

This README file contains descriptions and instructions concerning the data files (Excel) and program files (Matlab) used in the estimation exercises in “Monetary Policy and Investment Dynamics: Evidence from Disaggregate Data.”

## Data

**dataset.xlsx** - This file contains five worksheets labeled *Quantity*, *Price*, *Real*, *Macro*, and *Contributions*.

The *Quantity* worksheet contains quarterly observations on all disaggregate components of nominal private fixed investment (PFI) from 1959:Q1 – 2017:Q3. Units are billions of current US \$.

The *Price* worksheet contains quarterly observations on all disaggregate components of the price deflator for PFI from 1959:Q1 – 2017:Q3. Units are an index where 2009=100.

The *Real* worksheet computes the real value of each disaggregate PFI quantity from 1959:Q1 – 2017:Q3 according to the following formula:  $(\text{Quantity}/1000) / (\text{Price}/100)$ .

The *Macro* worksheet contains quarterly observations from 1959:Q1 – 2017:Q3 on Real Gross Domestic Product, the Chain-type Price Index for Gross Domestic Product, the Effective Federal Funds Rate, the Producer Price Index for Fuels and Related Products & Power, the Producer Price Index by Commodity for Final Demand: Finished Goods, and the M1 money stock.

The *Contributions* worksheet computes the share of each disaggregate PFI quantity as a fraction of total PFI from 1959:Q1 – 2017:Q3.

**equipmentprofit.xlsx** – This file contains twelve worksheets that report yearly observations from the US Census Bureau Annual Survey of Manufactures (ASM) from 2005 – 2015. Each worksheet lists the various industries (along with NAICS codes) that comprise the equipment component of PFI. For each industry, the ASM contains data on total fringe benefits, production workers annual wages, total cost of materials, total value of shipments and receipts for services, finished goods inventories (beginning of year), and finished goods inventories (end of year). This data is used to compute annual profits and gross profit rates (profits / total value of shipments) for each industry in each year of the survey. The last worksheet in this file, called *Gross Profit*, computes the average profit rate for each industry over the years 2005-2015.

**constructionprofit.xlsx** – This file contains three worksheets that report yearly observations from the US Census Bureau Business Expenses Survey (BES) for years 2007 and 2012. The worksheets list the various industries that comprise the structures (nonresidential and residential) components of PFI. For each industry, the BES contains survey data on annual payroll, value of construction work for specialized type, and cost of construction work subcontracted out to other. This data is used to compute annual profits and gross profit rates for each industry in 2007 and 2012. The third worksheet, called *Gross Profit*, computes the average profit rate for each industry over the two years in the survey.

## Program Codes

We have organized the Matlab codes used to generate our results in a way that makes replication very easy. The first thing that must be done to replicate our results is to save all Matlab files along with the Excel data files into the same directory. Once this is done, simply run the respective files one at a time from your chosen directory. The files that you will need to run individually are called Fig1, Fig2, Fig3, Fig4, Fig5, Fig6, Fig7, Fig8, Fig10, Table1, and Table2. Each of these files obviously corresponds to one of the figures or tables presented in the published paper. None of the codes within each of these files needs to be modified by the user. Simply run them as is.

The primary replication codes listed above call a number of subordinate codes (or “functions” in Matlab) that need not be modified by the user. In fact, these subordinate files do not even need to be opened up in the Matlab user interface when running Figs 1-8, Fig 10, and Tables 1-2. They only need to be stored on the user’s computer in the same directory as all other files. Below is a list of these subordinate files along with a brief description of what they do.

cols.m – computes the number of columns in a matrix X

rows.m – computes the number of rows in a matrix X

trimr.m – returns a new matrix that strips out the first n1 rows and last n2 rows of a called matrix X

lag.m - returns a matrix of lagged values of the observations given in a called matrix X

vec.m – performs the columnwise vectorization of an m x n matrix X

vech.m – returns the column vector of elements on or below the main diagonal of a square matrix X

duplication.m – the matrix X, which for any symmetric n x n matrix A, transforms vech(A) into vec(A)

e.m – returns a row vector of length n with zeros everywhere except for a one in the m<sup>th</sup> column.

multirandn.m – generates T multivariate normal random vectors with a specified mean and covariance

jbfill.m – highlights in gray the vertical space between upper and lower confidence bands for impulse response functions in a Matlab figure

sylvester.m – solves the discrete Lyapunov equation using a fixed point method

recursiveness.m – performs the recursive (lower triangular or Cholesky) identification of a reduced-form VAR

triang\_fact.m – computes the unique triangular factorization of a real symmetric positive definite matrix X using the Cholesky decomposition

impulse.m – computes the dynamic response functions for all variables contained in a VAR to an orthogonalized shock

irfbands\_guassian.m – computes confidence bands for the orthogonalized impulse response functions from a VAR using the empirical distribution implied by monte carlo draws from the asymptotic distribution of the VAR coefficient estimates and the residual covariance matrix

vardecomp.m – decomposes the k-step-ahead forecast error variance (at any chosen horizon) of the orthogonalized shocks in a VAR

olss.m – computes the standard ols estimator

pcomp.m – computes the first K principle components of a large data matrix X, which correspond to estimates of the K latent factors in a FAVAR model

twostep.m – performs the “iterative approach” to estimation of the latent factors in a FAVAR model as described by Boivin Giannoni and Mihov (2009, *American Economic Review*).

## Results

Before running the individual replication codes Figs 1-8, Fig 10, and Tables 1-2, it is important that the user be aware of the fact that many of these files call results that have already been stored in an output file (Excel) called responsefunctions.xlsx and in several .mat files (II, IImean\_1, IImean\_2, IImean3, IIstdv\_1, IIstdv\_2, IIstdv\_3, QQ, QQmean\_1, QQmean\_2, QQmean\_3, QQstdv\_1, QQstdv\_2, QQstdv\_3). These files can be re-generated by the user before running the primary replication codes, or they can be called to the files as is.

The matlab file estimate\_main.m essentially computes the impulse response functions for all disaggregate PFI prices and quantities to an identified monetary shock along with their 90% upper and lower confidence bands. The results are stored in matrices irf\_ii, irf\_qq, irf\_ii\_LB, irf\_ii\_UB, irf\_qq\_LB and irf\_qq\_UB on lines 120 through 126 of that particular file. These response functions and the confidence bands have already been stored in the Excel file responsefunctions.xlsx under the worksheet headings *Quantity*, *Price*, *QbandsLB*, *QbandsUB*, *PbandsLB*, and *PbandsUB*. Again, the user does NOT have to rerun estimate\_main.m in before running Fig3, Fig 4, Fig5, Fig6, Fig7, Fig10, Table1 or Table2, but can choose to do so to see how the results are generated in each case. All of these primary files call the results already stored in responsefunctions.xlsx.

The matlab file estimate\_industry.m performs the same task that estimate\_main.m performs. It just does it one industry at a time. Here the user must specify the quantity and price variable to use from the full menu laid out in lines 31-226 of the code. The user inserts the quantity-price pair for a specific industry on lines 249 and 250 of the code. Nothing else needs to be modified by the user.

In order to generate Figure 5 in the manuscript, we had to run a bootstrap simulation of the industry results as described in Lastrapes (2006, *Journal of Money, Credit & Banking*). The file bootstrap.m performs this task. The user can simply re-run this file without modifying any of the code. The results will be saved at the end of the file in lines 159 and 160 in two large matrices called II and QQ. These two matrices will in turn be called by Fig5 when replicating Figure 5 from the paper. Again, the user need NOT re-run bootstrap.m to reproduce Fig5 since the matrices II and QQ have already been added to the replication files. But the user can re-run them to see how the bootstrap results are obtained.

Fig10.m plots the cross-sectional mean and standard deviations of all PFI prices and quantities under four different specifications of the empirical model. The first is the benchmark specification. The second is a specification that looks only at a subsample that covers 1981:Q1 – 2007:Q4. The third is a specification that relaxes the block exogeneity restrictions, and the fourth is a FAVAR specification. The files `estimate_subsample.m`, `estimate_noblockex.m`, and `estimate_FAVAR.m` generate the estimates that need to be called to Fig10.m. In each of these three files, nothing needs to be modified by the user. The results will be stored in matrices `llmean_1`, `qqmean_1`, `llstdv_1`, `qqstdv_1` (`estimate_subsample.m`), `llmean_2`, `qqmean_2`, `llstdv_2`, `qqstdv_2` (`estimate_noblockex.m`), `llmean_3`, `qqmean_3`, `llstdv_3`, and `qqstdv_3` (`estimate_FAVAR.m`). These 12 .mat files are then called to Fig10.m when replicating Figure 10 from the manuscript. But again, the user need NOT re-run `estimate_subsample.m`, `estimate_noblockex.m`, or `estimate_FAVAR.m` before running Fig10.m because the relevant .mat files have already been saved. The user can re-run them, however, to see how the results are generated.