

# R-Package 'MIDD'

January 21, 2021

**Type** Package

**Title** Diagnostic Tool by Multiple Imputation for Regression Discontinuity Designs

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**Description** R-Package MIDD estimates the local average treatment effects based on regression discontinuity designs (RDDs) and multiple imputation discontinuity designs (MIDDs), and diagnoses RDDs by comparing the results from MIDDs.

**Depends** Amelia, rdrobust

**URL** <https://github.com/m-takahashi123/MIDD>

**Repository** GitHub

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MIDD-package	<i>Diagnostic Tool by Multiple Imputation for Regression Discontinuity Designs</i>
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### Description

To use this package, click Code and Download ZIP from <https://github.com/m-takahashi123/MIDD>. After downloading the package, set the working directory in R, and read R-Package MIDD using R-function `source` as follows.

```
setwd("C:/Folder")
source("MIDD.R")
```

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lee2008	<i>Dataset in Lee (2008)</i>
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### Description

This is a real dataset based used in Lee (2008).

### Usage

```
data1<-read.csv("lee2008.csv", header=TRUE)
attach(data1)
```

### Format

A data frame with 6558 observations on the following four variables.

`y1` the variable of interest (the dependent variable). Democrat vote share election  $t+1$

`x1` the running variable. The cutoff point is where  $x1=0$ . Diff. democratic share

`x2` additional covariate. Democrat vote share  $t-1$

### References

Angrist, J. D., and Pischke, J. S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton: Princeton University Press.

Lee, D. S. (2008). Randomized Experiments from Non-Random Selection in U.S. House Elections. *Journal of Econometrics*, 142, pp.675-697.

Olivares, M., and Sarmiento-Barbieri, I. (2020). "Package 'RATest'," The Comprehensive R Archive Network. Available at <https://cran.r-project.org/web/packages/RATest/RATest.pdf>.

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MIdiagRDD	<i>R-function to compute the local average treatment effects and to diagnose regression discontinuity designs by multiple imputation discontinuity designs.</i>
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## Description

MIdiagRDD estimates the local average treatment effects based on regression discontinuity designs (RDDs) and multiple imputation discontinuity designs (MIDDs), and diagnoses RDDs by comparing the results from MIDDs.

## Usage

```
MIdiagRDD(y, x, cut, seed=1, M1=100, M2=5, M3=1, p2s1=1,
          emp=0, bw="mserd", ker="triangular", bwidht=1,
          p1=1, conf=95, upper=1, covs1=NULL)
```

## Arguments

y	the variable of interest (the dependent variable)
x	the running variable (forcing variable) that determines the cutoff point.
cut	specifies the RDD cutoff point in x. The user must supply a specific number.
seed	sets the seed value for random numbers. Default is 1.
M1	the number of imputed datasets to create. Default is 100.
M2	the number of densities based on imputed datasets to display in graphs 3 and 4. Also, the number of estimated slopes in graphs 9, and 10 below. Default is 5. These datasets are the subsets of M1 imputed datasets. Thus, M2 cannot be larger than M1.
M3	the number of imputed datasets to display in graphs 5 to 10 below. Default is 1. These datasets are the subsets of M1 imputed datasets. Thus, M3 cannot be larger than M1.
p2s1	an integer value taking either 0 or 1, where 0 for no screen output and 1 for screen printing of multiple imputation process. Default is 1.
emp	number indicating level of the empirical (ridge) prior. Default is 0. A reasonable upper bound is 0.1.
bw	specifies the bandwidth selection procedure for the regression discontinuity design. Choice is mserd, msenum, cerrd, and cersum. Default is mserd.

	mserd is one common MSE-optimal bandwidth selector.
	msum is one common MSE-optimal bandwidth selector for the sum of regression estimates.
	cerd is one common CER-optimal bandwidth selector.
	csum is one common CER-optimal bandwidth selector for the sum of regression estimates.
	MSE is Mean Squared Error. CER is Coverage Error Rate.
ker	is the kernel function used to construct the local-polynomial estimator for the RDD. Options are <code>triangular</code> (default option), <code>epanechnikov</code> , and <code>uniform</code> .
bwidth	a number to adjust the size of the chosen bandwidth. Default is 1.
p1	specifies the order of the local-polynomial used to construct the point-estimator for the RDD and the MIDD. Default is <code>p1=1</code> (local linear regression). Can take either 1 (local linear regression) or 2 (local quadratic regression). When specified larger than 2, it will be considered 2.
conf	is the confidence level for the confidence interval. Default is 95.
upper	specifies which part of the running variable is the treatment group. If the upper part is the treatment group, <code>upper=1</code> (default). If the lower part is the treatment group, <code>upper=0</code> . Default is 1.
covs1	specifies additional covariates to be used for estimation and inference in the RDD and multiple imputation. Adding covariates can be done by specifying <code>covs1=data.frame(covariate1, covariate2, ..., covariatep)</code> .

### Value

Estimate	Estimated quantities of the local average treatment effects (LATE) at the cutoff.
Std.Error	Standard error of the estimate.
CI.LL	Lower limit of the 95% confidence interval.
CI.UL	Upper limit of the 95% confidence interval.
size	Sub-sample size to estimate the LATE at the cutoff.
ratio	Ratio of the sub-sample size to the original sample size.
bandwidth	Length of the bandwidth used for RDD analysis.
1.MI, RDD, Naive	A diagnostic plot to visualize the relationship among

	the three estimators. Red vertical line is RDD, black solid line is naïve, and histogram is MI.
2.MI and RDD	A diagnostic plot to visualize the relationship between the two estimators. Red vertical line is RDD and histogram is MI.
3.Densities (Control)	A diagnostic plot to visualize the densities of observed and imputed data. Gray solid curve is the density of observed data in the control group. Blue solid curve is the density of observed data in the treatment group. Red dashed lines are the densities of imputed data in the control group.
4.Densities (Treatment)	A diagnostic plot to visualize the densities of observed and imputed data. Gray solid curve is the density of observed data in the control group. Blue solid curve is the density of observed data in the treatment group. Red dashed lines are the densities of imputed data in the treatment group.
5.Observed Values	A diagnostic plot to visualize the scatterplot of observed data. Gray circles are observed data in the control group. Blue triangles are observed data in the treatment group.
6.Observed & Imputed Values	A diagnostic plot to visualize the scatterplot of observed and imputed data. Red circles are imputed data in the control group. Red triangles are imputed data in the treatment group. These imputed data are overlaid on the observed data in Figure 5.
7.Observed & Imputed (Control)	A diagnostic plot to clearly visualize the scatterplot of observed and imputed data in the control group only.
8.Observed & Imputed (Treatment)	A diagnostic plot to clearly visualize the scatterplot of observed and imputed data in the treatment group only.
9.Around Cutoff (Control)	A diagnostic plot to clearly visualize the scatterplot, around the cutoff point, of observed and imputed data in the control group only. Five solid lines are the estimated linear regression lines based on multiply

	imputed data.
10.Around Cutoff (Treatment)	A diagnostic plot to clearly visualize the scatterplot, around the cutoff point, of observed and imputed data in the treatment group only. Five solid lines are the estimated linear regression lines based on multiply imputed data.
11.Local Slope (Control)	A diagnostic plot to visualize the distribution of the coefficients of the estimated linear regression models around the cutoff point in the control group.
12.Local Slope (Treatment)	A diagnostic plot to visualize the distribution of the coefficients of the estimated linear regression models around the cutoff point in the treatment group.

## References

- Takahashi, M. (2021). Multiple Imputation Discontinuity Designs: Alternative to Regression Discontinuity Designs to Estimate the Local Average Treatment Effect at the Cutoff. Currently under review.
- Takahashi, M. (2021). MIDD: An R Package for Multiple Imputation Discontinuity Designs. Currently under review.
- Calonico, S., Cattaneo, M.D., and Titiunik, R. (2015). rdrobust: An R Package for Robust Nonparametric Inference in Regression-Discontinuity Designs. *R Journal* 7(1), pp.38-51.
- Honaker, J., King, G., and Blackwell, M. (2011). Amelia II: A Program for Missing Data. *Journal of Statistical Software*, 45(7), pp.1-47.

## Example 1

```
setwd("C:/Folder")
source("MIDD.R")
data1<-read.csv("lee2008.csv", header = TRUE)
attach(data1)
MIdiagRDD(y = y1, x = x1, cut = 0)
```

## Example 2

```
MIdiagRDD(y = y1, x = x1, cut = 0, bwidht = 2.2, covs1 =
  data.frame(x2))
```