README File to Generate Results for: Bianchi, Ottonello, and Presno (2021) - "Fiscal Stimulus under Sovereign Risk"

The results were generated using the following programs:

- EViews 11
- Matlab R2016a and R2019a
- Parallel Studio XE 2011 with Visual Studio 2010
- Intel Fortran Version 12.0.012

The code were last run on a **Intel®Core™ i7-8550U CPU @ 1.80GHz 1.99GHz**. The computation for the baseline model took 6 minutes.

Model

The list of Fortran codes for the baseline model is the following:

- default/defaus/MAIN.f90: runs all directories for the baseline default model
- default/defaus/GLOBAL.f90: contains parameter values for baseline model and auxiliary functions
- default/defaus/FUNCALLER.f90: solves baseline model, generates simulations and computes Monte Carlo
- default/defaus/COUNTER.f90: performs counterfactual exercise for alternative spending levels statistics and computes fiscal multipliers
- default/defaus/IRFS2.f90: computes IRFs
  - Note: To reproduce figure 5, we use finer grids for y^T and debt to compute value functions, policy functions and prices for the impulse responses. To do so, before calling subroutine IRFs, set na2=501 and nb2=501 and call subroutine pol_fcns. Subroutine IRFS2 computes IRFs for a given initial debt level. Therefore, for each initial debt level, set the scale for bss (i.e. 0.75 or 1) accordingly before calling IRFS2 and store the folder within folder irf (as irfmc_0.75bss or irfmc_bss, respectively).

The list of Matlab codes for the baseline model is the following:

- plots/main.m: calls the Matlab codes to plot different results for baseline, risk-free debt model and the application for Spain.
  - Note: In main.m, set label_model and label_graph to select the model and graph(s) to plot, respectively.
- default/defaus/output/output_aux_slides_final.m: plots policy functions, value functions, prices and fiscal multipliers (Figure 3) for baseline model.
- riskfree_debt/defaus/output/output_aux_slides_final.m: plots policy functions, value functions and prices for risk-free debt model.
- default/defaus/output/irf/irf2mc_slides_final.m: plots impulse responses for baseline model (Figure 5).
- default/defaus/output/counter/output_counter_slides_final.m: plots results for counterfactual exercise in baseline model (Figure 2).

- default/defaus/output/timeseries_final.m: plots time series from baseline model.
- default_debt/defaus/output/contour_sets_gny.m: produces heatmap for variations in optimal spending (Figure H.1).
  - Note: The script contour_sets_gny.m has to be run in Matlab R2019a.
- default_debt/defaus/output/gn_policy_final.m: plots policy functions for government spending from baseline and risk-free debt model (Figure 3).
- default_debt/defaus/output/load_rf_fcns.m: loads policy functions from risk-free debt model.

The list of Fortran codes for the risk-free debt model is the following:

- riskfree_debt/defaus/MAIN.f90: runs all directories for the risk-free debt model
- riskfree_debt/defaus/GLOBAL.f90: contains parameter values for risk-free debt model and auxiliary functions
- riskfree_debt/defaus/FUNCALLER.f90: solves baseline model, generates simulations and computes Monte Carlo

The Matlab code for the risk-free debt model is the following:

- riskfree_debt/defaus/output/output_aux_slides_final.m: plots policy functions, value functions and prices for risk-free debt model.

The list of Fortran codes for the model with flexible taxes (and defaultable debt), reported in Table G.1, is the following:

- flexible_taxes/defaus/MAIN.f90: runs all directories for the model with flexible taxes
- flexible_taxes/defaus/GLOBAL.f90: contains parameter values for the model with flexible taxes and auxiliary functions
- flexible_taxes/defaus/FUNCALLER.f90: solves the model with flexible taxes, generates simulations and computes Monte Carlo statistics

The list of Fortran codes for all other alternative models with defaultable debt, reported in Table G.1, is the following:

- sensitivity/defaus/MAIN.f90: runs all directories for each of the alternative models
- sensitivity/defaus/GLOBAL.f90: contains parameter values for the alternative model and auxiliary functions
  - Note: In MAIN.f90 and GLOBAL.f90, parameter values and grids have to be set for each specific alternative economy by commenting/uncommenting the corresponding lines accordingly.
- sensitivity/defaus/FUNCALLER.f90: solves the alternative model, generates simulations and computes Monte Carlo statistics

The list of Fortran codes for the applications of the baseline model to Brazil and Greece, reported in Table G.2, is the following:

- brazil_greece/defaus/MAIN.f90: runs all directories for the application of the baseline model to Brazil and Greece
- sensitivity/defaus/GLOBAL.f90: contains parameter values for the models and auxiliary functions
  - Note: In MAIN.f90 and GLOBAL.f90, parameter values and grids have to be set for each alternative economy by commenting/uncommenting the corresponding lines accordingly.
- brazil_greece/defaus/FUNCALLER.f90: solves the model, generates simulations and computes Monte Carlo statistics

For the simulation results from adopting fiscal rules, reported in Table E.1, and the exercise on the effects of austerity on default incentives, shown in Figure I.1, the list of Fortran codes is the following:

- rules/defaus/MAIN.f90: runs all directories for the model with the fiscal rules or baseline model
- rules/defaus/GLOBAL.f90: contains parameter values auxiliary functions
  - Note: In MAIN.f90 and GLOBAL.f90, parameter values and grids have to be set for each specific fiscal rule by commenting/uncommenting the corresponding lines accordingly.
- rules/defaus/FUNCALLER.f90: solves the baseline, generates simulations and computes Monte Carlo statistics
- rules/defaus/FUNCALLER_GN.f90: solves the model with fiscal rules, generates simulations and computes Monte Carlo statistics
- rules/defaus/WELFARE5.f90: computes the current public spending level that would render the government indifferent between repaying its debt and defaulting in the baseline model, as a function of the current state.
  - Note: Before running the code, store the solution to the baseline model in folder graphs and its policy functions and value functions with (na,nb)=(21,61) in the output folder. Also, run function *func* first to upload all the parameters (i.e. uncomment corresponding line in MAIN.f90).

For the exercise on the effects of austerity on default incentives, the Matlab code is the following:

- rules/defaus/output/welfare_austerity: plots difference relative to the Samuelson level of current public spending that would make the government indifferent between repaying and defaulting, as a function of the current state (Figure I.1).

For the exercise on fiscal forward guidance, the list of Fortran codes is the following:

- fwd/default_spain/MAIN.f90: runs all directories for the baseline default model
- fwd/default_spain/defaus/GLOBAL.f90: contains parameter values for baseline model and auxiliary functions
- fwd/default_spain/defaus/FUNCALLER.f90: solves baseline model, generates simulations, computes Monte Carlo statistics, and generates simulation for Spanish economy over 2007-2013.
- fwd/default_spain/defaus/COMMIT3.f90: solves for policy functions and value functions for the different austerity measures analyzed in the fiscal forward guidance exercise.

  - Note: Before running the code, store the solution to the baseline model in folder *graphs/base*, and its policy functions and value functions with (na,nb)=(21,61) in folder *graphs/base/pol*. In folder *graphs/commit_base/period1*, store value functions and policy functions of baseline model with (na,nb)=(501,3501). Keep in folder *graphs/commit_base/period2* the solution to baseline model to compute counterfactual bond spreads. Also, run function *func* first to upload all the parameters (i.e. uncomment corresponding line in MAIN.f90). The output files for this exercise will be stored in subfolders *period 1* and *period 2* from folder *graphs/commit*.

- fwd/default_spain/defaus/IRF3.f90: computes the initial responses for the different austerity measures (Table I.1), and welfare gains for all the exercises pertaining fiscal forward guidance.
  - Note: The variables to be reported in the output file have to be set accordingly with each type of austerity measure.
- fwd/default_spain/defaus/WELFARE4.f90: computes the percentage difference relative to the Samuelson level of current public spending that would render the government indifferent between repaying its debt and defaulting in the baseline model, as a function of the current state.
  - Note: Before running the code, store the solution to the baseline model in folder graphs and its policy functions and value functions with (na,nb)=(21,61) in the output folder. Also, run function *func* first to upload all the parameters (i.e. uncomment corresponding line in MAIN.f90).

For the exercise on fiscal forward guidance , the list of main Matlab codes is the following:

- fwd/output/welfare_blunt_cuts.m: plots the welfare gains from promised non-state-contigent cuts as function of the current state (Figure I.4).
- fwd/output/welfare_cut_size.m: plots welfare gains for non-state-contingent and state-contingent spending cuts next period, as a function of the size of the spending cut (Figure I.2).
- fwd/output/welfare_bounds.m: plots the welfare gains from state-contingent spending cuts as function of the threshold levels of total income (Figure I.5).

For the exercise on the Spanish economy during 2007-12013, the list of Fortran codes is the following:

- spain/default_spain/MAIN.f90: runs all directories for the baseline default model
- spain/default_spain/defaus/GLOBAL.f90: contains parameter values for baseline model and auxiliary functions
- spain/default_spain/defaus/FUNCALLER.f90: solves baseline model, generates simulations, computes Monte Carlo statistics, and generates simulation for Spanish economy over 2007-2013.
- spain/default_spain/defaus/FUNCALLER_SPAIN.f90: solves baseline model allowing for bailouts.

For the exercise on the Spanish economy during 2007-12013, the main Matlab code is the following:

- spain/default_spain/defaus/output/model_data_spain_slides2007_2013.m: plot simulation using data and model predictions for Spain in 2007-2013 (Figure 6).

The list of Excel and Eviews files is the following:

- data/spain/data_spain_final.xls: contains all the raw data and cyclical components for Spain
- data/spain/data_gdp_final.wf1: estimates AR(1) process for log-quadratic detrended y^T for Spain

  - Note: the original estimation was conducted using the outdated time series yt. The cyclical component of y^T for the exercise of Spain is obtained from detrending the up-to-date time series over the period 1980:2013.

- data/spain/spain_all_vars.wf1: computes cyclical component of all key variables for Spain
- data/brazil/data_brazil_final.xls: contains all the raw data and cyclical components for Brazil
- data/brazil/yt_proc_brazil.wf1: estimates AR(1) process for log-quadratic detrended y^T for Brazil
- data/brazil/brazil_all_vars.wf1: computes cyclical component of all key variables for Brazil
- data/greece/data_greece_final.xls: contains all the raw data and cyclical components for Greece
- data/greece/yt_proc_greece.wf1: estimates AR(1) process for log-quadratic detrended y^T for Greece
- data/greece/greece_all_vars.wf1: computes cyclical component of all key variables for Greece