Instructions For Replication "Incorporating Diagnostic Expectations into the New Keynesian Framework"

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1 Overview

This file first describes the data availability and describes the data used in estimation. Then we list the software requirements on which the paper's codes were constructed and verified, followed by summary of estimation routines, and finally description of codes that reproduce the figures and tables reported in the paper. Note that all data are in the public domain. To reproduce all figures and tables, wihout re-estimating the models, the replicator should expect the codes to run for less than 5 minutes. Run times for various estimations are provided in Table 1.

2 Data Availability and Provenance Statements

We list the sources of data. All data are in public domain. The data are licensed under a Creative Commons/CC-BY-NC license.

- We certify that the authors of the manuscript have legitimate access to and permission to use the data used in this manuscript.
- Some of the data used in this manuscript are borrowed from publicly available replication folders of published papers. Please cite the corresponding paper if using the data.

3 Data Description

We obtain the (non-forecast) data from the replication files of Blanchard, L'Huillier, and Lorenzoni (2013b). We briefly summarize the data construction as described by Blanchard, L'Huillier, and Lorenzoni (2013a). The series for Real GDP, Real Personal Consumption Expenditures, Real Personal Durable Consumption Expenditures, Real Gross Private Domestic Investment, Wages and the GDP Implicit Price Deflator are from the Bureau of Economic Analysis. Population and employment series are from the Bureau of Labor Statistics online database (series IDs LNS10000000Q and LNS12000000Q respectively). The Federal Funds Rate series is from the Federal Reserve Board online database (series ID H15/H15/RIFSPFF N.M).

We obtained the Survey of Professional Forecasters' forecast data directly from Survey of Professional Forecasters (2022). We use the median forecast (across individual forecasters) as the consensus forecast, available in Survey of Professional Forecasters (2022). All forecasts we use are

one quarter ahead forecasts. For the output (series ID RGDP), consumption (series ID RCONSUM), and investment (series ID RNRESIN) growth rate, we subtract these growth rate forecasts by actual population growth rate to obtain per capita forecasts. Inflation and the nominal interest rate are obtained from the GDP Price Deflator and the Treasury bill rate (series IDs PGDP and TBILL). Forecast data are available from 1968:IV to 2004:IV for the output growth rate and inflation, and from 1981:III to 2004:IV for the consumption and investment growth rate, and for the nominal interest rate.

For robustness estimations of comparison with alternate models, we obtain the data from the replication files of Smets and Wouters (2007a) and Justiniano, Primiceri, and Tambalotti (2010b).

4 Software Requirements

Matlab and Dynare are required to reproduce results. The results in the manuscript are generated by Matlab R2021b (update 3) and Dynare 4.57 on Windows 10 PC (11th Gen Intel Core i7-11700T @ 1.40GHz, 16 GB Ram).

5 Estimation

Dynare codes for Bayesian inference in diagnostic (DE) and rational (RE) agents models using both business cycle and expectations data.

5.1 Baseline estimation

To replicate DE parameter estimates (Table 1, DE), use `DE_BLL_growth.mod` in the directory `./Estimation/Baseline/DE`. To replicate RE parameter estimates (Table 1, RE), use `RE_BLL_growth.mod` in the directory `./Estimation/Baseline/RE`. The estimation routines use the full-information equivalent model.

- `data.m`: contains twelve series used for estimation, U.S. time series for GDP growth, consumption growth, investment growth, employment, the federal funds rate, inflation, and wages and SPF data on consumption growth, investment growth, output growth, short-term inflation, and short-term interest rate forecasts. The U.S. time series for GDP growth, consumption growth, investment growth, employment, the federal fund rate, inflation, and wage are obtained from the replication files of Blanchard et al. (2013b). The SPF data on consumption growth, investment growth, output growth, short-term inflation, and short-term interest rate forecasts are obtained from Survey of Professional Forecasters (2022). The model is estimated over the sample period from 1954:III to 2004:IV.
- `estimate_DE.mod`: runs Bayesian estimation of the baseline model under DE. It generates 5 million draws using a Metropolis-Hastings algorithm and discards the first 20% as initial burn-in.
- `estimate_RE.mod`: runs Bayesian estimation of the baseline model under RE. It generates 5 million draws using a Metropolis-Hastings algorithm and discards the first 20% as initial burn-in.
- `DE_BLL_mode.mat`: is used as the mode for DE estimation.
- `RE_BLL_mode.mat`: is used as the mode for RE estimation.

5.2 Robustness

5.2.1 Prior centered around 0

To replicate DE parameter estimates (Table 9, DE), use `DE_BLL_growth_0.mod` in the directory `./Estimation/Baseline/DE_Prior0`. The prior on θ is centered around 0.

- `DE_BLL_growth_0.mod`: runs Bayesian estimation of the baseline model under DE. We let the prior on the diagnosticity parameter centered to be around 0. It generates 5 million draws using a Metropolis-Hastings algorithm and discards the first 20% as initial burn-in.
- `DE_BLL_mode_0.mat`: is used as the mode for this estimation.

5.2.2 Smets and Wouters (2007a)

To replicate DE parameter estimates (Table 11, DE), use `estimate_SW_DE.mod`. The file is stored in the directory `./Estimation/Robustness/SW/DE`. To replicate RE parameter estimates (Table 11, RE), use `estimate_SW_RE.mod` in the directory `./Estimation/Robustness/SW/RE`.

- `usmodel_data.m`: contains seven series used for estimation: real GDP, real consumption, real investment, real wage, log hours worked, the log difference of the GDP deflator and the federal funds rate. We use the exact same data as in Smets and Wouters (2007b). The model is estimated over the sample period from 1966:I to 2004:IV.
- `estimate_SW_DE.mod`: runs Bayesian estimation of the baseline model under DE. It generates 1 million draws using a Metropolis-Hastings algorithm and discards the first 20% as initial burn-in.
- `estimate_SW_RE.mod`: runs Bayesian estimation of the baseline model under RE. It generates 1 million draws using a Metropolis-Hastings algorithm and discards the first 20% as initial burn-in.
- `SW_DE_mode.mat`: is used as the mode for DE estimation.
- `SW_RE_mode.mat`: is used as the mode for RE estimation.

5.2.3 Justiniano, Primiceri, and Tambalotti (2010a)

To replicate DE parameter estimates (Table 13, DE), use `estimate_JPT_DE.mod`. The file is stored in the directory `./Estimation/Robustness/JPT/DE`. To replicate RE estimates (Table 13, RE), use `estimate_JPT_RE.mod` in the directory `./Estimation/Robustness/JPT/RE`.

- `DataJPT.m`: contains seven series used for estimation: U.S. time series for real GDP, real consumption, real investment, real wage, log hours worked, the log difference of the GDP deflator and the federal funds rate. We use the exact same data as Justiniano et al. (2010a). These data were downloaded from Andrea Tambalotti's academic website which used to be hosted by the Federal Reserve Bank of New York and is no longer active. We attribute the data file to JPT and provide in our replication folder as is. See the web archive snapshot of his website at Justiniano, Primiceri, and Tambalotti (2010b). The model is estimated over the sample period from 1954:III to 2004:IV.

- `estimate_JPT_DE.mod`: runs Bayesian estimation of the baseline model under DE. It generates 1 million draws using a Metropolis-Hastings algorithm and combines them with pre-drawn 4 million draws. It discards the first 20% as initial burn-in.
- `estimate_JPT_RE.mod`: runs Bayesian estimation of the baseline model under RE. It generates 1,000,000 draws using a Metropolis-Hastings algorithm and combines them with pre-drawn 4 million draws. It discards the first 20% as initial burn-in.
- `estimate_JPT_DE_mh_mode.mat`: is used as the mode for DE estimation.
- `estimate_JPT_RE_mh_mode.mat`: is used as the mode for RE estimation.

Table 1: Run Time, Estimations

	DE	DE (Prior at 0)	RE
Baseline	34h41m17s	34h37m48s	32h14m07s
SW	10h40m19s		9h59m55s
JPT	15h04m29s		13h09m17s

Notes: SW and JPT refer to Smets and Wouters (2007a) and Justiniano et al. (2010a).

6 Replicating Tables and Figures

6.1 Section 2 (Simple demand and supply example.)

6.1.1 Figure 1

To replicate Figure 1, run `replicate_figure1.m`. The file is stored in the directory `./TablesFigures/Section_2/Figure_1`. Figures show the responses of investment I_t and the price P_t to a one-unit negative shock.

- `Muth.mod`: simulates the commodity market model suggested by Muth (1961) in Section 2.

6.2 Section 4 (Baseline New Keynesian model.)

6.2.1 Figure 3

To replicate the excess volatility result under DE in the baseline New Keynesian model (Figure 3), use `replicate_figure3.m`. The file is stored in the directory `./TablesFigures/Section_4/Figure_3`.

- `NK_vol.mod`: simulates a simple New Keynesian model to compute the output volatility given the slope of the Phillips curve, κ, and the degree of diagnosticity, θ.

6.2.2 Figure 4

To replicate Figure 4, run `replicate_figure4.m`. The file is stored in the directory `./TablesFigures/Section_4/Figure_4`.

- `baselineNK.mod`: simulates a baseline New Keynesian model under DE and RE.

6.3 Section 5 (Medium-scale DSGE model.)

6.3.1 Figure 5

Replicating impulse responses (Figure 5), run `replicate_figure5.m`. The file is stored in the directory `./TablesFigures/Section_5/Figure_5`.

- `RE_BLL_Growth.mod`: simulates the baseline DSGE model with RE counterfactual.
- `DE_BLL_Growth.mod`: simulates the baseline DSGE model with DE parameter estimates in Table 1.
- `mode_params_DE_RE.mod`: contains DE parameter estimates in Table 1 except setting $\theta = 0$.
- `mode_params_DE.mod`: contains DE parameter estimates in Table 1.
- `KF_BLL.m`: computes a Kalman filter.
- `convert_BLL_DE.m`: compute the IRFs of the DE model using IRFs of the equivalent full information model and compute the conditional variance decomposition.
- `convert_BLL_RE.m`: compute the IRFs of the RE model using IRFs of the equivalent full information model and compute the conditional variance decomposition.

6.3.2 Figure 6

To replicate impulse responses (Figure 6), run `replicate_figure6.m`. The file is stored in the directory `./TablesFigures/Section_5/Figure_6`.

- `RE_BLL_Growth.mod`: simulates the baseline DSGE model with RE counterfactual.
- `DE_BLL_Growth.mod`: simulates the baseline DSGE model with DE parameter estimates in Table 1.
- `mode_params_DE_RE.mod`: contains DE parameter estimates in Table 1 except setting $\theta = 0$.
- `mode_params_DE.mod`: contains DE parameter estimates in Table 1.
- `KF_BLL.m`: computes a Kalman filter.
- `convert_BLL_DE.m`: compute the IRFs of the DE model using IRFs of the equivalent full information model and compute the conditional variance decomposition.
- `convert_BLL_RE.m`: compute the IRFs of the RE model using IRFs of the equivalent full information model and compute the conditional variance decomposition.

6.3.3 Table 2

To compute the one-step-ahead variance decomposition across all structural shocks for quantities and prices in our baseline DSGE model (Table 2), run `replicate_table2.m`. The file is stored in the directory `./TablesFigures/Section_5/Table_2`.

- `RE_BLL_Growth.mod`: simulates the baseline DSGE model with RE parameter estimates in Table 1.
- `DE_BLL_Growth.mod`: simulates the baseline DSGE model with DE parameter estimates in Table 1.
- `mode_params_RE.mod`: contains RE parameter estimates in Table 1.
- `mode_params_DE.mod`: contains DE parameter estimates in Table 1.
- `KF_BLL.m`: computes a Kalman filter.
- `convert_vdec.m`: compute the IRFs of the original model using IRFs of the equivalent full information model and compute the conditional variance decomposition.

6.3.4 Table 3

To compute the one-step-ahead variance decomposition for the forecast data (Table 3), run `replicate_table3.m`. The file is stored in the directory `./TablesFigures/Section_5/Table_3`.

- `RE_BLL_Growth_F1.mod`: simulates the baseline DSGE model with RE parameter estimates in Table 1. It also generates the responses of forecast variables.
- `DE_BLL_Growth_F1.mod`: simulates the baseline DSGE model with DE parameter estimates in Table 1. It also generates the responses of forecast variables.
- `mode_params_RE.mod`: contains RE parameter estimates in Table 1.
- `mode_params_DE.mod`: contains DE parameter estimates in Table 1.
- `KF_BLL.m`: computes the Kalman filter.
- `convert_vdec_F1.m`: compute the IRFs of the original model using IRFs of the equivalent full information model and compute the conditional variance decomposition for forecast variables.

6.3.5 Figure 7

To replicate Figure 7, use `replicate_figure7.m`. The file is stored in the directory `./TablesFigures/Section_5/Figure_7`.

- `data.m`: contains twelve series used for estimation, U.S. time series for GDP growth, consumption growth, investment growth, employment, the federal funds rate, inflation, and wages and SPF data on consumption growth, investment growth, output growth, short-term inflation, and short-term interest rate forecasts.
- `DE_BLL_Growth_output.mat`: contains smoothed estimates of underlying variables from our DE estimation exercise.
- `RE_BLL_Growth_output.mat`: contains smoothed estimates of underlying variables from our RE estimation exercise.

6.4 Appendix D (Real business cycle model.)

6.4.1 Table 5

To compute model-implied volatilities with stationary TFP shocks with the baseline NK model and the RBC model, replicating Table 5, run `.replicate_table5.m`. The file is stored in the directory `./TablesFigures/Appendix_D/Table_5`.

- `simulate_NK.mod`: simulates a simple New Keynesian model to compute model-implied volatilities.
- `simulate_RBC.mod`: simulates a real business cycle model to compute model-implied volatilities.

References

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