

README FOR PYTHON IMPLEMENTATION OF FPMLE and FPMLE⁺⁺

(*nlmfe* package)

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This folder contains files for algorithms 1 (FPMLE) and 2 (FPMLE⁺⁺) developed in Mugnier and Wang (2022, WP).

FPMLE and FPMLE⁺⁺ are implemented for N -by- T data sets in the file *TwoWayFPMLE.py*.

Implementation covers the following models: unit $i \in \{1, \dots, N\}$ at time $t \in \{1, \dots, T\}$ with characteristics $x_{it} \in R^K$ chooses outcome $y_{it} \in \mathcal{Y}$ such that

$$\Pr(y_{it} = y \mid x_{i1}, \dots, x_{it}, \alpha_i, \xi_t, \beta_i) = g(y; x'_{it}\beta_i + \alpha_i + \xi_t).$$

Model	\mathcal{Y}	Link function g
Binary Probit	$\{0,1\}$	$g(y; x'_{it}\beta_i + \alpha_i + \xi_t) = I(y = 0) \times [1 - \Phi(x'_{it}\beta_i + \alpha_i + \xi_t)] + I(y = 1) \times \Phi(x'_{it}\beta_i + \alpha_i + \xi_t)$
Binary Logit	$\{0,1\}$	$g(y; x'_{it}\beta_i + \alpha_i + \xi_t) = I(y = 0) \times [1 - \Lambda(x'_{it}\beta_i + \alpha_i + \xi_t)] + I(y = 1) \times \Lambda(x'_{it}\beta_i + \alpha_i + \xi_t)$
Poisson Count	$\{0,1,2, \dots\}$	$g(y; x'_{it}\beta_i + \alpha_i + \xi_t) = \frac{\exp(-\exp(x'_{it}\beta_i + \alpha_i + \xi_t)) \exp(y(x'_{it}\beta_i + \alpha_i + \xi_t))}{y!}$

where Φ is the cumulative distribution function (cdf) of the standard normal, $\Lambda(x) = 1/(1 + \exp(-x))$ is the cdf of the standard logistic, for a user-specified unit i^* , $\alpha_{i^*} = 0$, for a user-specified set of indices $I \subset \{1, \dots, K\}$, $\beta_{i,k} \equiv \beta_k, \forall k \in I, \forall i$. Default is $I = \{all\ coordinates\}$, i.e., homogeneous slope coefficient $\beta_i \equiv \beta$.

The file *BiasCorrections.py* contains functions for performing the analytical bias corrections developed in Fernandez-Val and Weidner (2016).

The file *PanelPreProcess.py* contains functions for pre-formatting unbalanced panel data under a « missing at random » assumption.

The file *func.py* contains various useful functions.

All routines are illustrated by a simple Monte Carlo simulation and an application to trade data in the Jupyter notebook *nlmfe_in_practice.ipynb*.

References :

Fernandez-Val, I. and M. Weidner (2016): « Individual and time effects in nonlinear panel models with large N, T », *Journal of Econometrics*, 192(1), 291-312,

Mugnier, M. and A. Wang (2022): « Identification and (Fast) Estimation of Large Nonlinear Panel Models with Two-Way Fixed Effects », SSRN.