README file for "Private Overborrowing under Sovereign Risk"

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This document describes the files required to replicate the results in "Private Overborrowing under Sovereign Risk". The document is organized as follows in Section 1 we describe the public data sources used in assembling the final data set. Section 2 describes the files in the final data set. Section 3 describes the individual files required to reproduce each figure and table.

1 Data sources

1.1 Debt

Private and public debt data are from *Chapter 17 of the statistical bulletin of March 2019, Banco de Espana (2019), table 21c "Breakdown by institutional sector"*. Total debt corresponds to the inverse of the net international investment position of Spain and is calculated as the consolidation of private and public positions. Data is annualized from quarterly data from March 1999 to December 2015 and is in millions of Euros. In the calibration we use data only from 1999 to 2012.

- **Private debt**: Corresponds to the inverse of the net international investment position of Spanish monetary financial institutions (ex-

cluding the Bank of Spain) and other resident sectors. The data series used are 3273771 and 3273777. DOI: "https://www.bde.es/webbde/es/estadis/infoest/series/be17.zip"

- **Public debt**: Corresponds to the inverse of the net international investment position of the Bank of Spain and all public administrations. The data series used are 2386960 and 3273774. DOI: "https://www.bde.es/webbde/es/estadis/infoest/series/be17.zip"

1.2 Interest rates and Nonperforming loans

- **Risk free rate**: *Bloomberg ticker GTDEM1Y Govt*, Corresponds to the average interest rate spread paid on 1 year German treasury bonds. Data is annualized from quarterly data from March 1999 to December 2012.

- **Spread on public bonds**: *Bloomberg tickers GTESP6YR Govt and GTDEM6Y Govt*, Corresponds to the difference between average interest rate paid on 6 year Spanish treasury bonds and 6 year German treasury bonds. Data is annualized from quarterly data from March 1999 to December 2015. In the calibration we use data only from 1999 to 2012.

- **Nonperforming loans**: *Bloomberg ticker BLTLWESP Index*, Nonperforming loans as a share of total gross loans. Annual data from 1999 to 2015.

1.3 Total GDP and tradable GDP

- **Gross Domestic Product (GDP)**: *Eurostat March 2019,G DP and main components (output, expenditure and income) namq_10_gdp,-.* Corresponds to Gross Domestic Product at Market prices. The data is in chain linked volumes (2010) millions of Euros. Frequency is annual from 1999 to 2015. DOI :"https://doi.org/10.2908/NAMQ_10_GDP"

- **Tradable and Non-tradable share of GDP**: *Eurostat March 2019, National accounts aggregates by industry up to NACE A*64, nama_10_a64.* Non-tradable corresponds to the share of total value added produced in the following industries: public administration, wholesale and retail, construction, and real state. Tradables corresponds to the complement of nontradable valued added as a share of total value added.The data is in chain linked volumes (2010) millions of Euros. Frequency is annual from 1999 to 2015. DOI: "https://doi.org/10.2908/NAMA_10_A64"

1.4 Data for cycle statistics

- **Consumption**: *Eurostat , GDP and main components (output, expenditure and income) nama_10_gdp.* Corresponds to final consumption expenditure. The data is in chain linked volumes (2010) millions of Euros. Frequency is annual from 1999 to 2017. DOI: : "https://doi.org/10.2908/NAMQ_10_GDP".

- **Current Account**: *Eurostat, Balance of Payments BOP_GDP6_Q, table TIPSBP11.* Corresponds to current account as a percent of GDP. Def-

initions are based on the IMF's Sixth Balance of Payments Manual (BPM6). The data is unadjusted. Frequency is annual from 1999 to 2017. DOI: "https://doi.org/10.2908/BOP_GDP6_Q"

- **Trade Balance**: *Eurostat, Balance of Payments BOP_GDP6_Q, table TIPSBP11.* Corresponds to the balance of trade on goods and services as a percent of GDP. Definitions are based on the IMF's Sixth Balance of Payments Manual (BPM6). The data is unadjusted. Frequency is annual from 1999 to 2017. DOI: "https://doi.org/10.2908/BOP_GDP6_Q"

2 Datasets for replication

The folder "Stata" merges the raw data and conducts econometric analysis that is later used in the Matalb file.

2.1 Raw data merged

- "annual_panel.xlsx" combines data on debt, GDP, and interest rates. The Quarterly data is aggregated to generate an annual panel. "annual_panel.dta" the associated Stata input.
- "tradable_data.xls" aggregates the value added data to compute tradable output. "tradable_data.dta" is the associated Stata input.
- "nonperrforming.xls" uses the data on nonperforming loans. "nonperrforming.dta" is the associated Stata input.

2.2 Econometric treatment in Stata

The routine "Data_moments.do" uses the data from section 2.1 to generate:

- "targets.dta" these are the targeted moments in the baseline calibration."targets.xls" is the associated output used in the calibration.
- "Output_PViip_NonPerf_9917.dta" linearly detrended tradable output, debt, spreads, and nonperforming loans. This data is used in the validation exercise. "Output_PViip_NonPerf_9917.xls" is the associated output used for the figures.
- "BussinessCycle_data.xls" merges "Output_PViip_NonPerf_9917.xls" with the raw data on Consumption, Current Account, and Trade balance. It is used to compute the bussiness cycle statistics in the appendix.

3 Replication files

The folder "Matlab", routine "main.m", replicates all the figures and tables of the paper. Besides the scripts it contains the following subfolders:

- "auxiliar" contains the Matlab functions called in the code.
- "Plots" contains all the figures in the paper in .eps format.
- "Tables" contains all the tables in the paper in .tex format.
- "Simulated_Datasets" contains all the Matlab datasets generated by the code. At minimum it must contain "seed.mat'. The "init.mat" files

initialize the different versions of the model to speed convergence. The files solving the social planner models at the calibrated values require a computational memory of 512 gigabytes (GB). Versions with fewer data points can be solved with standard 64 GB of memory and produce very close results.

3.1 Running the model

- **Baseline model**: To solve the baseline version of the model run the routine "main_DE.m". It will solve the baseline version of the model. This routine takes as inputs : "Output_PViip_NonPerf_9917.xls", "targets.xls", and "BussinessCycle_data.xls". The following datasets are generated as output: "SIMULATION_ERGODIC_DE.mat", "simDE.mat", "Particle_endoPublic.mat", "plotsDE.mat", "Policies_for_Transition.mat".

- **Alternative specifications**: The three alternative models mentioned in the paper must be solved second. The routine "main_noGov.m" generates "NOGov.mat" and "Taxes_NoGov.mat". The routine "main_NoDefaultCosts.m" generates "DE_nodefaultcost.mat", "simDE_nocost.mat" and "SP_SIMULATION_NoDCost.mat". The routine "main_exo.m" generates "DE_exo.mat","simDE_EXO.mat", and "SP_15k_exo.mat".

- **Social Planner**: Finally, to solve the social planner version of the modelrun the routine "main_SP.m". This file will also generate all tables and graphs. This routine takes as inputs :

"Output_PViip_NonPerf_9917.xls", "targets.xls", and "BussinessCycle_data.xls", "SIMULATION_ERGODIC_DE.mat", "simDE.mat", "Particle_endoPublic.mat", "plotsDE.mat", "Policies_for_Transition.mat","NOGov.mat" , "Taxes_NoGov.mat", "DE_nodefaultcost.mat", "simDE_nocost.mat", "SP_SIMULATION_NoDCost.mat", "DE_exo.mat","simDE_EXO.mat", and "SP_15k_exo.mat".

The scripts called "Figure_X.m" or "Table_X.m" can be run independently, to obtain the associated figure or table, as long as all the simulated datasets are on the "Simulated_Datasets" folder.

References

Banco de Espana. 2019. “Statistical Bulletin [March 2019].” *Statistical Bulletin Banco de Espana, 2019* .