

# MONETARY POLICY AND INEQUALITY UNDER LABOR MARKET FRICTIONS AND CAPITAL-SKILL COMPLEMENTARITY

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Readme for the replication codes of the empirical exercise

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## 1 Data

### 1.1 Data availability statements

All data used in the main text and appendix of our manuscript are publicly available from the data sources below:

- Current Population Survey (CPS) by [United States Census Bureau and US Bureau of Labor Statistics \(2018\)](#)
  - NBER extracts of the CPS Merged Outgoing Rotation Groups
  - downloadable from <http://data.nber.org/morg/annual/> (one \*.dta file for each year 1979-2016)
- FRED by Federal Reserve Bank of St. Louis
  - inflation and CPI deflator series CPIAUCSL, available at <https://fred.stlouisfed.org/series/CPIAUCSL> ([U.S. Bureau of Labor Statistics, 2020a](#)), unit can be changed by clicking "Edit graph" and selecting "Index" or "Percentage change from year ago"
  - unemployment series UNRATE, available at <https://fred.stlouisfed.org/series/UNRATE> ([U.S. Bureau of Labor Statistics, 2020b](#))
  - Fed funds rate FEDFUNDS, available at <https://fred.stlouisfed.org/series/FEDFUNDS> ([Board of Governors of the Federal Reserve System , US](#))
- Romer and Romer narrative monetary policy shocks (Ramey)

- available at <https://econweb.ucsd.edu/~vramey/research.html#data> from [Ramey \(2016\)](#)
- Under the section *"Data and Programs for "Macroeconomic Shocks and Their Propagation" 2016 Handbook of Macroeconomics, June 2016"*, click *"Monetary Shocks"*, which should download a zip file `Ramey_HOM_monetary.zip`
- Inside the zip file find `Monetarydat.xls`, inside which the *"Monthly"* sheet contains variable *RRSHOCK* in column J, which is what we need from 1979 onwards.
- Romer and Romer narrative monetary policy shocks (Coibion et al) – only needed for the Online Appendix
  - available at <https://sites.google.com/site/ocoibion/> from [Coibion et al. \(2017\)](#)
  - Download the zip file by clicking to *"Codes and data"* for the *"Innocent Bystanders?"* paper: `Inequality_CGKS_replication_folder.zip`
  - Inside the zip file navigate to `source files / RR MPshocks Updated.xls`, where the *"Makemonthly"* sheet contains the variable *RR Updated Shocks, Quarterly frequency* in column *M* which we use from 1979-2008
- Romer and Romer narrative monetary policy shocks (Miranda-Agrippino) – only needed for the Online Appendix
  - The data were downloaded from the author's website at <http://silviamirandaagrippino.com/code-data> ([Miranda-Agrippino, 2018](#)) in December 2018.
  - The use of these series is referenced in [Miranda-Agrippino and Rey \(2015\)](#) in their Appendix D.2. on page 61.
  - However, shock series are no longer available for public download, as the author removed them from her website, therefore we include the data, as originally downloaded by us, in this repository.

## 1.2 Dataset list

- `labor market data prep / data files / morgYY.dta`
  - source: CPS
  - YY denotes years from 79-16
  - provided in the project repository if file limitations allow (almost 2GB altogether)
- `SVAR analysis / DATASET_DMP_IRIS.xlsx`

- Combines multiple data sources (CPS, FRED, Ramey), with some data already treated in previous steps, and some within the Excel file. It serves as the main input for the SVAR analysis.
- Sources and series names are listed on the "*Sources*" sheet. File is provided in the project repository.
- SVAR online appendix / DATA\_DMP\_Q.xlsx
  - Apart from transforming monthly data from SVAR analysis / DATASET\_DMP\_IRIS.xlsx into quarterly frequency (by using the middle month of the quarter), this file also includes the quarterly Romer and Romer shock series updated by [Coibion et al. \(2017\)](#), which can be found on "*shocks*" sheet under the name *TRSHOCK*.
  - File is provided in the project repository.
- SVAR online appendix / DATASET\_DMP\_IRIS.xlsx
  - Mainly a replication of SVAR analysis / DATASET\_DMP\_IRIS.xlsx.
  - Additionally it includes extended Romer and Romer shock series ([Miranda-Agrippino, 2018](#)) which were used in [Miranda-Agrippino and Rey \(2015\)](#), under the name *RRSHOCKMA*.

## 2 Computational requirements

### 2.1 Software requirements

- Stata (version 16)
  - the `sencode` command needs to be installed for this code to run (`ssc install sencode`)
  - the `sdecode` command needs to be installed for this code to run (`ssc install sdecode`)
  - alternatively, the user can run the `labor market data prep / stata_config_file.do` file as well, which is supposed to install these packages
- RStudio (version 1.2.5001)
- Java (Version 8 update 231, build 1.8.0\_231-b11)
- MS Excel 2013
- Matlab (release 2018b)
  - IRIS Toolbox 20150127: This is an open-source toolbox which we use for X13-ARIMA-SEATS seasonal adjustment. It runs on Matlab. Further information about the toolbox can be found at <https://iris.igpmn.org/> or at <https://github.com/IRIS-Solutions-Team/IRIS-Toolbox>. In this code we have used an older version of

the toolbox, released on 27 January 2015, and **it is important that our codes are run with this IRIS version!** Since this might no longer be available for download, we have included the IRIS Toolbox release 20150127 in this repository. Documentation corresponding to this version ([IRIS Solutions Team, 2015](#)) can be obtained by typing `irisman` into the Matlab command window after an IRIS session has been started up (see later), which should bring up the file `help/IRIS_Man.pdf` from the toolbox folder.

- VAR toolbox: For the SVAR analysis we use a toolbox which is based on [Cesa-Bianchi \(2015\)](#), but modified by the authors. It is included in this repository.

## 2.2 Memory and runtime requirements

The code was run on a Dell computer with the following specifications:

- operation system: Windows 8.1 pro (64-bit)
- processor: Intel 4-Core i7-4510U CPU @ 2.00GHz
- RAM: 8.00 GB
- if downloading the raw CPS data from their original source (NBER website), instead of using what we attached, then it can take up to an hour, depending on the internet connection – it also occupies almost 2GB of storage

All computations and figure generation are finished within 30 minutes.

## 2.3 Description of programs

### 2.3.1 Labor market data preparation

All following files are found within the `labor market data prep` subfolder:

- `IRIS_Tbx_20150127` folder: contains the particular release of the IRIS toolbox used for these codes
- `data files` folder: should contain the raw Stata data files from the Current Population Survey ([United States Census Bureau and US Bureau of Labor Statistics, 2018](#)) between 1979-2016, in the format `morgYY.dta` where YY denotes the year. If these files are not in this folder (due to size limitations), they should be directly downloaded from `http://data.nber.org/morg/annual/`
- functions to manipulate the raw data:
  - `stata_config_file.do`: SSC installs the Stata packages "sencode" and "sdecode".

- `data_preparation.do`: This Stata do file does most of the preparation of the raw CPS labor market data, as detailed in Appendix A of our manuscript. It calls the `morgYY.dta` files from the `data files` folder saves the results into the `clean data` folder, under the names `morg1979-2016_final.dta` and `morg1979-2016_final.xlsx`.
- `kalman.R`: This R file applies the Kalman-filter to some of the sectoral wage data in order to replace data-outliers with Kalman-smoothed predictions. It calls `morg1979-2016_final.xlsx` from the `clean data` folder. Then it saves the results into the `clean data` folder into Excel files named of the pattern `hrlwage_{ed, noed}_industry_{industry no.}_kalman.xlsx`
- `SA_labor_iris.m`: This Matlab file applies seasonal adjustment to monthly labor market series by using the IRIS Toolbox's X13-ARIMA-SEATS package. After starting an IRIS session, it loads data from the `clean data` folder, and then applies the seasonal adjustment. The result is saved as `SA_data_iris.csv` and as `SA_data_iris.xlsx`
- `clean data` folder: includes the results of preparing the CPS labor market data
  - `SA_data_iris.csv` (or `SA_data_iris.xlsx`) is the main file to be used in the later stage of our empirical analysis (SVAR)
  - for reference the non-seasonally adjusted data is also saved in `NA_data_iris.csv`
  - the remaining files, i.e. `morg1979-2016_final.xlsx`, and `hrlwage_{ed, noed}_industry_{industry no.}_kalman.xlsx` (and their `*.csv` and `*.dta` counterparts) were just needed as intermediate steps for switching between the above programs

WARNING: Users should note, that the folder names `clean data` and `data files` might automatically be hyphenated by some repositories (e.g. by openICPSR), in which case these references might need to be manually adjusted in the codes.

### 2.3.2 SVAR analysis

All following files are found within the `SVAR analysis` subfolder:

- `VAR_Toolbox`: contains auxiliary Matlab functions to run the SVAR analysis
- `proxySVAR`: contains auxiliary Matlab functions to run the SVAR analysis
- `auxfiles`: contains some auxiliary Matlab functions
- `charts`: contains the figures of impulse response functions
- files containing input data:
  - `DATASET_DMP_IRIS.xlsx`: contains the input data used in the SVAR analysis, which is used by...

- `...Import_data_DMP.m` which, in turn, saves it in the right format into...
- `...DATASET.mat` which is used for running the SVAR estimation and replicating the IRF figures
- `replicate_figureNN.m` are codes run the SVAR estimation for the aggregate and each sectoral data (NN denotes figure number in our manuscript)
  - they use `DATASET.mat` as input, and save the resulting figures in the `charts` subfolder
- `svar_master.m` runs all the Matlab files to generate and save the figures

### 2.3.3 Online appendix SVAR figures

All following files are found within the `SVAR online appendix` subfolder:

This subfolder includes the same files as those above needed for replicating SVAR results from the main manuscript, but it also has some more:

- `locproj.m`, `locproj_conf.m` and `locproj_cv.m` are files by [Brownlees \(2018\)](#) to implement local projection methods (they can be downloaded from <https://github.com/ctbrownlees/MATLAB-package-lproj> )
- `functions` subfolder contains auxiliary Matlab files for the SVAR analysis
- `DATA_DMP_Q.xlsx` contains the labor market, macro and shock data transformed from monthly into quarterly frequency for the local projection exercise. This uses already existing monthly data from `DATASET_DMP_IRIS.xlsx`, and also includes the quarterly Romer and Romer monetary policy shock series from [Coibion et al. \(2017\)](#).
- `DATASET_DMP_IRIS.xlsx` is a copy of the file with the same name in the `SVAR analysis` subfolder, but appended by additional series, like extended Romer and Romer shocks *RRSHOCKMA* from [Miranda-Agrippino and Rey \(2015\)](#) which are used only in the Online Appendix.
- `mainLP_DMP.m` runs the local projection exercise and generates some figures in the Online Appendix (saved in `charts` subfolder)
- `svar_appendix_master.m` runs all the codes needed to replicate the SVAR figures in the Online Appendix:
  - the individual files are `replicate_figureN_online.m`, with  $N$  denoting the figure number

## 3 Instructions

### 3.1 Labor market data preparation

1. Make sure that the CPS data from 1979-2016 is in the `labor market data prep/data files` folder with name pattern `morgYY.dta`.
  - If not, download them one-by-one from <http://data.nber.org/morg/annual/>
2. Run `data preparation.do` on Stata
  - You might have to change the base folder in line 9 to the one where you have downloaded this folder on your computer. Make sure it ends with the current subfolder where this do file is located, i.e. `labor market data prep`
  - If not yet in your Stata, install the `sencode` and `sdecode` commands before running this file by typing: `ssc install sencode` and `ssc install sdecode`. Alternatively, run the `stata_config_file.do` configuration file, which does the same.
  - This file uses `data files/morgYY.dta` files, so make sure they are there.
  - This file saves `clean data/morg1979-2016_final.xlsx` which will be needed later
3. Run `kalman.R` on RStudio
  - Install any missing packages. Some packages needed for the code to run might be missing, but RStudio offers to install them when loading the script.
  - This file uses `clean data/morg1979-2016_final.xlsx` so make sure it is there.
  - This file generates the Kalman-smoothed sectoral wage series `clean data/hrlwage_{ed, noed}_industry_{industry no.}_kalman.xlsx` which will be used later
4. Run `SA_labor_iris.m` on Matlab (current folder set to `labor market data prep`)
  - This adds the 2015-01-27 release of the IRIS Toolbox to the current Matlab path. The command `"irisstartup"` starts up an IRIS session. If you have already started up an IRIS session earlier, then this part of the code can be commented out.
  - This file calls `clean data / morg1979-2016_final.xlsx` and `clean data / hrlwage_{ed, noed}_industry_{industry no.}_kalman.xlsx`, so make sure they are in the same folder.
  - This file generates `clean data / SA_data_iris.csv` (and also `clean data / SA_data_iris.xlsx` with identical content) which will be needed in the SVAR analysis stage.

## 3.2 SVAR analysis

1. Collect and prepare all the input data in the Excel file `SVAR_analysis / DATASET_DMP_IRIS.xlsx`
  - for labor market variables use `labor market data prep / clean data / SA_data_iris.csv` to paste it into the `"SA_data_IRIS_csv"` sheet
  - for other macro variables use the sources indicated above and copy them into this Excel in their respective columns
  - some data transformation are done within Excel on the `"data transformations"` and `"computing backward MA"` sheets – the structure of the `"DATASET"` sheet is important to stay the same, such that data can be imported into Matlab in the correct way
  - **Note!** The exact copy of `SVAR_analysis / DATASET_DMP_IRIS.xlsx` which we used, is included in this repository.
2. Run `svar_master.m` on Matlab (with current folder set to `SVAR_analysis` ) to do all the SVAR analysis and replicate the figures
  - Runs `Import_data_DMP.m`
    - This imports data from `DATASET_DMP_IRIS.xlsx`, restructures it, then saves it in `DATASET.mat`
  - Runs `replicate_figureNN.m` on Matlab (where `NN` denotes the figure number)
    - These files use `DATASET.mat`, and then run the SVAR analysis to plot impulse responses.
    - The figures are then saved to the `charts` subfolder under the name pattern `MABaselineVAR.eps` or `MAsectorNVAR.eps`

## 3.3 Online Appendix – SVAR results

1. Construct the file `SVAR_online_appendix / DATA_DMP_Q.xlsx`
  - The sheet called: `"Mdata_from_DATASET_DMP_IRIS"` inserts the monthly data from for the `DATASET_DMP_IRIS.xls` file for the following variables: `UR`, `FFR`, `INF_Y`, `RWAGE_S`, `WPREMIUM`, `EMP_S`, `RAT_EMP` defined as in the file `DATASET_DMP_IRIS.xls`. Then `LRWAGE_S` is the natural logarithm of `RWAGE_S`.
  - Those series are transformed into quarterly series by choosing the 2nd, 5th, 8th and 11th month for every year, i.e., by using the middle month of the quarter (Excel's filter feature can be used for this). Copy the filtered results into the `"transform monthly to quarterly"` sheet.



- The clean data for UR, FFR, INF, WPREMIUM, EMP\_S, RAT\_EMP and LR-WAGE\_S, together with a linear trend called “ltrend” are copied in the sheet named “data”.
  - The sheet called “shocks” includes the quarterly Romer and Romer shock series updated by Coibion et al. (2017), with the name TRSHOCK.
2. Run `mainLP_DMP.m` for the local projection exercise
    - As input, this file uses `SVAR online appendix / DATA_DMP_Q.xlsx`
    - It saves the figures in the `charts` subfolder
  3. Run `svar_appendix_master.m` to replicate the SVAR figures of the Online Appendix
    - This will execute the `replicate_figureNN_online.m` files, which replicate the figures one-by-one, and save them in the `charts` subfolder

## 4 List of figures and numbers

Numbers:

- Most numbers cited in the main text are just read off of charts and figures.
- Other numeric results are replicated below:
  - `SVAR analysis / Import data DMP.m` (line 59 and 61) prints correlation coefficients in the Matlab command window: between unemployment rate and employment ratio, and unemployment rate and skill premium, as cited in the second paragraph of Chapter I

Figures: listed in Tables 1 and 2.

**Table 1:** List of figures appearing in the main text of the manuscript and in its Appendix

Figures	Program	Line no.	Output file
Figure 1	<code>replicate_figure1.m</code>	35	<code>MAbaselineVAR.eps</code>
Figure B1	<code>replicate_figure9a.m</code>	39	<code>MAsector1VAR.eps</code>
Figure B2	<code>replicate_figure9b.m</code>	39	<code>MAsector2VAR.eps</code>
Figure B3	<code>replicate_figure9c.m</code>	39	<code>MAsector3VAR.eps</code>
Figure B4	<code>replicate_figure9d.m</code>	39	<code>MAsector4VAR.eps</code>
Figure B5	<code>replicate_figure9e.m</code>	39	<code>MAsector5VAR.eps</code>
Figure B6	<code>replicate_figure9f.m</code>	39	<code>MAsector6VAR.eps</code>

**Table 2:** List of figures appearing in the Online Appendix

Figures	Program	Line no.	Output file
O.A. Figure 1	replicate_figure1_online.m	34	MAextsampleVAR.png
O.A. Figure 2a	replicate_figure2a_online.m	39	MAsector1extsample.png
O.A. Figure 2b	replicate_figure2b_online.m	39	MAsector2extsample.png
O.A. Figure 2c	replicate_figure2c_online.m	39	MAsector3extsample.png
O.A. Figure 2d	replicate_figure2d_online.m	39	MAsector4extsample.png
O.A. Figure 2e	replicate_figure2e_online.m	39	MAsector5extsample.png
O.A. Figure 2f	replicate_figure2f_online.m	39	MAsector6extsample.png
O.A. Figure 3	replicate_figure3_online.m	23	MAcholesky_whole.png
O.A. Figure 4a	mainLP_DMP.m	124	localproj_wage_LRWAGE_S.png
O.A. Figure 4b	mainLP_DMP.m	124	localproj_wage_WPREMIUM.png
O.A. Figure 4c	mainLP_DMP.m	124	localproj_wage_EMP_S.png
O.A. Figure 4d	mainLP_DMP.m	124	localproj_wage_RAT_EMP.png
O.A. Figure 5	replicate_figure5_online.m	33	MAcompoVAR.png
O.A. Figure 6	replicate_figure6_online.m	34	baselineVAR.png

## 5 Repository

The repository with the above described replication codes is available at <https://github.com/gergomotyovszki/DMP-monopol-and-CSC---empirical-replication>

## References

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- IRIS Solutions Team.** 2015. “IRIS Toolbox Reference Manual.” , (2015-01-27).
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