Documentation of the Replication Code Package

Persistent Crises and Levered Asset Prices*

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This documents details the files and folder structure of the replication code package for "Persistent Crises and Levered Asset Prices", published in the *Review of Financial Studies*.

1 Overview

The code for the paper was written in MATLAB 2021b. The appendix to the paper describes details of the numerical model solution. The replication package is organized into six folders (consumption, data, long-sample, LRR, main, utilities), each of which is detailed below.

2 Folder: Main

The file **main_model.m** runs the numerical model solution and associated simulations, and saves output that is required for replicating tables and figures in the paper. After executing this file, one can run **Table_1.m** to **Table_8.m** and **Figure_1.m** to **Figure_7.m** to generate the corresponding objects in the paper. The following files are called by **main_model.m**:

- **main_para.m** contains the model calibration and numerical settings. This file also saves the consumption distribution for Figure 2 in **Figure_2_out.mat**.
- **main_simu.m** simulates the model as described in Section 2.4 of the paper. This file generates and saves results for Tables 5 to 8 in the file **model_simulation.mat**.
- **main_simu_pop.m** simulates the model based on the ergodic distribution of the aggregate state, as described in Section 2.6, and generates results for the "Population" columns in Tables 5 and 7. The results are saved in **model_simulation_pop.mat**.

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- **main_simu_crisis.m** simulates crises, which mimic the Great Depression, and saves the output in **crisis_simulation_out.mat**.
- **Figure_6_simulation.m** simulates crises episodes from the model with different levels of crisis severity, which are shown in Figure 6 and described in Section 3.3. The results are saved in **Figure_6_out.mat**.
- **Figure_7_calculations.m** computes prices and implied volatilities of firm-level and aggregate asset options for Figure 7. The results are saved in **Figure_7_out.mat**.

Additionally, the code relies on the following auxiliary files

- **solve_beta.m**, a fixed point function called by **main_model.m**. It solves for the time discount factor β that is required for an annualized risk-free rate of 1%, given other parameter choices.
- **main_func_SE.m** is used to compute the Jacobian of the moment conditions and called by the function **Table_4.m**. The numerical Jacobian matrix is saved in **jacobian.mat**.

and data from

- **aggregate_path_samples.mat** contains the aggregate consumption paths used in the model simulation (described in Section 2.6 of the paper). They are generated by **consumption/generate_estimation_samples.m**.
- **cov_matrix_infl.mat** contains the covariance matrix estimated using the influence function approach. The covariance matrix is needed to compute standard errors in Table 4, as explained in Appendix F.
- **cov_matrix_NW.mat** contains the covariance matrix estimated using the Newey-West approach. The covariance matrix is needed to compute standard errors in Table 4, as explained in Appendix F.
- The model solution is saved in **model_solution.mat**.

3 Folder: Long-Sample

The files in this folder are analogous to those in the **main** folder, but rely on parameter estimates for the extended 1996–2019 sample described in Appendix G. As such, the model simulation builds on simulated firm panels that are 282 months long, rather than 186 months long as in the benchmark estimates. The file **main_model.m** runs the numerical model solution and associated simulations, and saves output that is required to replicate Tables G1 and G2 in the paper.

4 Folder: LRR

The files in this folder are analogous to those in the **main** folder, but rely on a long-run risks pricing kernel as described in Section 2.7 of the paper. The file **main_model.m** runs the numerical model solution and associated simulations, and saves output that is required for Tables 4 and 5.

5 Folder: Utilitites

This folder contains functions that are called by **main_model.m** in the **main**, **Long-Sample**, and **LRR** folders.

- **main_CDS.m** solves for the term structure of risk-neutral default probabilities, loss given default rates, and CDS rates with maturities between 1 to 60 months.
- **main_CDS_P.m** solves for the term structure of physical default probabilities and loss given default rates with maturities between 1 to 60 months.
- **main_options.m** solves for the price of a put option and Black-Scholes implied volatility for a range of strike prices.
- **main_options_on_assets.m** solves for the price of a put option and Black-Scholes implied volatility for a range of strike prices written on the unlevered assets.
- **main_Ret.m** solves for the conditional mean and volatility of equity returns.
- **main_SDF.m** solves for the Epstein-Zin stochastic discount factor and the implied risk-neutral measure.
- **main_VFI.m** solves for the value of equity and debt.

6 Folder: Consumption

This file generates the consumption paths used in the main and long-sample model simulation.

- **generate_estimation_samples.m** generates 5,000 consumption paths, which mimic the post-war sample, as explained in Section 2.4 of the paper. The results are saved in **aggregate_path_samples.mat**.
- **generate_estimation_samples_long.m** generates analogous consumption paths for the robust test in Appendix G. The results are saved in **aggregate_path_samples_long.mat**.

7 Folder: Data

This folder contains six files:

- **barro_ursua_tables.xlsx** contains data on consumption disasters in the Barro-Ursua dataset, including the country name (column B), end date (column C), start date (column D), and cumulative consumption drop in percent (column E). This data is used in Figure 2 and for some statistics reported in Section 2.
- **consumption.xlsx** contains data on nondurables and services consumption from FRED. This data is used in the estimation of the consumption process, the results of which are shown in Table 1.
- **IV_Skew_data.xlsx** contains average implied volatilities (in annualized units) of call and put options. This data is used in Figure 7.
- **projected_series.xlsx** contains average leverage ratios from our hand-collected Moody's data, as well as fitted values of implied volatilities and CDS rates from the projection described in Section 3.1 of the paper. This data is used in Figure 1.
- **SW18_simulation.mat** contains simulation output from the model of Seo and Wachter (2018). This data is used in Figure 1.
- **W13_simulation.mat** contains simulation output from the model of Wachter (2013). This data is used in Figure 1.
- **CPI.xlsx** contains monthly data on the consumer price index from the BLS. This data is used in Figure 3.
- **CRSP_m.xlsx** contains monthly returns on the value-weighted CRSP market index. This data is used in Figure 3.
- **defaults.xlsx** contains annual default rates for different rating classes. The data comes from Moody's and is used in Figure 3.