



## *The World Bank's MFMod Framework in Python with Modelflow*

*Fourth Submission: FR\_WLD\_2025\_379*

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*September 05th, 2025*

This review verifies the reproducibility of the exhibits included in the paper "*The World Bank's MFMod Framework in Python with Modelflow*".

### **Contents in this review:**

1. Main findings
2. List of exhibits and reproducibility status
3. Reproduction Environment

### *Main findings*

- **Every exhibit has been reproduced accurately.**
- The code was successfully executed on a new computer after following the instructions of the README to install all required Python dependencies and configure Jupyter Notebook.
- The output demonstrates consistent stability across multiple runs. Specifically, executing the code two times consecutively yielded identical results.
- The code takes approximately 20 minutes to run.
- We conducted our reproducibility analysis based on the book PDF file shared via email by the authors on September 04, 2025.
- **Verification Process and Data Handling:**
  - The reproducibility package relies on one type of data: open data.
  - Open data is downloaded and stored by running the reproducibility package.
  - *data\_hash\_report.csv* lists the SHA256 hashes of all data files to support data integrity checks. Users who download the data by running the reproducibility package can use this file to verify whether the input data is the same as used by the reviewers.
- **Reproducibility Summary:**
  - **Data:** All data are public and downloaded by running the reproducibility package.
  - **Code:** All code files (from cleaning to analysis) are included in the reproducibility package.
  - **Outputs:** All outputs are generated by code included in the reproducibility package.

- **Reproducibility verification:** Reviewers had access to the same materials in the public reproducibility package.
- **Dependencies environment:** The reviewers created a new environment using the latest versions of dependencies available at the moment of the review.

### *List of exhibits and reproducibility status*

#### **Chapter 1**

No exhibits are included in this section.

#### **Chapter 2**

No exhibits are included in this section.

#### **Chapter 3**

No exhibits are included in this section.

#### **Chapter 4**

No exhibits are included in this section.

#### **Chapter 5**

No exhibits are included in this section.

#### **Chapter 6**

No exhibits are included in this section.

#### **Chapter 7**

- **Section 7.4.5 Figure 1 (p. 60)** [Reproduced.](#)
- **Section 7.4.5 Figure 2 (p. 60)** [Reproduced.](#)
- **Section 7.4.5 Figure 3 (p. 61)** [Reproduced.](#)

#### **Chapter 8**

No exhibits are included in this section.

#### **Chapter 9**

- **Section 9.3.2 Figure 1 (p. 89)** [Reproduced.](#)
- **Section 9.3.3 Figure 1 (p. 92)** [Reproduced.](#)

- Section 9.4.5 Table 1 (p. 95) Reproduced.
- Section 9.4.5 Table 2 (p. 96) Reproduced.
- Section 9.4.5 Table 3 (p. 97) Reproduced.

#### Chapter 10

- Section 10.5.4 Figure 1 (p. 104) Reproduced.
- Section 10.5.4 Table 1 (p. 105) Reproduced.

#### Chapter 11

- Section 11.2.1 Figure 1 (p. 111) Reproduced.
- Section 11.2.1 Figure 2 (p. 112) Reproduced.
- Section 11.2.2 Figure 1 (p. 114) Reproduced.
- Section 11.2.3 Figure 1 (p. 116) Reproduced.
- Section 11.2.3 Figure 2 (p. 117) Reproduced.
- Section 11.2.4 Figure 1 (p. 118) Reproduced.
- Section 11.2.5 Figure 1 (p. 122) Reproduced.
- Section 11.3 Figure 1 (p. 124) Reproduced.

#### Chapter 12

- Section 12.4.1 Figure 1 (p. 129) Reproduced.
- Section 12.5 Figure 1 (p. 131) Reproduced.
- Section 12.6.2 Figure 1 (p. 136) Reproduced.

#### Chapter 13

- Section 13.4.5 Figure 1 (p. 142) Reproduced.
- Section 13.4.5 Figure 2 (p. 143) Reproduced.
- Section 13.4.5 Figure 3 (p. 143) Reproduced.
- Section 13.4.5 Figure 4 (p. 144) Reproduced.
- Section 13.4.5 Figure 5 (p. 144) Reproduced.
- Section 13.4.5 Figure 6 (p. 145) Reproduced.
- Section 13.4.5 Figure 7 (p. 145) Reproduced.
- Section 13.4.5 Figure 8 (p. 145) Reproduced.

- Section 13.7.1 Figure 1 (p. 150) Reproduced.
- Section 13.7.1 Figure 2 (p. 151) Reproduced.
- Section 13.7.1 Figure 3 (p. 151) Reproduced.
- Section 13.8 Figure 1 (p. 153) Reproduced.
- Section 13.8 Figure 2 (p. 153) Reproduced.

#### Chapter 14

- Section 14.2.2 Table 1 (p. 160) Reproduced.
- Section 14.2.4 Table 1 (p. 164) Reproduced.
- Section 14.2.4 Table 2 (p. 164) Reproduced.
- Section 14.2.4 Table 3 (p. 165) Reproduced.
- Section 14.2.4 Table 4 (p. 166) Reproduced.
- Section 14.4 Figure 1 (p. 173) Reproduced.
- Section 14.4 Figure 2 (p. 174) Reproduced.
- Section 14.4.2 Figure 1 (p. 175) Reproduced.
- Section 14.4.2 Figure 2 (p. 176) Reproduced.
- Section 14.4.2 Figure 3 (p. 176) Reproduced.
- Section 14.4.5 Figure 1 (p. 179) Reproduced.
- Section 14.4.6 Figure 1 (p. 179) Reproduced.
- Section 14.4.6 Figure 2 (p. 180) Reproduced.
- Section 14.4.7 Figure 1 (p. 181) Reproduced.
- Section 14.4.7 Figure 2 (p. 181) Reproduced.
- Section 14.4.7 Figure 3 (p. 182) Reproduced.
- Section 14.4.8 Figure 1 (p. 183) Reproduced.
- Section 14.4.9 Figure 1 (p. 184) Reproduced.
- Section 14.6.2 Figure 1 (p. 189) Reproduced.
- Section 14.6.2 Figure 2 (p. 190) Reproduced.
- Section 14.6.2 Table 1 (p. 190) Reproduced.
- Section 14.6.3 Figure 1 (p. 191) Reproduced.

- Section 14.6.3 Figure 2 (p. 192) Reproduced.
- Section 14.6.3 Table 1 (p. 192) Reproduced.
- Section 14.7.2 Figure 1 (p. 194) Reproduced.
- Section 14.7.3 Figure 1 (p. 195) Reproduced.
- Section 14.7.3 Figure 2 (p. 195) Reproduced.
- Section 14.7.3 Figure 3 (p. 196) Reproduced.
- Section 14.7.4 Figure 1 (p. 197) Reproduced.
- Section 14.8 Figure 1 (p. 198) Reproduced.
- Section 14.8 Figure 2 (p. 199) Reproduced.
- Section 14.9.1 Figure 1 (p. 199) Reproduced.

#### Chapter 15

- Section 15.3 Figure 1 (p. 205) Reproduced.
- Section 15.4 Figure 1 Does not Apply.
- Section 15.4.1 Figure 1 (p. 208) Reproduced.
- Section 15.4.2 Figure 2 (p. 209) Does not Apply.
- Section 15.4.3 Figure 1 (p. 210) Does not Apply.
- Section 15.4.4 Figure 1 (p. 210) Does not Apply.
- Section 15.4.4 Table 1 (p. 212) Reproduced. The order of components in the code result is different but that does not affect reproducibility.
- Section 15.4.5 Figure 1 (p. 213) Does not Apply.
- Section 15.4.6 Figure 1 (p. 214) Does not Apply.

#### Chapter 16

- Section 16.4 Table 1 (p. 218) Reproduced.
- Section 16.4 Table 2 (p. 219) Reproduced.
- Section 16.4 Table 3 (p. 220) Reproduced.
- Section 16.4 Table 4 (p. 220) Reproduced.
- Section 16.4 Table 5 (p. 221) Reproduced.
- Section 16.4 Table 6 (p. 221) Reproduced.
- Section 16.5 Table 1 (p. 223) Reproduced.

- Section 16.5.1 Table 1 (p. 224 & 225) Reproduced.
- Section 16.6.1 Table 1 (p. 226) Reproduced.
- Section 16.6.2 Table 1 (p. 227) Reproduced.
- Section 16.6.4 Table 1 (p. 228) Reproduced.
- Section 16.6.5 Table 1 (p. 228) Reproduced.
- Section 16.6.5 Table 2 (p. 230) Reproduced.
- Section 16.6.5 Table 3 (p. 230) Reproduced.
- Section 16.6.5 Table 4 (p. 230) Reproduced.
- Section 16.6.6 Figure 1 (p. 231) Reproduced.
- Section 16.6.6 Figure 2 (p. 232) Reproduced.
- Section 16.6.7 Table 1 (p. 232) Reproduced.
- Section 16.7 Figure 1 (p. 234) Does not Apply.
- Section 16.8 Table 1 (p. 235) Reproduced.
- Section 16.8 Table 2 (p. 236) Reproduced.
- Section 16.8 Figure 1 (p. 236) Reproduced. The order of components in the code result is different but that does not affect reproducibility.
- Section 16.9 Figure 1 (p. 237) Reproduced.
- Section 16.10 Figure 1 (p. 238) Reproduced.
- Section 16.10 Figure 2 (p. 239) Reproduced.
- Section 16.11 Figure 1 (p. 240) Reproduced.
- Section 16.12.3 Figure 1 (p. 242) Reproduced.
- Section 16.12.4 Figure 1 (p. 243) Reproduced.
- Section 16.12.5 Figure 1 (p. 245) Reproduced.
- Section 16.12.5 Figure 2 (p. 245) Reproduced.
- Section 16.12.6 Figure 1 (p. 246) Reproduced.
- Section 16.12.6 Figure 2 (p. 246) Reproduced.
- Section 16.12.7 Figure 1 (p. 247) Reproduced.
- Section 16.12.8 Figure 1 (p. 248) Reproduced.
- Section 16.13.1 Figure 1 (p. 249) Reproduced.

- Section 16.13.2 Figure 1 (p. 250) Reproduced.
- Section 16.13.3 Table 1 (p. 250 & 251) Reproduced.
- Section 16.13.3 Figure 2 (p. 252) Reproduced.

## Chapter 17

No exhibits are included in this section.

## Chapter 18

- Section 18.6.3 Table 1 (p. 268) Reproduced.
- Section 18.13 Figure 1 (p. 279) Reproduced.
- Section 18.15.7 Figure 1 (p. 287) Reproduced.
- Section 18.16.1 Figure 1 (p. 290) Reproduced.
- Section 18.16.2 Figure 1 (p. 292) Reproduced.
- Section 18.16.7 Figure 1 (p. 294) Reproduced.
- Section 18.16.8 Figure 1 (p. 294) Reproduced.
- Section 18.16.9 Figure 1 (p. 295) Reproduced.
- Section 18.16.10 Figure 1 (p. 295) Reproduced.
- Section 18.17 Figure 1 (p. 296) Reproduced.
- Section 18.17.1 Figure 1 (p. 298) Reproduced.
- Section 18.18 Figure 1 (p. 299) Reproduced.
- Section 18.19 Figure 1 (p. 299) Reproduced.
- Section 18.19.1 Figure 1 (p. 300) Reproduced.
- Section 18.19.2 Figure 1 (p. 301) Reproduced.
- Section 18.19.3 Figure 1 (p. 302) Reproduced.
- Section 18.20.1 Figure 1 (p. 303) Does not Apply.
- Section 18.20.1 Figure 2 (p. 304) Does not Apply.
- Section 18.20.2 Figure 1 (p. 305) Reproduced. The order of components in the figure is different in the html file but that does not jeopardize reproducibility.
- Section 18.21.1 Table 1 (p. 306) Reproduced.
- Section 18.21.1 Table 2 (p. 307) Reproduced.
- Section 18.21.2 Figure 1 (p. 311) Reproduced.
- Section 18.23 Figure 1 (p. 313) Reproduced.

### *Reproduction Environment*

Paper exhibits were reproduced on a computer with the following specifications:

- OS: Windows 11 Enterprise, version 24H2
- Processor: Intel(R) Core(TM) Ultra 7 165U (2.10 GHz)
- Memory available: 31.5 GB
- Software version: Python 3.12.6