Instructions to Use the Transportation Modeling Package

MDCEV Model with Outside Good

MDCEV Estimation Model with Outside Good

- This is an addendum to help understand how to use R script for running the MDCEV model with outside good, and with no mixing. The input dataset specifications, a description of the test data, and the outputs from the test data are also provided in this documentation.
- For further details, please refer to Bhat (2007) "The Multiple Discrete-Continuous Extreme Value (MDCEV) Model: Role of Utility Function Parameters, Identification Considerations, and Model Extensions," Technical paper, Department of Civil Engineering, The University of Texas at Austin, available at http://www.caee.utexas.edu/prof/bhat/MDCEV.html

MDCEV Estimation Model with Outside Good: R Scripts

- In the package, there are two scripts that are provided for estimating an MDCEV model with outside good:
  - **mdcev_outside.r:** This is the script containing the actual MDCEV code. Please do not modify this script.
  - **Run_mdcev_outside.r:** This R script contains the settings and parameters that need to be specified for the MDCEV model. Users can update the model parameters and settings using this script.

MDCEV Estimation Model with Outside Good: Preparing the Input Data

- The input data to the MDCEV R-code should be in the form of a Comma Separated Values (CSV) file. The input data **should** include the following columns with the variables names given below:
  - A column of 1s with a variable name "uno" (Mandatory)
  - A column of 0s with a variable name "sero" (Mandatory)
  - Case ID: A column of observation numbers (or case numbers) from 1 to the number of observations in the data. The name of this column should be "caseid" (Mandatory)

MDCEV Estimation Model with Outside Good: Preparing the Input Data

- **Dependent variables:** As many columns as the number of alternatives, with each column containing the expenditure amount for each alternative. (Mandatory)
- **Price variables:** As many columns as the number of alternatives, with each column containing the price per unit consumption for each alternative. This data is required only when there is price variation across goods. (Optional)
- **Weights:** One column of estimation-weights to be applied to each decision-maker. This data is required only when working with weighted data. (Optional)
- **Explanatory variables:** One column for each explanatory variable. (Mandatory)

MDCEV Estimation Model with Outside Good: Running the Model Using the R Script

- **Step 1**: Open the R code "Run_mdcev_outside.r".
- **Step 2**: Update the path of the source code (mdcev_outside.r), and the path and name of input data as required.
- **Step 3**: Change the settings of the MDCEV model in the R-code (Run_mdcev_outside.r) as required.
- The data dictionaries for the two datasets used here are as follows.

Data dictionary for "testout.csv" data

Variable Name	Description
config	Utility specification configuration, possible values: 1, 4, 5, 6, or 7
alp0to1	1 if you want the Alpha values to be constrained between 0 and 1; 0 otherwise
price	1 if there is price variation across goods; 0 otherwise
nc	Number of alternatives (in the universal choice set) including outside goods
po	Position of pointer to case number in data set

MDCEV Estimation Model with Outside Good: Running the Model Using the R Script

Data dictionary for "testout.csv" data (Cont.)

Variable Name	Description
ivuno	Position of UNO variable (i.e., the column of ones) in data set
ivsero	Position of SERO variable (i.e., the column of zeros) in data set
wtind	Position of WEIGHT variable (i.e., the column of weights). If the data has weights, then the dataset should consist of a column of weights.
def	DEPENDENT variables (i.e., the consumption quantities for each alternative - NOT consumption expenditures for each alternative) (number of labels = number of alternatives).
fp	PRICE variables (number of labels = number of alternatives). First good (i.e., outside good, or the first of the outside goods if there are several) should be specified as a numeraire good with price one (UNO). Provide all UNO variables if there is no price variation
ivmt	• Definition of INDEPENDENT variables • First 'numout' goods are those that are always consumed (i.e., the outside goods), and the first good is numeraire • In the following specification, ivmt[[1]], ivmt[[2]], ivmt[[3]] contain independent variable specifications (on right hand side) for baseline utility (PSI) for alternatives 1, 2, and 3 • Add a row for ivmt[[4]] if there is a 4th alternative, another additional row for ivmt[[5]] if there is a 5th alternative, ... (number of rows = number of alternatives) • Number of columns = Number of variables including alternative specific constants; consider the first alternative as base

MDCEV Estimation Model with Outside Good: Running the Model Using the R Script

Data dictionary for "testout.csv" data (Cont.)

Variable Name	Description
ivdts	• In the following specification, ivdts[[1]], ivdts[[2]], ivdts[[3]] contain input data specifications (on the right hand side) for satiation parameters (alphas) for alternatives 1, 2, and 3 • Add a row for ivdts[[4]] if there is a 4th alternative, another additional row for ivdts[[5]] if there is a 5th alternative,.... (number of rows = number of alternatives) • Number of columns = Number of alternatives; Note that you can also add individual-specific variables below, so that satiation varies across individuals • However, you will then have to translate outputs to compute actual alpha parameters • This code is written to provide you with the alpha parameters directly for the case when there is no variation in alpha across individuals
ivgts	• In the following specification, ivgts[[1]], ivgts[[2]], ivgts[[3]] contain input data specifications (on the right hand side) for translation parameters (gammas) for alternatives 1, 2, and 3 • Add a row for ivgts[[4]] if there is a 4th alternative, another additional row for ivgts[[5]] if there is a 5th alternative,....(number of rows = number of alternatives) • Number of columns = Number of alternatives; Note that you can also add individual-specific variables, so that gamma varies across individuals • However, you will then have to translate outputs to compute actual gamma parameters • This code is written to provide you with the gamma parameters directly for the case when there is no variation in gamma across individuals • Since gamma=0 for the outside goods, the first "numout" columns of the "ivgts" vectors will be "sero"

MDCEV Estimation Model with Outside Good: Running the Model Using the R Script

Data dictionary for "testout.csv" data (Cont.)

Variable Name	Description
alpha_names	Satiation parameter names for labeling (number of labels = number of alternatives)
gamma_names	Translation parameter names for labeling (number of labels = number of alternatives)
maxlikmethod1	The method of maximum likelihood for initial estimation
maxlikmethod2	The method of maximum likelihood for final estimation

MDCEV Estimation Model with Outside Good: Running the Model Using the R Script

- **Step 4**: Select all and run (Ctrl+A and Ctrl+R).

Note 1: Detailed information regarding the settings of the MDCEV model is available within the R code "Run_mdcev_outside.r".

Note 2: R Libraries needed to run this code are "miscTools" and "maxLik".

Note 3: For the case "with outside good", the first row in the variable specification (ivmt) should not contain any variable, i.e. ivmt[[1]] <- c("").

MDCEV Estimation Model with Outside Good: Results from the Test Data – "testout.csv"

- The following pages show the results for various configurations of the MDCEV model using "testout.csv" data.

MDCEV Estimation Model with Outside Good: Results from the Test Data – "testout.csv"

```
> summary(result);   # Show results from the MDCEV model with outside good
---------------------------------------------
Maximum Likelihood estimation
BFGS maximization, 0 iterations
Return code 0: successful convergence
Log-Likelihood: -3656.443
7  free parameters
Estimates:
                Std. error
uno    -6.954e+00  3.069e-01 -2.266e+01 0.00
hhsize -2.344e-01  6.586e-02 -3.558e+00 0.00
uno    -7.387e+00  3.014e-01 -2.451e+01 0.00
hhsize -2.773e-02  6.306e-02 -4.398e-01 0.66
D01     1.164e-11  4.168e-02  2.793e-10 1.00
D02     9.921e-01  7.588e-03  1.308e+02 0.00
D03     9.119e-01  1.780e-02  5.123e+01 0.00
G01     0.000e+00  0.000e+00         NA   NA
G02     1.000e+00  0.000e+00         NA   NA
sigm    1.000e+00  0.000e+00         NA   NA
---------------------------------------------
>
```

Example Result of a MDCEV from R-Studio (config = 1)

MDCEV Estimation Model with Outside Good: Results from the Test Data – "testout.csv"

```
> summary(result);   # Show results from the MDCEV model with outside good
--------------------------------------------
Maximum Likelihood estimation
BFGS maximisation, 0 iterations
Return code 0: successful convergence
Log-Likelihood: -3550.167
6  free parameters
Estimates:
                Std. error
uno      -6.88985    0.17302  -39.82169 0.000
hhsize   -0.24352    0.06426   -3.78942 0.000
uno      -7.38153    0.18118  -40.74031 0.000
hhsize   -0.02357    0.06151   -0.38325 0.702
D01       0.00000    0.00000         NA    NA
G01       0.00000    0.00000         NA    NA
G02    1043.71841  353.25784    2.95455 0.003
G03     231.07800   47.97508    4.81663 0.000
sigm      1.00000    0.00000         NA    NA
--------------------------------------------
>
```

Example Result of a MDCEV from R-Studio (config = 4)

MDCEV Estimation Model with Outside Good: Results from the Test Data – "testout.csv"

```
> summary(result);   # Show results from the MDCEV model with  outside good
--------------------------------------------
Maximum Likelihood estimation
BFGS maximisation, 0 iterations
Return code 0: successful convergence
Log-Likelihood: -3545.041
7  free parameters
Estimates:
                Std. error
uno      -5.87992    0.35428 -16.59665 0.000
hhsize   -0.23929    0.06492  -3.68608 0.000
uno      -6.38730    0.34253 -18.64718 0.000
hhsize   -0.01795    0.06236  -0.28791 0.773
D01       0.16365    0.04944   3.30979 0.001
G01       0.00000    0.00000         NA    NA
G02     630.26232  219.23099    2.87488 0.004
G03     178.95484   46.46623    3.85129 0.000
sigm      1.00000    0.00000         NA    NA
--------------------------------------------
>
```

Example Result of a MDCEV from R-Studio (config = 5)

MDCEV Estimation Model with Outside Good: Results from the Test Data – "testout.csv"

```
> summary(result);   # Show results from the MDCEV model with outside good
--------------------------------------------
Maximum Likelihood estimation
BFGS maximisation, 0 iterations
Return code 0: successful convergence
Log-Likelihood: -3540.803
7  free parameters
Estimates:
                Std. error
uno     -5.38103    0.37308 -14.42334 0.000
hhsize  -0.23753    0.06519  -3.64365 0.000
uno     -5.89472    0.35609 -16.55407 0.000
hhsize  -0.01435    0.06232  -0.23021 0.818
D01      0.24447    0.05261   4.64710 0.000
D02      0.00000    0.00000        NA    NA
G01      0.00000    0.00000        NA    NA
G02    669.57728  187.44620   3.57210 0.000
G03    209.32434   43.91769   4.76629 0.000
sigm     1.00000    0.00000        NA    NA
--------------------------------------------
>
```

Example Result of a MDCEV from R-Studio (config = 6)

MDCEV Estimation Model with Outside Good: Results from the Test Data ("testout.csv" in the package)

```
> summary(result);   # Show results from the MDCEV model with outside good
--------------------------------------------
Maximum Likelihood estimation
BFGS maximisation, 0 iterations
Return code 0: successful convergence
Log-Likelihood: -5129.885
4  free parameters
Estimates:
                Std. error
uno     -6.38595    0.13837 -46.15235 0.000
hhsize  -0.31525    0.05344  -5.89905 0.000
uno     -7.07524    0.14571 -48.55538 0.000
hhsize  -0.01477    0.04894  -0.30184 0.763
D01      0.00000    0.00000        NA    NA
G01      0.00000    0.00000        NA    NA
G02      1.00000    0.00000        NA    NA
G03      1.00000    0.00000        NA    NA
sigm     1.00000    0.00000        NA    NA
--------------------------------------------
>
```

Example Result of a MDCEV from R-Studio (config = 7)