Discrete Choice Model V1.0

Documentation

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Revision History

|  |  |  |
| --- | --- | --- |
| Version No. | Date | Details |
| 1.0 | 25/07/22 |  |
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# Introduction

## Scope and objectives

Analytical tool to model agents' preferences, assess adoption/acceptance/reaction, optimise stimuli selection and identify compromise solutions. Discrete choice models (DCM) are econometric models aimed at analysing the behaviour of a decision-maker when choosing among different (discrete) options. This model can be used to investigate stakeholders’ preference heterogeneity to forecast their choice behaviour related to some scenario, policy-making or decision.

Once the consumer preferences have been collected (through a well-designed stated preference model), then this information will be processed and organized in a structured way to support econometric analysis and experimentation (simulation). The DCM use random utility theory to model SP respondents’ decision-making and is a valuable instrument in addressing, from a theoretically well-grounded perspective, stakeholders’ heterogeneous preferences concerning alternative delivery configurations.

Key assumptions:

* The user has already collected the data to be analysed through the DCM model
* The data was collected via a Stated Preference (SP) questionnaire

# Requirements.

## Software requirements

The simulators have been built using RStudio version 1.4

The following R libraries need to be installed:

1. library(mlogit)
2. library(stargazer)
3. library(readxl)

## Input/Outputs

### Inputs

As shown in Table 1, every column describes respectively respondents’ answers to the SP experiment, attributes levels and alternatives. Even in this case, columns order must be respected, and you can add new attributes by inserting new columns.

Table 1 - Example of input for the DCM model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Answer** | **Attribute 1** | **Attribute 2** | **Attribute 3** | **Attribute 4** |
| **Price of Delivery** | **Delivery time** | **Date of the delivery** | **CO2 emission** |
| 1 | 1 | High | 100 | High |
| 0 | 0 | High | 200 | High |
| 1 | 0 | Low | 300 | Low |
| 0 | 1 | High | 100 | High |
| 1 | 1 | High | 200 | High |
| 0 | 1 | Low | 200 | Low |
| 0 | 0 | High | 100 | High |
| 1 | 0 | Low | 300 | Low |
| 0 | 1 | High | 200 | High |
| 1 | 0 | Low | 100 | Low |

Table 2 below contain the description of the file.

Table 2 DCM – Inputs

|  |  |
| --- | --- |
| Inputs | Description |
| answers.xlm | Excel file containing all answers and collected data |

### Outputs

Table 3 shows an example of an output obtained from the DCM model. The R code provides a csv file that can be easily transformed into an Excel file.

With these results, it is possible to formulate a utility function (equation 1). is the systematic utility expressed as a function of observable variables and is the random utility component.

Based on idea that an individual n selects the alternative with the highest utility among those in the choice set . Specifically, the goal of this choice model is to estimate the significance of the determinants of .

Equation 1

The interpretation of the estimator depends on the nature of the attributes.

Table 3 - Example of input for de DCM model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Estimate** | **Std. Error** | **z-value** | **Pr(>lzl)** |
| (intercept):2 | -83,0993347 | 10527,133394 | -0,007893823 | 0,993701706 |
| Attribute 1 | -49,55247018 | 7122,786155 | -0,006956894 | 0,994449246 |
| Attribute 2 | 66,75697207 | 8560,27969 | 0,007798457 | 0,003777795 |
| Attribute 3 | 0,164785195 | 26,89874632 | 0,006126092 | 0,996112116 |
| Attribute 4 | 0,852621457 | 56,25412876 | 0,008524731 | 0,001243387 |

Table 4 DCM – Outputs

|  |  |
| --- | --- |
| Outputs | Description |
| dcm.csv | Attributes list with the estimation of the coefficients |

## Paths’ structure

The directory where the model is located has the following structure:

── Root

├── Input Folder

│

└── Output folder

# Model Description

This section describes the different files and scripts present in the model

|  |  |  |
| --- | --- | --- |
| File name | Location | Description |
| DCM.R | Root | Main script |
| requirements.txt | Root | R packages required |

# Instructions to run the model

## Environment preparation

### Environment

### Use of the code

Once created the file, r code can be easily run typing “name\_of\_the\_file.xlsx”, namely the file path of the excel file, in the function called model.

A picture containing logo

Description automatically generated

## Command line execution of the model

### Execution command

### Execution example

An example for the implementation