# Package: hcinfer (via r-universe)

June 10, 2026

**Title** Heteroskedasticity-Consistent Inference for Linear Models

**Version** 0.1.0

**Description** Computes heteroskedasticity-consistent covariance matrix estimators for ordinary least squares regression models. The published HC0 through HC5m estimators implemented in the package follow White (1980) <doi:10.2307/1912934>, Hinkley (1977) <doi:10.1080/00401706.1977.10489550>, Horn et al. (1975) <doi:10.1080/01621459.1975.10479877>, MacKinnon and White (1985) <doi:10.1016/0304-4076(85)90158-7>, Cribari-Neto (2004) <doi:10.1016/S0167-9473(02)00366-3>, Cribari-Neto and da Silva (2011) <doi:10.1007/s10182-010-0141-2>, Cribari-Neto et al. (2007) <doi:10.1080/03610920601126589>, and Li et al. (2016) <doi:10.1080/00949655.2016.1198906>. The package also includes HCbeta, a new estimator proposed by the package authors. It provides normal Wald tests, confidence intervals, diagnostics, and S3 output for applied inference.

**URL** https://prdm0.github.io/hcinfer/, https://github.com/prdm0/hcinfer

**BugReports** https://github.com/prdm0/hcinfer/issues

**License** MIT + file LICENSE

**Encoding** UTF-8

**Depends** R (>= 4.1.0)

**Imports** cli, ggplot2, purrr, rlang, tibble

**Suggests** dplyr, knitr, rmarkdown, testthat (>= 3.0.0)

**VignetteBuilder** knitr

**Config/testthat/edition** 3

**Config/Needs/website** pkgdown

**LazyData** true

**Config/roxygen2/version** 8.0.0

**RoxygenNote** 7.3.3

**NeedsCompilation** no

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**Repository** https://cran.r-universe.dev

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**RemoteUrl** https://github.com/cran/hcinfer

**RemoteRef** HEAD

**RemoteSha** 3b62a488d885b14125aabacfc519924875482130

# Contents



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`coef.hcinfer` *Extract model coefficients from an hcinfer object*

---

## Description

Extracts the OLS coefficients stored in an `hcinfer()` result.

## Usage

```
## S3 method for class 'hcinfer'
coef(object, ...)
```

### Arguments

| | |
|---|---|
| `object` | An object returned by `hcinfer()`. |
| `...` | Unused. |

### Value

A named numeric vector of OLS coefficients.

---

`confint.hcinfer` *Confidence intervals for hcinfer objects*

---

### Description

Extracts normal Wald confidence intervals from an `hcinfer()` result. If the requested level differs from the level used to create the object, only the normal critical value and interval endpoints are recomputed.

### Usage

```
## S3 method for class 'hcinfer'
confint(object, parm, level = object$confidence_level, ...)
```

### Arguments

| | |
|---|---|
| `object` | An object returned by `hcinfer()`. |
| `parm` | Optional coefficient names or positions. |
| `level` | Confidence level. |
| `...` | Unused. |

### Value

A tibble with columns `term`, `conf_low`, `conf_high`, and `level`.

## hc_methods *Available heteroskedasticity-consistent estimators*

### Description

Returns the HC covariance estimators implemented by hcinfer.

### Usage

```
hc_methods()
```

### Value

A tibble with columns `type`, `label`, `description`, and `default_arguments`.

### Examples

```
hc_methods()
```

## hcinfer *Heteroskedasticity-consistent Wald inference*

### Description

Computes normal Wald tests and confidence intervals for an ordinary least squares model using a heteroskedasticity-consistent covariance estimator.

### Usage

```
hcinfer(object, type = "hcbeta", alpha = 0.05, null = 0, ...)
```

### Arguments

| | |
|---|---|
| `object` | An ordinary least squares model fitted by `stats::lm()`. |
| `type` | A character string specifying the HC estimator. The default is `"hcbeta"`. |
| `alpha` | Significance level. The confidence level is `1 - alpha`. |
| `null` | Null values for the coefficient tests. Use a scalar to test all coefficients against the same value, or a numeric vector with one value per coefficient. |
| `...` | Method-specific constants passed to `vcov_hc()`. Defaults are documented in `vcov_hc()` and can be inspected with `hc_methods()`. |

## Details

For each coefficient, hcinfer tests

$$H_0 : \beta_j = \beta_j^{(0)}$$

against a two-sided alternative using the statistic

$$z_j = \frac{\hat{\beta}_j - \beta_j^{(0)}}{\sqrt{[\widehat{\Psi}_{HC}]_{jj}}}.$$

The reference distribution is the standard normal distribution. Confidence intervals are Wald intervals obtained by direct inversion of the test,

$$\hat{\beta}_j \pm z_{1-\alpha/2}\sqrt{[\widehat{\Psi}_{HC}]_{jj}}.$$

Bootstrap intervals and Student t quantiles are not used.

## Value

An object of class `hcinfer` containing the fitted HC covariance estimator, coefficient tests, p-values, confidence intervals, diagnostics, and method parameters.

## References

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817-838. doi:10.2307/1912934

Hinkley, D. V. (1977). Jackknifing in unbalanced situations. *Technometrics*, 19(3), 285-292. doi:10.1080/00401706.1977.10489550

Horn, S. D., Horn, R. A., and Duncan, D. B. (1975). Estimating heteroscedastic variances in linear models. *Journal of the American Statistical Association*, 70(350), 380-385. doi:10.1080/01621459.1975.10479877

MacKinnon, J. G. and White, H. (1985). Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics*, 29(3), 305-325. doi:10.1016/03044076(85)901587

Davidson, R. and MacKinnon, J. G. (1993). *Estimation and Inference in Econometrics*. Oxford University Press.

Cribari-Neto, F. (2004). Asymptotic inference under heteroskedasticity of unknown form. *Computational Statistics and Data Analysis*, 45(2), 215-233. doi:10.1016/S01679473(02)003663

Cribari-Neto, F. and da Silva, W. B. (2011). A new heteroskedasticity consistent covariance matrix estimator for the linear regression model. *AStA Advances in Statistical Analysis*, 95(2), 129-146. doi:10.1007/s1018201001412

Cribari-Neto, F., Souza, T. C., and Vasconcellos, K. L. P. (2007). Inference under heteroskedasticity and leveraged data. *Communications in Statistics - Theory and Methods*, 36(10), 1877-1888. doi:10.1080/03610920601126589

Li, S., Zhang, N., Zhang, X., and Wang, G. (2016). A new heteroskedasticity-consistent covariance matrix estimator and inference under heteroskedasticity. *Journal of Statistical Computation and Simulation*, 87(1), 198-210. doi:10.1080/00949655.2016.1198906

## Examples

```
schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)
result <- hcinfer(fit, type = "hcbeta")
result
summary(result)
confint(result)

hcinfer(fit, type = "hcbeta", c1 = 7, c2 = 0.75, lower = 0.01, upper = 0.99)
hcinfer(fit, type = "hc5", k = 0.7)
hcinfer(fit, type = "hc5m", k = 0.7, k1 = 1, k2 = 0, k3 = 1)
```

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# plot.hcinfer *Plot robust confidence intervals*

---

## Description

Plots normal Wald confidence intervals for an `hcinfer()` result. Each interval is color-coded by the test decision at the stored significance level: coefficients for which the null hypothesis is rejected are shown in red, and those for which it is not rejected are shown in blue. Formatted p-values are printed to the right of each interval for quick reading.

## Usage

```
## S3 method for class 'hcinfer'
plot(x, parm, ...)
```

## Arguments

| | |
|---|---|
| `x` | An object returned by `hcinfer()`. |
| `parm` | Optional coefficient names or integer positions. When supplied, only the selected coefficients are plotted. The selection follows the same rules as `confint.hcinfer()` and `tests.hcinfer()`. |
| `...` | Unused. Passing named arguments raises an error. |

## Value

A `ggplot2::ggplot()` object.

## See Also

hcinfer(), confint.hcinfer(), tests.hcinfer()

## Examples

```
schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)
result <- hcinfer(fit)
plot(result)
plot(result, parm = "income_scaled_sq")
```

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# plot.hcinfer_vcov *Plot HC adjustment factors against leverages*

---

## Description

Plots the HC adjustment factors $g_t$ against the leverage values $h_t$ stored in a vcov_hc() object. Points with $h_t > 3p/n$ are highlighted because this threshold is commonly used to flag high-leverage observations in the empirical examples from the HCbeta paper.

## Usage

```
## S3 method for class 'hcinfer_vcov'
plot(x, label_top = 3, ...)
```

## Arguments

| | |
|---|---|
| x | An object returned by vcov_hc(). |
| label_top | A nonnegative whole number. The observations with the largest adjustment factors are labeled. Use 0 to suppress labels. |
| ... | Unused. Passing named arguments raises an error. |

## Value

A ggplot2::ggplot() object.

## See Also

vcov_hc(), hcinfer(), plot.hcinfer()

## Examples

```
schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)

cov <- vcov_hc(fit, type = "hcbeta")
plot(cov)
plot(vcov_hc(fit, type = "hc4"), label_top = 2)
```

---

# print.hcinfer *Print hcinfer objects*

---

## Description

Prints a compact overview of a heteroskedasticity-consistent inference object. Emoji markers are used when the current locale supports UTF-8 and `getOption("hcinfer.use_emoji", TRUE)` is true.

## Usage

```
## S3 method for class 'hcinfer'
print(x, ...)
```

## Arguments

| | |
|---|---|
| x | An object returned by `hcinfer()`. |
| ... | Unused. |

## Value

The input object, invisibly.

---

# print.hcinfer_vcov *Print hcinfer covariance objects*

---

## Description

Prints a compact overview of a heteroskedasticity-consistent covariance object. Emoji markers are used when the current locale supports UTF-8 and `getOption("hcinfer.use_emoji", TRUE)` is true.

### Usage

```
## S3 method for class 'hcinfer_vcov'
print(x, ...)
```

### Arguments

| | |
|---|---|
| x | An object returned by vcov_hc(). |
| ... | Unused. |

### Value

The input object, invisibly.

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## PublicSchools *Public school expenditure and income by US state*

---

### Description

Public school expenditure and income data for US states and Washington DC in 1979. The expenditure value for Wisconsin is missing in the source data, so the standard regression example uses 50 complete observations. The data are useful for illustrating heteroskedasticity-consistent inference because Alaska is a high-leverage observation in the quadratic public-schools model studied in the HCbeta paper.

### Usage

```
PublicSchools
```

### Format

A tibble with 51 rows and 3 variables:

**state** US state or Washington DC.

**expenditure** Per capita expenditure on public schools in 1979. This variable has one missing value.

**income** Per capita income in 1979.

### Source

Greene, W. H. (1993). *Econometric Analysis*, 2nd ed. Macmillan Publishing Company, New York. Table 14.1, p. 385. The data were originally sourced from the U.S. Department of Commerce, *Statistical Abstract of the United States* (1979). The dataset is also available in the sandwich R package.

## Examples

```
data(PublicSchools)
PublicSchools[PublicSchools$state == "Alaska", ]

schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)
hcinfer(fit, type = "hcbeta")
```

---

`summary.hcinfer` *Summarize heteroskedasticity-consistent inference*

---

## Description

Builds a detailed summary for an `hcinfer()` result. The summary includes model metadata, HC method information, leverage diagnostics, robust weight diagnostics, and coefficient-by-coefficient normal Wald tests with p-values and confidence intervals. The print method adds formal test decisions to improve interpretation while preserving the numeric components of the object.

## Usage

```
## S3 method for class 'hcinfer'
summary(object, ...)
```

## Arguments

| | |
|---|---|
| `object` | An object returned by `hcinfer()`. |
| `...` | Unused. |

## Value

An object of class `summary_hcinfer`.

## summary.hcinfer_vcov *Summarize heteroskedasticity-consistent covariance objects*

### Description

Builds a detailed summary for an object returned by `vcov_hc()`.

### Usage

```
## S3 method for class 'hcinfer_vcov'
summary(object, ...)
```

### Arguments

| | |
|---|---|
| `object` | An object returned by `vcov_hc()`. |
| `...` | Unused. |

### Value

An object of class `summary_hcinfer_vcov`.

## tests *Extract coefficient test results*

### Description

Extracts the normal Wald test results from an `hcinfer()` object. If the requested significance level differs from the one used to create the object, only the `reject` column is recomputed. The test statistics and p-values are not affected by `alpha` and are never recomputed.

### Usage

```
tests(object, ...)

## S3 method for class 'hcinfer'
tests(object, parm, alpha = object$alpha, ...)
```

### Arguments

| | |
|---|---|
| `object` | An object returned by `hcinfer()`. |
| `...` | Unused. Passing named arguments raises an error. |
| `parm` | Optional coefficient names or integer positions to select a subset of coefficients. When omitted, all coefficients are returned. |
| `alpha` | Significance level used to compute the `reject` column. Must be strictly between 0 and 1. Defaults to the level stored in `object`. Changing `alpha` updates only the `reject` column; all other columns remain identical to the stored values. |

## Details

For each coefficient, the stored test is

$$H_0 : \beta_j = \beta_j^{(0)}$$

against a two-sided alternative. The test statistic is

$$z_j = \frac{\hat{\beta}_j - \beta_j^{(0)}}{\sqrt{[\widehat{\Psi}_{HC}]_{jj}}},$$

and the p-value is $2\,\Phi(-|z_j|)$, where $\Phi$ is the standard normal distribution function. The null value $\beta_j^{(0)}$ is the one stored in the object, set when `hcinfer()` was called.

To test against a different null value, rerun `hcinfer()` with the desired `null` argument.

## Value

A tibble with one row per selected coefficient and the following columns:

`term` Coefficient name.

`estimate` OLS estimate $\hat{\beta}_j$.

`null_value` Null hypothesis value $\beta_j^{(0)}$.

`std_error` Robust standard error $\sqrt{[\widehat{\Psi}_{HC}]_{jj}}$.

`z_value` Normal Wald statistic $z_j$.

`p_value` Two-sided p-value $2\,\Phi(-|z_j|)$.

`alpha` Significance level used for the `reject` column.

`reject` Logical. `TRUE` when `p_value < alpha`.

## References

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817-838. doi:10.2307/1912934

Hinkley, D. V. (1977). Jackknifing in unbalanced situations. *Technometrics*, 19(3), 285-292. doi:10.1080/00401706.1977.10489550

Horn, S. D., Horn, R. A., and Duncan, D. B. (1975). Estimating heteroscedastic variances in linear models. *Journal of the American Statistical Association*, 70(350), 380-385. doi:10.1080/01621459.1975.10479877

MacKinnon, J. G. and White, H. (1985). Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics*, 29(3), 305-325. doi:10.1016/03044076(85)901587

Davidson, R. and MacKinnon, J. G. (1993). *Estimation and Inference in Econometrics*. Oxford University Press.

Cribari-Neto, F. (2004). Asymptotic inference under heteroskedasticity of unknown form. *Computational Statistics and Data Analysis*, 45(2), 215-233. doi:10.1016/S01679473(02)003663

Cribari-Neto, F. and da Silva, W. B. (2011). A new heteroskedasticity consistent covariance matrix estimator for the linear regression model. *AStA Advances in Statistical Analysis*, 95(2), 129-146. doi:10.1007/s1018201001412

Cribari-Neto, F., Souza, T. C., and Vasconcellos, K. L. P. (2007). Inference under heteroskedasticity and leveraged data. *Communications in Statistics - Theory and Methods*, 36(10), 1877-1888. doi:10.1080/03610920601126589

Li, S., Zhang, N., Zhang, X., and Wang, G. (2016). A new heteroskedasticity-consistent covariance matrix estimator and inference under heteroskedasticity. *Journal of Statistical Computation and Simulation*, 87(1), 198-210. doi:10.1080/00949655.2016.1198906

## See Also

`hcinfer()`, `confint.hcinfer()`

## Examples

```
schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)
result <- hcinfer(fit)

tests(result)
tests(result, parm = "income_scaled_sq")
tests(result, alpha = 0.10)
```

---

# vcov.hcinfer *Extract robust covariance matrices*

---

## Description

Extracts the heteroskedasticity-consistent covariance matrix stored in an hcinfer object. The matrix is returned directly and is not recomputed.

## Usage

```
## S3 method for class 'hcinfer'
vcov(object, ...)

## S3 method for class 'hcinfer_vcov'
vcov(object, ...)
```

## Arguments

| | |
|---|---|
| `object` | An object returned by `hcinfer()` or `vcov_hc()`. |
| `...` | Unused. |

## Value

A numeric covariance matrix.

---

vcov_hc *Heteroskedasticity-consistent covariance estimator*

---

## Description

Computes a heteroskedasticity-consistent covariance matrix estimator for an ordinary least squares model fitted with `stats::lm()`. The function returns a rich S3 object that stores the covariance matrix, HC weights, leverage values, method parameters, and model metadata.

## Usage

```
vcov_hc(object, type = "hcbeta", ...)
```

## Arguments

| | |
|---|---|
| `object` | An ordinary least squares model fitted by `stats::lm()`. |
| `type` | A character string specifying the HC estimator. The default is `"hcbeta"`. |
| `...` | Method-specific constants. Unknown names are rejected. See Details for the accepted names, defaults, and parameter domains. |

## Details

For a linear model with design matrix $X$, OLS residuals $\hat{e}_t$, and HC weights $g_t$, the estimator is

$$\widehat{\Psi}_{HC} = (X'X)^{-1}X'\widehat{\Omega}X(X'X)^{-1},$$

where $\widehat{\Omega} = diag(\hat{e}_t^2 g_t)$. The supported estimators are `"hc0"`, `"hc1"`, `"hc2"`, `"hc3"`, `"hc4"`, `"hc4m"`, `"hc5"`, `"hc5m"`, and `"hcbeta"`.

Additional arguments in `...` are method-specific. The defaults are:

- `"hc0"`, `"hc1"`, `"hc2"`, `"hc3"`, `"hc4"`, and `"hc4m"`: no method-specific arguments.
- `"hc5"`: `k = 0.7`.
- `"hc5m"`: `k = 0.7`, `k1 = 1`, `k2 = 0`, `k3 = 1`, `gamma1 = 1`, and `gamma2 = 1.5`.
- `"hcbeta"`: `c1 = 7`, `c2 = 0.75`, `lower = 0.01`, and `upper = 0.99`.

For `"hc5"` and `"hc5m"`, `k`, `k1`, `k2`, and `k3` must be nonnegative, while `gamma1` and `gamma2` must be positive. For `"hcbeta"`, `c1` must be nonnegative, `c2` must be positive, and `lower` and `upper` must lie in `(0, 1)` with `lower < upper`. The HCbeta truncation is $w_t = max(lower, min(1 - h_t, upper))$.

## Value

An object of class `hcinfer_vcov`. The covariance matrix is stored in `object$vcov` and is returned directly by `vcov()`.

## References

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817-838. doi:10.2307/1912934

Hinkley, D. V. (1977). Jackknifing in unbalanced situations. *Technometrics*, 19(3), 285-292. doi:10.1080/00401706.1977.10489550

Horn, S. D., Horn, R. A., and Duncan, D. B. (1975). Estimating heteroscedastic variances in linear models. *Journal of the American Statistical Association*, 70(350), 380-385. doi:10.1080/01621459.1975.10479877

MacKinnon, J. G. and White, H. (1985). Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics*, 29(3), 305-325. doi:10.1016/03044076(85)901587

Davidson, R. and MacKinnon, J. G. (1993). *Estimation and Inference in Econometrics*. Oxford University Press.

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Cribari-Neto, F. and da Silva, W. B. (2011). A new heteroskedasticity consistent covariance matrix estimator for the linear regression model. *AStA Advances in Statistical Analysis*, 95(2), 129-146. doi:10.1007/s1018201001412

Cribari-Neto, F., Souza, T. C., and Vasconcellos, K. L. P. (2007). Inference under heteroskedasticity and leveraged data. *Communications in Statistics - Theory and Methods*, 36(10), 1877-1888. doi:10.1080/03610920601126589

Li, S., Zhang, N., Zhang, X., and Wang, G. (2016). A new heteroskedasticity-consistent covariance matrix estimator and inference under heteroskedasticity. *Journal of Statistical Computation and Simulation*, 87(1), 198-210. doi:10.1080/00949655.2016.1198906

## Examples

```
schools <- PublicSchools |>
  dplyr::mutate(
    income_scaled = income / 10000,
    income_scaled_sq = income_scaled^2
  )
fit <- lm(expenditure ~ income_scaled + income_scaled_sq, data = schools)
cov <- vcov_hc(fit, type = "hcbeta")
cov
vcov(cov)
plot(cov)

vcov_hc(fit, type = "hcbeta", c1 = 7, c2 = 0.75, lower = 0.01, upper = 0.99)
vcov_hc(fit, type = "hc5", k = 0.7)
vcov_hc(fit, type = "hc5m", k = 0.7, k1 = 1, k2 = 0, k3 = 1)
```

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