factor are recomputed with the effective sample size. Because cluster-robust standard errors typically exceed classical ones, `n_effective()` is typically smaller than `n`, which yields a larger calibrated alpha.

Value

A numeric vector with the effective sample size.

References

Wulff, J. N., & Taylor, L. (2024). How and why alpha should depend on sample size: A Bayesian-frequentist compromise for significance testing. *Strategic Organization*, 22(3), 550-581. doi:10.1177/14761270231214429

See Also

```
alphaN\(\)
```

Examples

```
# A regression on 237 clustered observations where the cluster-robust
# standard error is twice the classical one implies an effective sample
# size four times smaller (Wulff & Taylor, 2024, Example 3)
n_effective(n = 237, se = 0.1, se_robust = 0.2)

# Alpha for moderate evidence at the nominal and the effective sample size
alphaN(n = 237, BF = 3, method = "robust")
alphaN(n = n_effective(237, 0.1, 0.2), BF = 3, method = "robust")
```

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