README for *Unemployment Insurance in Macroeconomic Stabilization*

Data Availability Statements

The underlying data used in the paper is publicly available from the Bank of Italy, Board of Governors of the Federal Reserve System (Fed Board), U.S. Bureau of Economic Analysis (BEA), U.S. Bureau of Labor Statistics (BLS), and U.S. Census Bureau (Census).

In most cases I provide the raw datasets. In some cases the data has been cleaned and organized by other researchers, such as the Center for Economic Policy Research (CEPR), to facilitate its use. Only in one case (`data/separation_rate_estimation/CPS_basic_final.dta`) do I provide an intermediate dataset for parsimony. This file is constructed from the Current Population Survey (CPS) Basic Monthly Files, seasonally adjusted using Census' X-13ARIMA-SEATS, following Shimer (2012).

Dataset list

All datasets described below are provided in the replication package.

Data file	Source
`data/2004_2007_CPS/cepr_org_2004.dta`	CEPR (n.d.)
`data/2004_2007_CPS/cepr_org_2005.dta`	CEPR (n.d.)
`data/2004_2007_CPS/cepr_org_2006.dta`	CEPR (n.d.)
`data/2004_2007_CPS/cepr_org_2007.dta`	CEPR (n.d.)
`data/2004_SCF/p04i6.dta`	Fed Board (n.d.,a)
`data/2004_SCF/rscfp2004.dta`	Fed Board (n.d.,a)
`data/2004_SIPP/sippl04puw3.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw5.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw6.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw7.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw8.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw9.dta`	Census (n.d.)
`data/2004_SIPP/sippl04puw10.dta`	Census (n.d.)
`data/2004_SIPP/sippp04putm3.dta`	Census (n.d.)
`data/2004_SIPP/sippp04putm6.dta`	Census (n.d.)
`data/2010_SHIW/carcom10.dta`	Bank of Italy (n.d.)
`data/2010_SHIW/q10e.dta`	Bank of Italy (n.d.)
`data/macro_ts/CES0500000003.xls`	BLS (n.d.,a)
`data/macro_ts/FEDFUNDS.xls`	Fed Board (n.d.,b)
`data/macro_ts/JTSJOL.xls`	BLS (n.d.,b)
`data/macro_ts/LNS13025703.xlsx`	BLS (n.d.,c)
`data/macro_ts/LNS14000000.xlsx`	BLS (n.d.,g)
`data/macro_ts/PCEPILFE.xls`	BEA (n.d.,a)

Data file	Source
`data/macro_ts/ui_weeks_fv.dta`	Farber and Valletta (2013)
`data/macro_ts/UNEMPLOY.xls`	BLS (n.d.,e)
`data/macro_ts/US_Civilian_Pop.xlsx`	BLS (n.d.,f)
`data/macro_ts/US_GDP.csv`	BEA (n.d.,b)
`data/macro_ts/US_Real_GDP.csv`	BEA (n.d.,c)
`data/RV_2017/eventstudysample_3-20-17.dta`	Rothstein and Valletta (2017)
`data/sep_rate/BLS_employed.xlsx`	BLS (n.d.,i)
`data/sep_rate/BLS_unemployed.xlsx`	BLS (n.d.,h)
`data/sep_rate/BLS_unemployed_lt5wk.xlsx`	BLS (n.d.,d)
`data/sep_rate/CPS_basic_final.dta`	constructed

Computational requirements

Software requirements

- Stata (code was last run with version 14.2)
  - Packages: `estout`
- Matlab (code was last run with Matlab release 2016a on laptop, and release 2021b on computing cluster)
  - Toolboxes: Optimization Toolbox, Parallel Computing Toolbox, MATLAB Parallel Server

Description of programs

- Programs in `programs/empirical` generate all empirical series and moments in the paper.
- Programs in `programs/model` generate all model results in the paper.

The names of output files should be easy to correspond with the manuscript (e.g., `Table1.txt`), though an exhaustive mapping is given below.

Memory and runtime requirements

The code to produce all figures and tables was last run on a standard Intel-based laptop with Windows 10. The runtimes are:

Program	Runtime
empirical/analyzeCPS.do	12 s
empirical/analyzeRV2017.do	1 s
empirical/analyzeSCF.do	2 s
empirical/analyzeSCF.m	1 s
empirical/analyzeSHIW.do	0 s
empirical/analyzeSIPP.do	13 s
empirical/estimateSepRate.do	1 s
empirical/estimateSepRate.m	2 s

Program	Runtime
empirical/makeMacroData.do	1 s
model/makeFiguresTables.m	6 m, 45 s

As further described in the next section, reproducing all model stationary RCEs, transitional dynamics, and simulations of the Great Recession (inputs to the production of figures and tables above) is more involved. This code was last run on the Mercury computing cluster maintained by Chicago Booth, which uses the Slurm scheduler to manage jobs. My Slurm submission scripts are provided in the folder `programs/model/slurm` (each program `xyz.m` has an associated script `xyz.sh`). Lines 9-14 of each submission script describe the cpu requirements of each program, ranging from 1-27 cpus, 10-60 gigabytes memory per cpu, and wall clock limits of 1-72 hours. The runtimes are:

Program	Runtime
model/solveStationary_baseline.m	18 m, 47 s
model/solveStationary_baseline_dbarbar22.m	30 m, 48 s
model/solveStationary_noEps.m	17 m, 22 s
model/solveStationary_durElast.m	15 m, 34 s
model/solveStationary_liquid.m	10 m, 12 s
model/ident_Delta.m	1 h, 29 m, 32 s
model/ident_eps_delta_beta.m	24 m, 22 s
model/ident_eps_delta_a.m	54 m, 34 s
model/ident_lambda.m	2 h, 22 m, 29 s
model/simTransition_baseline_noshocks.m	1 m, 15 s
model/simTransition_baseline_dbarbar22_noshocks.m	2 m, 46 s
model/simTransition_noEps_noshocks.m	1 m, 37 s
model/simTransition_durElast_noshocks.m	2 m, 14 s
model/simTransition_liquid_noshocks.m	1 m, 49 s
model/simJacobian_baseline_1.m	2 h, 40 m, 20 s
model/simJacobian_baseline_2.m	4 h, 55 m, 28 s
model/simJacobian_baseline_3.m	4 h, 55 m, 18 s
model/simJacobian_baseline_4.m	4 h, 57 m, 55 s
model/simJacobian_noEps_1.m	2 h, 32 m, 25 s
model/simJacobian_durElast_1.m	2 h, 11 m, 25 s
model/simJacobian_liquid_1.m	2 h, 8 m, 7 s
model/simTransition_baseline.m	5 m, 20 s
model/simTransition_baseline_dur.m	5 m, 56 s
model/simTransition_baseline_dbar.m	11 m, 13 s
model/simTransition_noEps.m	5 m, 49 s
model/simTransition_durElast.m	4 m, 44 s
model/simTransition_liquid.m	4 m, 11 s
model/simTransition_baseline_iota0p9.m	7 m, 31 s
model/simTransition_baseline_policy.m	21 m, 55 s

Program	Runtime
model/simTransition_baseline_fiscal.m	17 m, 15 s
model/simTransition_baseline_macro.m	10 m, 24 s
model/simGR_time1.m	32 m, 9 s
model/simJacobian_time1_1.m	2 h, 34 m, 19 s
model/simJacobian_time1_2.m	5 h, 19 m, 39 s
model/simJacobian_time1_3.m	4 h, 49 m, 10 s
model/simJacobian_time1_4.m	4 h, 54 m, 38 s
model/simGR_ui.m	34 h, 34 m, 11 s
model/simGR_noui.m	12 h, 5 m, 5 s
model/simGR_nozlb.m	19 h, 0 m, 35 s
model/simGR_nozlbui.m	9 h, 50 m, 35 s
model/simGR_multipliers.m	22 h, 14 m, 57 s
model/simGR_expiration.m	4 h, 16 m, 42 s
model/simGR_noexpiration.m	3 h, 35 m, 24 s
model/simGR_seprate_time1.m	38 m, 15 s
model/simJacobian_seprate_1.m	2 h, 34 m, 9 s
model/simJacobian_seprate_2.m	4 h, 49 m, 32 s
model/simJacobian_seprate_3.m	4 h, 50 m, 4 s
model/simJacobian_seprate_4.m	4 h, 48 m, 33 s
model/simGR_seprate_ui.m	39 h, 57 m, 36 m
model/simGR_seprate_noui.m	19 h, 44 m, 43 s

Instructions

Reproducing empirical results

To reproduce the empirical results in the paper:

- Download the data files referenced above. Each should be stored in the appropriately named subfolder of `data` in the format you download in.
- Update the directory containing `data` in line 12 of all Stata `.do` files referenced in the following steps. Update the directory containing `programs/empirical/output` in line 13 in these same files. Finally, update the directory containing `programs/model/output` in line 15 in these same files.
- Run `programs/empirical/analyzeCPS.do` to produce estimates of EU flows by weekly pay from the CPS.
- Run `programs/empirical/analyzeRV2017.do` to produce estimates of income through unemployment using the SIPP extract studied by Rothstein and Valletta (2017).
- Run `programs/empirical/analyzeSCF.do` and then `programs/empirical/analyzeSCF.m` to produce moments of the wealth distribution using the SCF.
- Run `programs/empirical/analyzeSHIW.do` to produce estimates of

MPCs by employment status using the SHIW.
- Run `programs/empirical/analyzeSIPP.do` to produce estimates of EU flows by wealth and earnings from the SIPP.
- Run `programs/empirical/estimateSepRate.do` and then `programs/empirical/estimateSepRate.m` to produce estimates of the aggregate separation rate adjusted for time aggregation using the CPS, following the methodology of Shimer (2012).
- Run `programs/empirical/makeMacroData.do` to organize macro time-series to compare against the model simulations.

All output files will be in the subdirectory `programs/empirical/output/figures_and_tables`. Copies of the files `macrodata.csv` and `seprate.csv`, and the selected series in `seprate05081214.csv`, `ui_weeks_fv.csv`, and `ur05081214.csv`, will also be produced in the subdirectory `programs/model/output` for easy use with the Matlab codes below.

Reproducing model simulation results

To reproduce model results in the paper, we distinguish between the steps required to reproduce all tables and figures in the paper (fast), and the steps required to re-solve for the stationary RCE, transitional dynamics, and Great Recession simulation (more involved).

Tables and figures To reproduce all model-generated tables and figures:

1. Run `programs/model/makeFiguresTables.m`.

All output files will be in the subdirectory `programs/model/output/figures_and_tables`.

Stationary RCEs To reproduce the stationary RCEs:

1. Run `programs/model/solveStationary_baseline.m` to produce the baseline calibration.
2. Run `programs/model/solveStationary_baseline_dbarbar22.m` to produce the baseline calibration with $\bar{\bar{d}} = 22$.
3. Run `programs/model/solveStationary_noEps.m` to produce the alternative calibration with $\epsilon_a^\delta = \epsilon_\beta^\delta = 0$.
4. Run `programs/model/solveStationary_durElast.m` to produce the alternative calibration targeting a higher disincentive elasticity to UI generosity.
5. Run `programs/model/solveStationary_liquid.m` to produce the alternative calibration targeting the liquid wealth distribution.
6. Run the files `programs/model/ident_*.m` to characterize the identification of selected parameters in the baseline calibration.

These programs call `programs/model/StationaryRCE.m`, the top-level function which computes the stationary RCE given any set of parameters, which in turn calls several helper functions described in the code. See appendix F.1 for a description of the algorithm used to compute the stationary RCE. All output files will be in the subdirectory `programs/model/output`.

Transitional dynamics To reproduce transitional dynamics starting from the stationary RCE:

1. Run `programs/model/simTransition_*_noshocks.m` to produce the transitional dynamics starting from each stationary RCE without any shocks. This allows you to net out any computational error in the dynamics with shocks below.
2. Run `programs/model/simJacobian_baseline_*.m`, `programs/model/simJacobian_noEps_1.m`, `programs/model/simJacobian_durElast_1.m`, and `programs/model/simJacobian_liquid_1.m` to produce the Jacobians starting from each stationary RCE.
3. Run `programs/model/simTransition_baseline.m` to produce the baseline transitional dynamics to UI shocks given $\iota = 1$.
4. Run `programs/model/simTransition_noEps.m` to produce the sensitivity analysis to the `noEps` calibration.
5. Run `programs/model/simTransition_durElast.m` to produce the sensitivity analysis to the `durElast` calibration.
6. Run `programs/model/simTransition_liquid.m` to produce the sensitivity analysis to the `liquid` calibration.
7. Run `programs/model/simTransition_baseline_dur.m` to produce the sensitivity analysis to the horizon of benefit extensions.
8. Run `programs/model/simTransition_baseline_dbar.m` to produce the sensitivity analysis to the magnitude of benefit extensions.
9. Run `programs/model/simTransition_baseline_iota0p9.m` to produce the sensitivity analysis to $\iota = 0.9$.
10. Run `programs/model/simTransition_baseline_policy.m` to produce the sensitivity analysis to eligibility/take-up, debt financing, and increases in the replacement rate.
11. Run `programs/model/simTransition_baseline_fiscal.m` to produce the transitional dynamics to government spending shocks.
12. Run `programs/model/simTransition_baseline_macro.m` to produce the transitional dynamics to discount factor, borrowing constraint, productivity, separation rate, and match efficiency shocks.

These programs call `programs/model/Transition.m`, the top-level function which computes transitional dynamics given any stationary RCE and path of exogenous aggregate variables, which in turn calls several helper functions described in the code. See appendix F.2 for a description of the algorithm used to compute transitional dynamics. All output files will be in the subdirectory `programs/model/output`.

Great Recession simulations Finally, to reproduce the simulation of the Great Recession:

1. Run `programs/model/simGR_time1.m` to calibrate the first discount factor shock to match unemployment in May 2008 given (arbitrarily) $\iota = 0.975$.
2. Run `programs/model/simJacobian_time1_*.m` to calibrate the Jacobian starting from the above dynamics.
3. Run `programs/model/simGR_ui.m` to calibrate the sequence of discount factor shocks to match unemployment during the Great Recession, given observed UI extensions and $\iota \in \{0.88, 0.94, 1\}$.
4. Run `programs/model/simGR_noui.m` to re-simulate the above shocks during the Great Recession in the absence of any UI extensions, given $\iota \in \{0.88, 0.94, 1\}$.
5. Run `programs/model/simGR_nozlb.m` to re-simulate the above shocks during the Great Recession in the absence of any zero lower bound, given $\iota = 0.94$.
6. Run `programs/model/simGR_nozlbui.m` to re-simulate the above shocks during the Great Recession in the absence of any UI extensions and zero lower bound, given $\iota = 0.94$.
7. Run `programs/model/simGR_multipliers.m` to compute transitional dynamics with and without each UI shock during the Great Recession simulation, given $\iota = 0.94$.
8. Run `programs/model/simGR_expiration.m` to simulate the case in which the final UI extension was expected to last through December 2014 but then unexpectedly expired in December 2013.
9. Run `programs/model/simGR_noexpiration.m` to build on the latter case and consider the counterfactual in which the final UI extension did not expire in December 2013.
10. Run `programs/model/simGR_seprate_time1.m` to calibrate the first discount factor shock to match unemployment in May 2008 given the estimated separation rate shock in May 2008 and (arbitrarily) $\iota = 0.975$.
11. Run `programs/model/simJacobian_seprate_time1_*.m` to calibrate the Jacobian starting from the above dynamics.

12. Run `programs/model/simGR_seprate_ui.m` to calibrate the sequence of discount factor shocks to match unemployment during the Great Recession, given observed UI extensions, the estimated separation rate shocks, and $\iota = 0.94$.

13. Run `programs/model/simGR_seprate_noui.m` to re-simulate the above shocks during the Great Recession in the absence of any UI extensions, given $\iota = 0.94$.

These programs call `programs/model/GR.m` and `programs/model/GR_multipliers.m`. The former is used to calibrate a sequence of aggregate shocks to match the dynamics of unemployment in the Great Recession. The latter is used to compute UI multipliers in response to each UI shock in the simulation. Both repeatedly call `programs/model/Transition.m` to simulate the transitional dynamics in response to each shock. All output files will be in the subdirectory `programs/model/output`.

List of tables and programs

All output files are in the subdirectories `programs/model/output/figures_and_tables` and `programs/empirical/output/figures_and_tables`.

Figure/ Table #	Program	Output file(s)
Table 1	model/makeFiguresTables.m	Table1.txt
Figure 1	model/makeFiguresTables.m	Figure1_{1-4}.eps
Table 2	model/makeFiguresTables.m	Table2.txt
Figure 2	model/makeFiguresTables.m	Figure2_{1-2}.eps
Table 3	model/makeFiguresTables.m	Table3.txt
Table 4	model/makeFiguresTables.m	Table4.txt
Figure 3	model/makeFiguresTables.m	Figure3_{1-2}.eps
Table 5	model/makeFiguresTables.m	Table5.txt
Figure 4	model/makeFiguresTables.m	Figure4_{1-2}.eps
Table 6	model/makeFiguresTables.m	Table6.txt
Figure 5	model/makeFiguresTables.m	Figure5.eps
Figure 6	model/makeFiguresTables.m	Figure6_{1-2}.eps
Figure 7	model/makeFiguresTables.m	Figure7_{1-6}.eps
Figure 8	model/makeFiguresTables.m	Figure8.eps
Figure 9	model/makeFiguresTables.m	Figure9_{1-6}.eps
Table 8	model/makeFiguresTables.m	Table8.txt
Figure 10	model/makeFiguresTables.m	Figure10_{1-2}.eps
Figure 11	model/makeFiguresTables.m	Figure11_{1-2}.eps
Table 9	model/makeFiguresTables.m	Table9.txt
Table A.1, r1-4	empirical/analyzeSHIW.do	TableA1.xlsx
Table A.2	empirical/analyzeSCF.do	TableA2.xlsx
Table A.3, c1	empirical/analyzeCPS.do	TableA3_1.csv

Figure/ Table #	Program	Output file(s)
Table A.3, c2-3	empirical/analyzeSIPP.do	TableA3_2.csv
Table A.4, c1-6	empirical/analyzeRV2017.do	TableA4.xlsx
Figure A.1	empirical/analyzeSCF.m	FigureA1.eps
Figure A.2	model/makeFiguresTables.m	FigureA2_{1-6}.eps
Table A.5	model/makeFiguresTables.m	TableA5.txt
Table A.6	model/makeFiguresTables.m	TableA6.txt
Table A.7	model/makeFiguresTables.m	TableA7.txt
Table A.8	model/makeFiguresTables.m	TableA8.txt
Table A.9	model/makeFiguresTables.m	TableA9.txt
Table A.10	model/makeFiguresTables.m	TableA10.txt
Figure A.3	model/makeFiguresTables.m	FigureA3_{1-6}.eps
Figure A.4	model/makeFiguresTables.m	FigureA4_{1-6}.eps
Figure A.5	model/makeFiguresTables.m	FigureA5_{1-6}.eps
Figure A.6	model/makeFiguresTables.m	FigureA6_{1-6}.eps
Figure A.7	model/makeFiguresTables.m	FigureA7_{1-6}.eps
Figure A.8	model/makeFiguresTables.m	FigureA8_{1-2}.eps
Figure A.9	model/makeFiguresTables.m	FigureA9_{1-2}.eps
Figure A.10	model/makeFiguresTables.m	FigureA10_{1-6}.eps
Figure A.11	model/makeFiguresTables.m	FigureA11_{1-2}.eps
Figure A.12	model/makeFiguresTables.m	FigureA12_{1-6}.eps
Figure A.13	model/makeFiguresTables.m	FigureA13.eps
Figure A.14	model/makeFiguresTables.m	FigureA14_{1-2}.eps
Figure A.15	model/makeFiguresTables.m	FigureA15_{1-2}.eps

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