README

The Flight to Safety and International Risk Sharing

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1 Overview

This replication package contains two sets of codes to replicate all tables and figures in the paper. These codes are split into two folders:

1. `Empirical`: estimates all data moments in sections 4 through 6 and impulse responses in appendix D
2. `Quantitative Model`: produces all model results in sections 4 through 6 and appendices C and D

The next two sections provide a description of files and programs in each folder as well as instructions to reproduce all tables and figures in the paper.

2 `Empirical`

2.1 Data availability statement

All data used in the paper is publicly available from the sources described in the next subsection. All raw datasets are provided in this replication package.

2.2 Dataset list

All datasets described below are in the subfolder `data/raw`. The following acronyms are used: BEA for U.S. Bureau of Economic Analysis; BLS for U.S. Bureau of Labor Statistics; CRSP for Center for Research in Security Prices; Fed Board for Board of Governors of the Federal Reserve System; and TIC for Treasury International Capital Reporting System.

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Data file	Source
BarroLiao2020/disasterprobabilities.xlsx	Barro and Liao (2021)
BEA/US_GDP_nov2020.csv	BEA (n.d.b)
BEA/US_IIP_Annual_sep2020.csv	BEA (n.d.d)
BEA/US_IIP_sep2020.csv	BEA (n.d.d)
BEA/US_IntlTransactions_sep2020.csv	BEA (n.d.a)
BEA/US_Real_GDP.csv	BEA (n.d.c)
Bloomberg/indices_for_stata.xlsx	Bloomberg (n.d.a.)
Bloomberg/mx_exus_us_monthly.xlsx	Bloomberg (n.d.b)
BLS/US_Civilian_Pop.xlsx	BLS (n.d.b)
CountryCode/CountryCode.xlsx	ISO (n.d.)
CRSP-WRDS/1monthannyield_updated.xlsx	CRSP (n.d.a)
CRSP-WRDS/3monthannyield_updated.xlsx	CRSP (n.d.b)
DuImSchreger2020/cip_all_adj.dta	Du, Im, and Schreger (2018) [‡]
Federal Reserve Board/FRB_H10.csv	Fed Board (n.d.c)
FRED/CPIAUCSL_updated.csv	BLS (n.d.a)
FRED/INDPRO.csv	Fed Board (n.d.d)
FRED/RIFSPPNAAD90NB_eom.csv	Fed Board (n.d.a)
FRED/SWPT.csv	Fed Board (n.d.b)
LaneMilesiFerretti2018/41308_2017_48_-MOESM1_ESM.xlsx	Lane and Milesi-Ferretti (2018)
OECD/consumption_quarterly.csv	OECD (n.d.e)
OECD/CPI_monthly.csv	OECD (n.d.b)
OECD/CPI_quarterly.csv	OECD (n.d.b)
OECD/GDP_quarterly.csv	OECD (n.d.d)
OECD/industrial_production_monthly.csv	OECD (n.d.c)
OECD/industrial_production_-quarterly.csv	OECD (n.d.c)
OECD/working_pop_quarterly.csv	OECD (n.d.a)
TIC/lb_99996.txt	TIC (n.d.)

[‡]This file contains an update of the data used in Du et al. (2018) through 2020 shared with us by Wenxin Du.

2.3 Computational requirements

2.3.1 Software requirements

- Stata (code was last run with version 17.0)
- Matlab (code was last run with R2023b), including Econometrics Toolbox

2.3.2 Description of programs

- `makeData.do`: produces annual, quarterly, and monthly data files from raw sources
- `computeMoments.do`: computes all moments in sections 4 through 6 and organizes data for plotting and VAR analysis
- `plotFigures.m`: plots Figures 1 and 8 in section 4 and appendix D
- `estimateIRFs.m`: estimates and plots impulse responses to safety shocks in appendix D

2.3.3 Memory and runtime requirements

The code was last run on an Intel based laptop with Windows 10. Runtimes for each master file described in the following section are below:

Program	Runtime
`makeData.do`	7s
`computeMoments.do`	1s
`plotFigures.m`	1s
`estimateIRFs.m`	38m, 20s

2.4 Instructions

1. Run `makeData.do` to produce annual, quarterly, and monthly data files from raw sources (after setting the directory of the `data` and `output` subfolders on the local machine in line 11).

2. Run `computeMoments.do` to compute all moments in sections 4 through 6 and organize data for plotting and VAR analysis (after setting the directory of the `data` and `output` subfolders on the local machine in line 11).

3. Run `plotFigures.m` to plot Figures 1 and 8.

4. Run `estimateIRFs.m` to estimate and plot responses to safety shocks in appendix D.

All output files will appear in the subdirectory named `output`.

2.5 List of tables and programs

Figure/Table #	Program	Output file
Figure 1	`plotFigures.m`	`fig_1.pdf`
Table 1, c. "Notes", r. 12-16	`computeMoments.do`	`table_1.xlsx`
Table 2, c. "Target"	`computeMoments.do`	`table_2.xlsx`
Table 3, c. "Data"	`computeMoments.do`	`table_3.xlsx`
Table 4, c. "Data"	`computeMoments.do`	`table_4.xlsx`
Table 5, c. "Data"	`computeMoments.do`	`table_5.xlsx`
Table 6, c. "Data"	`computeMoments.do`	`table_6.xlsx`
Table 11	`computeMoments.do`	`table_11.xlsx`
Figure 8	`plotFigures.m`	`fig_8.pdf`
Figure 9	`estimateIRFs.m`	`fig_9.pdf`

3 Quantitative Model

3.1 Computational requirements

3.1.1 Software requirements

- Fortran compiler (code was last run with Intel Fortran Compiler included in Intel oneAPI toolkit, version 2021.4.0)
- Numerical Algorithm Group Fortran library (code was last run with NAG Fortran Library, Mark 28)
- Matlab (code was last run with version R2020b)

3.1.2 Description of key program files

- `bin/runme.sh`: bash script to compile the code, solve and simulate the model for all calibrations and create output files
- `src/params/create_param_files.m`: Matlab script creating the parameter files for the different calibrations
- `src/fortran`: folder containing the Fortran source code to solve the model
  - `main.f90`: main program to solve the model
  - `mod_calc.f90`: module containing the numerical routines to solve the model
  - `mod_param.f90`: module containing the model parameters and the routines for the numerical setup
  - `mod_results.f90`: module containing the numerical routines to simulate the model and produce output files that are then read by Matlab
  - `AuxCodes`: folder containing additional auxiliary Fortran source code
- `src/matlab`: folder containing the Matlab files to create figures and tables in the paper
  - `main.m`: main program reading in solution files across calibrations and creating figures and tables
  - several additional scripts called by `main.m`, see comments in code for details

3.1.3 Memory and runtime requirements

The code was run on a workstation with 2x 16 Core Xeon Silver 4216 processors and 64GB of RAM. The operating system was Linux Mint 20.2. The runtime for the full set of calibrations and output files was about 2 hours. The following steps are measured in `runme.sh` and stored in `output/tmp/runtime.txt`.

Program steps	Runtime
1. setup of environment	2s
2. run `create_param_files.m`	10s

3.	compilation of `main`	51s
4.	run `main` for all calibrations	112m, 24s
5.	output creation with `main.m`	7m, 23s

3.2 Instructions

To run the code and create all output files, change to the `bin` directory and run `runme.sh`. Note that this bash file has been written for a specific Unix system and will need to be adapted for other operating systems. The bash file runs the following steps:

1. Setup of environment.
    - Requires an installation of a Fortran compiler. When also using the Intel OneAPI toolkit adjust line 22 (`source ..`) to reflect the current system's installation path.
    - Requires an installation of NAG Fortran library to be installed and the environment variable `nagfdir` to be set to the NAG installation directory. Adjust line 29 (`source ..`) as needed.
2. Runs `create_param_files.m` to create parameter files for all calibrations.
    - Requires an installation of Matlab. Note that this script is run using `bin` as a working directory.
3. Compiles `main` from Fortran source code.
    - When using a different Fortran compiler adjust the compiler flags as needed (lines 33-40).
4. Runs `main` for all calibrations.
    - Which calibration is solved is determined by an input flag, i.e. the benchmark calibration is run using `./main 1`.
5. Runs `main.m` to create output files.
    - Requires an installation of Matlab. Note that this script is run using `bin` as a working directory.

- `make_pdf.sh` assembles the output files into a PDF that contains all tables and figures related to the quantitative solution in the paper.

3.3 List of tables and programs

All tables and figures related to the quantitative solution in the paper are created by `src/matlab/main.m` and stored in the `output` folder. To easily find the specific scripts called in `main.m` that create the individual output files refer to the following table.

Figure/Table #	Program	Output file
Figure 2	`create_figures.m`	`fig_2.pdf`
Figure 3	`create_figures.m`	`fig_3.pdf`
Figure 4	`create_recession_fig.m`	`fig_4.pdf`
Figure 5	`create_figures.m`	`fig_5.pdf`
Figure 6	`create_recession_fig.m`	`fig_6.pdf`
Figure 7	`create_recession_fig.m`	`fig_7.pdf`
Figure 10	`create_safety_fig.m`	`fig_10.pdf`
Figure 11-20	`create_figures.m`	`fig_11.pdf`-`fig_20.pdf`
Table 1-10	`create_tables.m`	`table_1.tex`-`table_10.tex`

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