

# Package ‘mded’

May 8, 2026

**Type** Package

**Title** Measuring the Difference Between Two Empirical Distributions

**Version** 0.1-2

**Date** 2015-04-27

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**Description** Provides a function for measuring the difference between two independent or non-independent empirical distributions and returning a significance level of the difference.

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**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2015-04-27 11:04:01

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## Description

The package provides a function for measuring the difference between two independent or non-independent empirical distributions and returning a significance level of the difference.

## Acknowledgments

I would like to thank Professor Gregory L. Poe for his kindness.

**Note**

Recommended citations:

Aizaki H (2014). **mded**: Measuring the difference between two empirical distributions, R package version 0.1-1. URL <http://CRAN.R-project.org/package=mded>.

Poe GL, Giraud KL, Loomis JB (2005). Computational methods for measuring the difference of empirical distributions. *American Journal of Agricultural Economics*, **87**, 353–365.

Poe GL, Welsh MP, Champ PA (1997). Measuring the difference in mean willingness to pay when dichotomous choice contingent valuation responses are not independent. *Land Economics*, **73**, 255–267.

**Author(s)**

Hideo Aizaki

**References**

Poe GL, Giraud KL, Loomis JB (2005). Computational methods for measuring the difference of empirical distributions. *American Journal of Agricultural Economics*, **87**, 353–365.

Poe GL, Severance-Lossin EK, Welsh WP (1994). Measuring the difference (X - Y) of simulated distributions: A convolutions approach. *American Journal of Agricultural Economics*, **76**, 904–915.

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mded

*Measuring the difference between two empirical distributions*

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**Description**

The function measures the difference between two independent or non-independent empirical distributions and returns a significance level of the difference.

**Usage**

```
mded(distr1, distr2, detail = FALSE, independent = TRUE)
```

```
## S3 method for class 'mded'  
print(x, digits = max(3, getOption("digits") - 3), ...)
```

**Arguments**

distr1	A vector of empirical distribution. distr1 is greater than distr2.
distr2	A vector of empirical distribution.
detail	If TRUE, a vector of the difference between distr1 and distr2 is returned.
independent	Set as FALSE when distr1 and distr2 are not independent of each other.
x	An object of S3 class 'mded.'
digits	A number of significant digits.
...	Arguments passed to the function print.

**Details**

The function measures the difference between two independent or non-independent empirical distributions and returns a significance level of the difference on the basis of the methods proposed by Poe et al. (1997, 2005). Such calculations are frequently needed in empirical econometric studies wherein (marginal) willingness-to-pay distributions that are estimated using contingent valuation methods or discrete choice experiments have to be compared to each other.

Let us assume that  $X$  and  $Y$  are empirical distributions, which are depicted by the vector  $\mathbf{x} = (x_1, x_2, \dots, x_m)$ , and  $\mathbf{y} = (y_1, y_2, \dots, y_n)$ . The null hypothesis ( $H_0$ ) is  $X - Y = 0$ , while the alternative hypothesis ( $H_1$ ) is  $X - Y > 0$ . When  $X$  and  $Y$  are independent of each other, the complete combinatorial method (Poe et al. 2005) provides the one-sided significance level of  $H_0$  that is calculated by  $\#\{x_i - y_j \leq 0\} / m * n$ , where  $\#\{cond\}$  provides the number of times that *cond* is true. When  $X$  and  $Y$  are not independent of each other, the paired difference method (Poe et al. 1997) provides the one-sided significance level of  $H_0$  that is calculated by  $\#\{x_i - y_i \leq 0\} / m$ , where  $m$  is equal to  $n$ .

Note that the function may take quite long, and would require large amount of memory to calculate the difference between two *independent* distributions if the argument *detail* is set as TRUE because the resulting difference is stored as a vector. For example, when *distr1* and *distr2* each contain 10,000 elements (observations), the vector of the difference contains 100,000,000 elements. If memory is lacking, R would stop running the function, showing an error message related to memory limitation.

**Value**

stat	One-side significance level of the difference between <i>distr1</i> and <i>distr2</i> .
means	A vector of mean values of <i>distr1</i> and <i>distr2</i> .
cases	A vector of integer values describing a number of cases wherein the <i>cond</i> is true and that is false.
distr1	A vector assigned to <i>distr1</i> .
distr2	A vector assigned to <i>distr2</i> .
distr.names	A vector of the names of objects assigned to <i>distr1</i> and <i>distr2</i> .
diff	A vector of the difference. If <i>detail</i> = TRUE, it is returned.

**Author(s)**

Hideo Aizaki

## References

Poe GL, Giraud KL, Loomis JB (2005). Computational methods for measuring the difference of empirical distributions. *American Journal of Agricultural Economics*, **87**, 353–365.

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## Examples

```
set.seed(123)
x <- rnorm(100, 3)
y <- rnorm(100, 1)

out <- mded(distr1 = x, distr2 = y, detail = TRUE)
out
```

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