Econometrics
of Policy

Evaluation

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Material available on





# grmpy Tutorial

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# Introduction

#### grmpy

grmpy is an open-source Python package for the simulation and estimation of generalized Roy model. Its main purpose is to serve as a teaching tool to promote the conceptual framework provided by the generalized Roy model to illustrate a variety of issues in the econometrics of policy evaluation.

## grmpy

### grmpy is ...

- ...an open-source Python Package for the simulation and estimation of the generalized Roy model.
- ...intended as an useful device to support and improve the understanding of the framework by the opportunity to experience the effect of particular specifications directly.

# Setup

## Setup

Normal linear-in-parameters version of the generalized Roy model.

Potential Outcomes Cost 
$$Y_1 = \beta_1 X + U_1 \qquad C = \gamma Z + U_C$$
 
$$Y_0 = \beta_0 X + U_0$$

Observed Outcomes Choice 
$$Y = DY_1 + (1 - D)Y_0 \qquad S = Y_1 - Y_0 - C$$
 
$$D = I[S > 0]$$

## **Features**

#### **Features**

- grmpy is currently capable of the following features:
  - Simulating a dataset based on your own specifications.
  - Providing some useful information about the simulated dataset for instance:
    - Distributional outcome characteristics
    - ATE, TT, TUT
    - MTE by decile
  - Estimating the coefficients of interest given a dataset (of a specific form).

### Install the package

- OS, Linux: Use the pip install manager (pip install grmpy) or download the package via GitHub and install it manually.
- Windows: The same procedure as for Linux, OS but you have to verify that the numpy package is already installed on your machine.

#### Initialization file

- The initialization file provides the user the opportunity to specify all parameters of his/her model, for instance:
  - Simulation parameters (number of observations, name of the output files)
  - Estimation parameters (optimization algorithm, start values)
  - Optimization parameters
  - Coefficients and covariance parameters, dummy variables...
- ► Example
- ▶ for a detailed explanation see: grmpy-documentation

#### **Simulation**

- grmpy.simulate(): :
  - Input: path of the initialization file.
  - ► The function returns a data frame based on your specifications and different output files.
    - The data set as a pickle and a txt file.
    - An Info file that provides the distributional characteristics of the data as well as information about the different treatment effects.

#### **Estimation**

- grmpy.estimate():
  - Input: path of the initialization file.
  - At the moment the estimation process is only capable of two different optimization algorithms:
    - Broyden Fletcher Goldfarb Shanno (BFGS) algorithm
    - Powell's conjugate direction method

- ► There are two different options for the start values that could be set in the initialization file:
  - init: The estimation process uses the coefficient values specified in the initialization file as the start values for the estimation process.
  - auto: The start values are determined via a simple OLS followed by a Probit regression for the choice indicator.
- The estimation results are printed to an output file

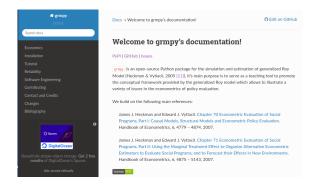
### Test battery

- We also provide a test battery that includes several tests to ensure that the processes perform as intended.
  - Property-based testing
  - Reliability testing
  - Regression testing

# **Application Example**

# **Additional Information**

#### Online documentation



#### **Additional Information**

- ► *grmpy*-documentation
- Course material regarding the generalized Roy model
- GitHub Repository

# **Appendix**

# References

- Heckman, J. J., & Vytlacil, E. J. (2007a). Econometric evaluation of social programs, part I: Causal effects, structural models and econometric policy evaluation. In J. J. Heckman & E. E. Leamer (Eds.), Handbook of econometrics (Vol. 6B, pp. 4779–4874). Amsterdam, Netherlands: Elsevier Science.
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