Readme file for "Measuring Uncertainty and its Impact on the Economy"

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This file details the contents of the program and data files made available in the RESTAT data archive. These contents include data and computer programs used to produce the results in the published paper, the subset of results and separate programs used to produce the specific charts in the published paper, as well as the replication results provided. The results were produced with the RATS software program, run on the Mac OS X platform (Intel processor) with MacRats Pro 9.1. The programs will also run in RATS v.9 on the Linux and Windows platforms.

The files provided include the following:

- `uncertaintyestimates.xlsx`: Excel file containing posterior median uncertainty estimates (macro and financial, $\sqrt{m_t}$ and $\sqrt{f_t}$ in the paper's notation) from our baseline model.

- `codeanddata.tar.gz`: zipped file containing code and data used to produce the results, including charts covering all variables. Contents are detailed below.

- `producingfinalcharts.tar.gz` zipped file containing additional programs that were used on a post-processing basis to read in stored estimates and produce the charts as they appear in the paper, covering a subset of variables in many cases. This folder contains both the programs and estimates that are read in to create the charts (these estimates are duplicates of those available in the results contained within `codeanddata.tar.gz`).

- `drawsofparamsandstates.tar.gz` (very large) zipped file containing the draws of the models parameters and latent states. Some of the programs in `codeanddata.tar.gz` and `producingfinalcharts.tar.gz` call the files stored in this folder to produce estimates (historical decompositions and predictive distributions).

When the file `codeanddata.tar.gz` is unzipped, the contents will be organized into three folders, with contents as follows. Sections 1 through 4 detail the contents of these folders.

- `data` folder containing Excel files of time series data used in RATS programs;

- `procedures` folder containing RATS programs (text files) for model estimation and other calculations, called by other programs; and

- `programs` folder containing RATS programs (text files) that read in and transform data, call procedures, and produce the results provided in the paper. This folder also contains output files of results.

1 Data folder

The monthly data used in estimating the model are contained in two Excel files:

- `FRED_MD_2015m1.xls`
- `Frenchdata.xls`.

The variables used and their data file/program acronyms are listed in Table 1 below. For those variables transformed (differenced, log differenced, etc.), the transformations are conducted within the RATS programs for model estimation, etc. Additional variables used in computing the correlations of the paper's Table 2 are listed in the Table 2 below.

The first tab of the file `FRED_MD_2015m1.xls` contains most of the variables used in our analysis. The data were taken (in February 2015) from the McCracken and Ng (2016, JBES) factor model dataset. The dataset can be obtained at `https://research.stlouisfed.org/econ/mccracken/fred-databases/monthly/2015-01.csv`. The second tab of the file `FRED_MD_2015m1.xls` contains the full McCracken and Ng dataset as we originally obtained it.

The file `Frenchdata.xls` contains data on the remaining variables of our model, all constructed by Prof. Kenneth French from CRSP returns, made available on his webpage, and included as we originally obtained them in January 2016. We obtained our series from four files on French's website, for factors and various portfolios portfolios:

- Our series *excessreturn*, *SMB*, and *HML* come from the file `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Research_Data_Factors_CSV.zip`
- Our series *momentum* comes from the file `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Momentum_Factor_CSV.zip`
- Our series *R15_R11* is formed as the spread between the (1) small, high book-to-market and (2) small, low book-to-market portfolios in `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/25_Portfolios_5x5_CSV.zip`
- Our series *AGGIND1* through *AGGIND5* come from the file `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/5_Industry_Portfolios_CSV.zip`.

The following Excel files contain other data used in the analysis, as indicated below:

- `JLNuncertainty.xls`: Contains the monthly estimates of 1-step ahead macroeconomic uncertainty (series denoted *jlnh1*) from Jurado, Ludvigson, and Ng (2015) and 1-step ahead financial uncertainty (series denoted *jlnfinh1*) from Ma, Ludvigson, and Ng

(2016) used to initialize uncertainty in our model estimation. These series are read in and transformed by the program `estimatemodel.prg` described below. The data were obtained from the website of Prof. Sydney Ludvigson in February 2015 (macro uncertainty) and Dec. 2015 (financial uncertainty)

- `PPIcrudepetroleum.xls`: Contains the monthly PPI for crude petroleum used to form the net oil price increase (NOPI) series used to compute the correlation of our uncertainty shocks with oil price shocks. The PPI data were obtained from the Federal Reserve Bank of St. Louis' FRED database, as series *WPU0561*; details are provided in the second worksheet of the file. The program `constructingnetoilpriceshock.prg` described below reads in and transforms the PPI series to obtain the NOPI.

- `externalshocks.xlsx`: Contains macroeconomic shocks used in computing the correlations with our estimated uncertainty shocks in the paper's Table 2. The shock series, their acronyms, and their sources are listed in Table 2 below.

Table 1. Variables in the baseline model, with acronyms

Variable (transformation)	*acronym*
All Employees: Total nonfarm ($\Delta \ln$)	PAYEMS
IP Index ($\Delta \ln$)	INDPRO
Capacity Utilization: Manufacturing (Δ)	CAPUTLB00004S
Help wanted to unemployed ratio (Δ)	HWIURATIO
Unemployment rate (Δ)	UNRATE
Real personal income ($\Delta \ln$)	RPI
Weekly hours: goods-producing	CES0600000007
Housing starts (ln)	HOUST
Housing permits (ln)	PERMIT
Real consumer spending ($\Delta \ln$)	DPCERA3M086SBEA
Real manuf. and trade sales ($\Delta \ln$)	CMRMTSPLX
ISM: new orders index	NAPMNOI
Orders for durable goods ($\Delta \ln$)	AMDMNOX
Avg. hourly earnings, goods-prod. ($\Delta^2 \ln$)	CES0600000008
PPI, finished goods ($\Delta^2 \ln$)	PPIFGS
PPI, commodities ($\Delta^2 \ln$)	PPICMM
PCE price index ($\Delta^2 \ln$)	PCEPI
Federal funds rate (Δ)	FEDFUNDS
S&P 500 ($\Delta \ln$)	SP500
Spread, Baa-10y Treasury	BAAT10Y
Excess return	EXCESSRETURN
SMB FF factor	SMB
HML FF factor	HML
Momentum factor	MOMENTUM
R15_R11	R15_R11
Industry 1 return	AGGIND1
Industry 2 return	AGGIND2
Industry 3 return	AGGIND3
Industry 4 return	AGGIND4
Industry 5 return	AGGIND5

Note: For those variables transformed for use in the model, the table indicates the transformation in parentheses following the variable description.

Table 2. Variables used in correlation analysis

variable (sample)	*acronym*	*source*
Productivity: Fernald TFP	FernaldTFP	*dtfp_util* in Excel file on Fernald's webpage
(1960:Q4-2014:Q2)		http://www.frbsf.org/economic-research/files/quarterly_tfp.xls
Oil supply: Hamilton (2003)	HamiltonNOPI	constructed as indicated above
(1960:Q4-2014:Q2)		
Oil supply: Kilian (2008)	Kilianoil	obtained from file bpea_inst_1_corrected.xlsx of Stock and Watson (2012)
(1971:Q1-2004:Q3)	http://www.princeton.edu/~mwatson/ddisk/Stock_Watson_Disentangling_ReplicationFiles_July05_2013.zip	
Monetary policy: Guykaynak, et al. (2005)	GSSMP	obtained from file bpea_inst_1_corrected.xlsx of Stock and Watson (2012)
(1990:Q1-2004:Q4)	http://www.princeton.edu/~mwatson/ddisk/Stock_Watson_Disentangling_ReplicationFiles_July05_2013.zip	
Monetary policy: Coibion, et al. (2016)	CGKSMP	obtained from Excel file on Gorodnichenko's website
(1969:Q1-2008:Q4)		http://eml.berkeley.edu/~ygorodni/RR_MPshocks_Updated.xls
Fiscal policy: Ramey (2011)	Rameyfiscal	obtained from Excel file on Ramey's website
(1960:Q4-2008:Q4)		http://econweb.ucsd.edu/~vramey/research/govdat3908.csv
Fiscal policy: Mertens and Ravn (2012)	Mrfiscal	*sut* in file MertensRavnDATA_new.xls
(1960:Q4-2006:Q4)		https://www.aeaweb.org/aej/pol/data/2010-0152_data.zip

2 Procedures folder

The following files are RATS procedures written to perform calculations as indicated below. These procedures are called by the programs described in the next section.

- `modelestimation.src`: procedure for estimating paper's proposed model with two volatility factors; called by `estimatemodel.prg`.
- `impulseresponses.src`: procedure for computing impulse responses for shocks to uncertainty, using draws of coefficients given as inputs; called by `estimatemodel.prg`.
- `histdecomp.src`: procedure for computing historical decompositions, using draws of coefficients, latent states, etc., given as inputs; called by `histdecomp.prg`.
- `fcdistributioncomparison.src`: procedure for computing comparisons of predictive distributions with and without additional sequence of shocks to uncertainty, using draws of coefficients, latent states, etc., given as inputs; called by `forecastdistrib.prg`.
- `QSHAC.src`: procedure for regression estimation with standard errors computed using the pre-whitened QS estimator (Andrews-Monahan 1992); called by `shockcorrelations.prg`.

3 Programs folder

With one exception as indicated, the following files are RATS programs written to perform calculations as indicated below. Note: If one were to adapt the code to estimate with other data, it would probably be preferable to make the simple changes needed to `histdecomp.prg` and `forecastdistrib.prg` to pull the draws of parameters and latent states from the folder `draws_mly` needed and used by `estimatemodel.prg` to write results. Note: intentionally, the folder `programs` contains an empty subfolder `draws_mly` for storing draws if the program `estimatemodel.prg` is run (without that folder, if the program is run in batch mode, it will produce an error and crash).

- `estimatemodel.prg`: program for estimating paper's proposed model with two volatility factors. After writing to files draws of coefficients and latent states, the program produces charts of volatility and uncertainty estimates, computes the impulse responses for shocks to uncertainty, and produces charts of the impulse responses. The stored draws can be used by the programs `histdecomp.prg` and `forecastdistrib.prg`. The estimated uncertainty series, volatility series, and impulse responses are reported in the paper's Figures 1, 2, 3, and 4.

- `histdecomp.prg`: program for computing historical decompositions for 2003-2014 using the paper's proposed model with two volatility factors. After reading in files of draws of coefficients and latent states from the folder `drawsofparamsandstates`, the program computes the decompositions and produces charts. The estimated historical decompositions are reported in the paper's Figure 5.

- `histdecomp_8502.prg`: program for computing historical decompositions for 1985-2002 using the paper's proposed model with two volatility factors. After reading in files of draws of coefficients and latent states from the folder `drawsofparamsandstates`, the program computes the decompositions and produces charts. The program is the same as `histdecomp.prg` except in the definition of the decomposition sample and the names of the files to which charts are written. The estimated historical decompositions are reported in the paper's Figure 6.

- `forecastdistrib.prg`: program for computing comparisons of predictive distributions with and without sequence of shocks to uncertainty using the paper's proposed model with two volatility factors. The sequence of shocks = posterior medians of shocks to uncertainty over the NBER-dated recession. After reading in files of draws of coefficients and latent states from the folder `drawsofparamsandstates`, the program computes the predictive distributions and produces charts. The estimated distributions are reported in the paper's Figure 7.

- `constructingnetoilpriceshock.prg`: program for using the PPI for crude petroleum to construct the net oil price shock of Hamilton (2003). The series is written to the Excel file `netoilprice.xls`.

- `shockcorrelations.prg`: Program for computing the correlation results in the paper's Table 2. The program reads in posterior medians of our orthogonalized shocks to uncertainty (produced by running estimatemodel.prg) and reads in data on known macro shocks, to TFP, oil, etc. The shocks to uncertainty are stored in `uncertaintyshocks.xlsx`, and the known macro shocks are stored in `externalshocks.xlsx`. The program then computes correlations and t-statistics for the slope coefficient of a regression of the uncertainty shocks on the known macro shocks.

- `uncertaintyshocks.xlsx`: Excel file containing the time series of the posterior medians of orthogonalized shocks to macroeconomic and financial uncertainty. The estimates are produced by `estimatemodel.prg` and used by `shockcorrelations.prg` to compute the shock correlations reported in Table 2.

In the folder `programs`, the folder `out` contains the results of running the programs listed above. These results include: text files of output produced by RATS; Excel files containing estimates of uncertainty, volatility, historical decompositions, and the predictive distributions; and pdf files of charts.

4 Producingfinalcharts folder

This folder contains programs used to read in estimates produced by the code described above and create the charts as they appear in the paper. The underlying results are exactly the same as those produced by the code above; these programs cut down the sets of variables for which results are shown and change chart formatting for readability. (If one does not want to produce the exact charts of the paper, one does not need this folder.)

The programs are as follows, for the indicated figures. In producing the charts of the paper, the programs were run in RATS in interactive mode, to write charts in black and white as portrait postscript files.

- `Figure1.prg`
- `Figure2.prg`
- `Figure7.prg`
- `Figures3and4.prg`
- `Figures5and6.prg`

The programs `Figure2.prg` and `Figure7.prg` read in two text files, `figure2linesettings.txt` and `figure7linesettings.txt`, respectively, to read in some chart settings to modify software defaults.

As needed, the programs read in estimates or data from the following Excel files. The data files are exactly the same as those available in the main `data` folder. The estimates in the other files listed are taken from files produced by running the programs in the main `programs` folder; these files have the same results as those in the `programs/out` folder (with some deleted because they are not needed for the charts).

- `FRED_MD_2015m1.xls`: data file as above.
- `Frenchdata.xls`: data file as above.
- `estimatemodel.xlsx`: Excel file with uncertainty estimates of Figure 1 and volatility estimates reported in Figure 2

- `estimatemodel_idiosynvol.xlsx`: Excel file with idiosyncratic volatility estimates reported in Figure 2
- `estimatemodel.impresp.xlsx`: Excel file with impulse response estimates reported in Figures 3 and 4
- `histdecomp.xlsx`: Excel file with 2003-2014 historical distributions reported in Figure 5
- `histdecomp_8502.xlsx`: Excel file with 1984-2002 historical distributions reported in Figure 5
- `forecastdistrib.xlsx`: Excel file with predictive distributions reported in Figure 7