

ReadMe for Replication Package

Inflation and Real Activity over the Business Cycle

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Overview

The package reproduces all exhibits in the manuscript (Figures 1–7, Tables 1–4). All codes are in MATLAB; `RUN_ALL.m`, run from this folder, executes the whole workflow from the raw data to every exhibit. All data are included. Folders:

- **Replication Package BNS Data 2026** — raw data (Excel) and the scripts that build the analysis datasets.
- **Replication Package BNS Estimation 2026** — estimation, identification, and forecasting routines; `Do_*` scripts for Figures 1–6 and Tables 1–4.
- **Replication Package BNS Simulation 2026** — simulation study and Figure 7.

Data Availability and Provenance Statements

- ☒ We certify that the authors of the manuscript have legitimate access to and permission to use the data used in this manuscript.
- ☒ We certify that the authors of the manuscript have documented permission to redistribute/publish the data contained within this replication package.
- ☒ All data are publicly available, free of restrictions, and included in the package. No data are subject to access restrictions. “Obtaining the raw data” below gives, for each series, the source, the file to download, and the steps to the analysis datasets.

The Angeletos, Collard, and Dellas (2020) dataset used in Table 2 and Figure 6 is constructed from the FRED and TFP series above (Table A4). Variable definitions and transformations are in Tables A1–A4.

Computational requirements

MATLAB R2025b with the Statistics and Machine Learning Toolbox; the simulation study also needs the Global Optimization and Optimization Toolboxes and uses the Parallel Computing Toolbox if installed. All random draws use fixed seeds (`rng(1234567890)` in the estimation package, `rng(1)` in the simulation package), so results reproduce exactly. A full run of `RUN_ALL.m` takes about 45 hours on a MacBook Pro (Apple M4 Max, 16 cores, 128 GB RAM), most of it in the four forecasting routines; the simulation study takes about 55 minutes with 16 workers. Intermediate `.mat` results (about 13 GB) are not included; all final figures and tables are.

Data	File (sheet)	Provided	Access	Citation
Macroeconomic series from FRED (14 series, Table A3)	Data_macro_1955_2019.xlsx (Quarterly)	Yes	FRED: free, no registration. Downloaded July 2026	U.S. Bureau of Economic Analysis (2026); U.S. Bureau of Labor Statistics (2026); Board of Governors (2026)
Utilization-adjusted TFP growth (DTFPu)	Data_macro_1955_2019.xlsx (Quarterly)	Yes	FRB San Francisco website: free. File quarterly_tfp.xlsx, vintage Feb. 12, 2025	Fernald (2014)
SPF median forecasts: inflation (INFPGDP1YR, INFCPI10YR) and unemployment (UNEMP6)	Data_expectations_inflation.xlsx (Raw); Data_expectations_unemp.xlsx (Median_Level)	Yes	FRB Philadelphia website: free, no registration. Files Inflation.xlsx, Median_UNEMP_Level.xlsx. Downloaded July 2026	Federal Reserve Bank of Philadelphia (2026a, 2026b)
Blue Chip ten-year-ahead CPI inflation forecasts, 1979:Q4–1991:Q1 (24 semiannual obs.)	Additional-CPIE10.xlsx (column Blue Chip); copied to Data_expectations_inflation.xlsx (Raw, column INFCPI10YR_BlueChip)	Yes	FRB Philadelphia website, file Additional-CPIE10.xlsx (compiled and distributed by the FRB Philadelphia): free, no registration. Downloaded September 2026	Federal Reserve Bank of Philadelphia (2026c); Blue Chip Economic Indicators (1991)
CPI and GDP deflator (CPIAUCSL, GDPDEF)	Data_expectations_inflation.xlsx (Historical)	Yes	FRED, as above	U.S. Bureau of Labor Statistics (2026); U.S. Bureau of Economic Analysis (2026)
NBER recession dates (shading in Figure 1)	recess.mat (estimation folder, data)	Yes	NBER website: free	National Bureau of Economic Research (2026)

Instructions to replicators

In MATLAB, set the current folder to this folder and run RUN_ALL. It executes, in order:

1. MAIN_data.m (data folder): builds data_1955_2019.mat, data_infl_exp_19.mat, and data_unr_exp_19.mat from the Excel files (scripts build_data_*.m) and copies them to the estimation folder data.
2. MASTER.m (estimation folder): estimation (MAIN_ESTIMATE_TCVAR, _VAR, _VAR_AER; 50,000 draws, first half discarded), max-share identification (MAIN_IDSHOCKS_TCVAR_cyc2a11 baseline, _TCVAR_obs, _VAR, _VAR_AER), historical shocks (MAIN_SHOCK_DRAW_TCVAR, _VAR), and recursive forecasting (MAIN_FORECAST_TCVAR, _TCVAR_woSPF, _VAR, _VAR_AER; 68 windows, 10,000 draws each). Results are saved in results and forecasting results.
3. Do_Figure_1 to Do_Figure_6 and Do_Table_1 to Do_Table_4 (estimation folder).
4. MAIN_SIMULATION.m and Do_Figure_7.m (simulation folder).

Console output, including the printed tables, is saved to RUN_ALL_log.txt. To reproduce one exhibit, run the routines listed under “Required routines” below, then the Do_* script. The Online Appendix routines (MAIN_ESTIMATE_TCVAR_lag4, _uncorr, _woSPF, the matching MAIN_IDSHOCKS routines, and Do_APPX_*) are included and listed as comments in MASTER.m; RUN_ALL.m does not run them (about 10 additional hours). The VAR estimation leaves scratch files (H.dat, g1.mat–g3.mat).

Obtaining the raw data

All raw files are free downloads without registration; the Excel files in the data folder hold them as values (no formulas).

1. **FRED** (<https://fred.stlouisfed.org/>): the series of Table A3, quarterly (UNRATE, FEDFUNDS: quarterly averages; CNP160V, CE160V: end of quarter), 1954:Q4–2019:Q4, into the columns of that name in sheet Quarterly of Data_macro_1955_2019.xlsx; GDPDEF and CPIAUCSL levels, 1947:Q1–2019:Q4, into sheet Historical of Data_expectations_inflation.xlsx.
2. **Fernald TFP** (<https://www.frbsf.org/research-and-insights/data-and-indicators/total-factor-productivity-tfp/>): file quarterly_tfp.xlsx, series dtfp_util, into column DTFPu of sheet Quarterly.
3. **Survey of Professional Forecasters** (<https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/survey-of-professional-forecasters>): file Inflation.xlsx, columns INFPGDP1YR and INFCPI10YR, into columns INFPGDP1YR and INFCPI10YR_SPF of sheet Raw of Data_expectations_inflation.xlsx; file Median_UNEMP_Level.xlsx, column UNEMP6, into sheet Median_Level of Data_expectations_unemp.xlsx. From the page “Short-Term and Long-Term Inflation Forecasts” (<https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/inflation-forecasts>), file Additional-CPIE10.xlsx, column Blue Chip, into column INFCPI10YR_BlueChip of sheet Raw.
4. **NBER recession dates** (<https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions>): peak and trough months as decimal years in recess.mat (estimation folder, data); shading in Figure 1 only.

From the raw files to the analysis datasets (MAIN_data.m runs the three scripts and copies the output to the estimation folder):

- build_data_macro.m: applies the transformations of Tables A2 and A4 to sheet Quarterly and saves data_1955_2019.mat.
- build_data_infl_exp_19.m: following Del Negro and Schorfheide (2013), the ten-year series is the Blue Chip forecast (24 semiannual observations, 1979:Q4–1991:Q1) or, from 1991:Q4, INFCPI10YR, minus the CPI–GDP-deflator gap, divided by 4. The gap (0.3436, cell H2 of sheet Raw) is the 1955:Q2–2019:Q4 average difference between the four-quarter CPI and GDP-deflator inflation rates in sheet Historical. Sheet Raw shows the calculation; sheet Data_expectations holds the quarterly series 1955:Q1–2019:Q4 (NaN where no survey exists). The script reads it, recomputes the Blue Chip quarters from column INFCPI10YR_BlueChip, and saves data_infl_exp_19.mat.
- build_data_unr_exp_19.m: reads sheet UNEMP6 (the Median_Level series at quarterly dates) and saves data_unr_exp_19.mat.

List of tables and figures

Paths are relative to the estimation folder (Figure 7: simulation folder); MAIN_ prefixes omitted. Figures are saved as .pdf and .eps; each .csv has, per panel, a label line, a header line, and rows for the posterior median (50) and the 16th and 84th percentiles.

Numbers quoted in the text are cells of these tables, the correlations shown in the legends of Figures 3 and 4, and the population variance decompositions printed to the console by Do_Figure_7.

Exhibit	Script	Required routines	Output file
Figure 1	Do_Figure_1	ESTIMATE.TCVAR	figure/Figure_1Trends.pdf, figure/Figure_1Cycles.pdf
Figure 2	Do_Figure_2	ESTIMATE.TCVAR, IDSHOCKS.TCVAR_cyc2all	figure/Figure_2.pdf
Figure 3	Do_Figure_3	ESTIMATE.TCVAR, SHOCK_DRAW.TCVAR, ESTIMATE.VAR, SHOCK_DRAW.VAR	figure/Figure_3_observables.pdf, figure/Figure_3_cycles.pdf
Figure 4	Do_Figure_4	same as Figure 3	figure/Figure_4_Shock.pdf, figure/Figure_4_ImpliedSeries.pdf
Figure 5	Do_Figure_5	ESTIMATE.TCVAR, IDSHOCKS.TCVAR_obs, ESTIMATE.VAR, IDSHOCKS.VAR	figure/Figure_5.6-32-Q.pdf, figure/Figure_5.16-50-Q.pdf
Figure 6	Do_Figure_6	the four FORECAST routines	figure/Figure_6.pdf
Figure 7	Do_Figure_7	SIMULATION	figures/Figure_7_Population.pdf, figures/Figure_7_FiniteSample.pdf
Table 1	Do_Table_1	ESTIMATE.TCVAR, IDSHOCKS.TCVAR_cyc2all	results/Table_1.csv
Table 2	Do_Table_2	ESTIMATE.VAR, IDSHOCKS.VAR, ESTIMATE.VAR_AER, IDSHOCKS.VAR_AER	results/Table_2.csv (six panels: three priors $\times$ two datasets)
Table 3	Do_Table_3	ESTIMATE.TCVAR, IDSHOCKS.TCVAR_cyc2all	results/Table_3.csv (panel A, then the three bands of panel B)
Table 4	Do_Table_4	ESTIMATE.TCVAR, IDSHOCKS.TCVAR_obs, ESTIMATE.VAR, IDSHOCKS.VAR	results/Table_4.csv (one panel per cell: nine for panel A, nine for panel B)

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Data description

Table A1: Baseline data

Data	Mnemonic	Frequency	Transform
Real gross domestic product per capita	A939RX0Q048SBEA	Q	—
Gross domestic product: implicit price deflator	GDPDEF	Q	—
Unemployment rate	UNRATE	M	Ave
Federal funds rate	FEDFUNDS	M	Ave
Inflation expectations, 1 year, SPF	INFPGDP1YR	Q	—
Inflation expectations, 10 years, SPF	INFCPI10YR	Q	—
Inflation expectations, 10 years, Blue Chip	Blue Chip	semiannual	—
Unemployment rate expectations, 1 year, SPF	UNEMP6	Q	—

Note: Q: quarterly. M: monthly. EoP: end of period. Ave: quarterly average.

Table A2: Baseline data: transformations

Variable	Transformation
Real GDP per capita [growth rate]	$Y = 400 \times \log(A939RX0Q048SBEA[t]/A939RX0Q048SBEA[t-1])$
Inflation rate	$\pi = 400 \times \log(GDPDEF[t]/GDPDEF[t-1])$
Inflation expectations, 1 year	$\pi^{e,1y} = \text{INFPGDP1YR}$
Inflation expectations, 10 years	$\pi^{e,10y} = \text{INFCPI10YR}$ (from 1991:Q4) or Blue Chip (semiannual, 1979:Q4–1991:Q1), minus the 1955:Q2–2019:Q4 average difference between annualized CPI and GDP-deflator inflation
Unemployment expectations, 1 year	$u^{e,1y} = \text{UNEMP6}$

Table A3: Angeletos et al. (2020) data

Data	Mnemonic	Frequency	Transform
Real gross domestic product per capita	A939RX0Q048SBEA	Q	—
Gross domestic product	GDP	Q	—
Gross domestic product: implicit price deflator	GDPDEF	Q	—
Share of GDP: personal consumption expenditures: nondurable goods	DNDGRE1Q156NBEA	Q	—
Share of GDP: personal consumption expenditures: services	DSERRE1Q156NBEA	Q	—
Share of GDP: personal consumption expenditures: durable goods	DDURRE1Q156NBEA	Q	—
Share of GDP: gross private domestic investment	A006RE1Q156NBEA	Q	—
Nonfarm business sector: real output per hour of all persons	OPHNFB	Q	—
Nonfarm business sector: labor share	PRS85006173	Q	—
Nonfarm business sector: average weekly hours	PRS85006023	Q	—
Civilian non-institutional population	CNP16OV	M	EoP
Civilian employment level	CE16OV	M	EoP
Unemployment rate	UNRATE	M	Ave
Federal funds rate	FEDFUNDS	M	Ave
Utilization-adjusted TFP [growth rate]	DTFPu	Q	—

Note: Q: quarterly. M: monthly. EoP: end of period. Ave: quarterly average. GDP is in the data file but not used. All series except DTFPu are from FRED; DTFPu is from Fernald (2014).

Table A4: Angeletos et al. (2020) data: transformations

Variable	Transformation
Real GDP per capita	$Y = 100 \times \log(\text{A939RX0Q048SBEA})$
Real consumption per capita	$C = 100 \times \log((\text{DNDGRE1Q156NBEA} + \text{DSERRE1Q156NBEA}) \times \text{A939RX0Q048SBEA})$
Real investment per capita	$I = 100 \times \log((\text{DDURRE1Q156NBEA} + \text{A006RE1Q156NBEA}) \times \text{A939RX0Q048SBEA})$
Hours worked	$h = 100 \times \log(\text{PRS85006023} \times \text{CE16OV}/\text{CNP16OV})$
Inflation rate	$\pi = 100 \times \log(\text{GDPDEF}[t]/\text{GDPDEF}[t-1])$
Interest rate	$R = \text{FEDFUNDS}/4$
Productivity (NFB)	$\gamma/h = 100 \times \log(\text{OPHNFB})$
Labor share	$wh/y = 100 \times \log(\text{PRS85006173})$
TFP	$\text{TFP} = \text{cumulative sum}(\text{DTFPu}/4)$

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