Supplementary Material for "Estimating the Natural Rate of Interest in an Open Economy"

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1   Data

The Data.xlsx contains five excel sheets:

(1) Sheet "USA" contains all the U.S. indicators we used to estimate the model, most of which are from HAVER Analytics. The HAVER codes for the data series we use are: GDP - GDPH@USECON; Core PCE deflator - JCXFE@USECON; Effective Federal Funds Rate - FFED@USECON; FRBNY discount rate - FDWB@USECON; PCE deflator - JC@USECON. The Price index for imports excluding petroleum, computers and semiconductors as well as the crude imported oil price are from the FRB/US dataset (https://www.federalreserve.gov/econres/us-models-package.htm).

(2) Sheet "Japan" contains all the Japanese indicators we used to estimate the model. The HAVER codes for the data series we use for Japan are as follows: GDP - A158GDPC@OECDNAQ; Core CPI - C158CZCN@OECDMEI; Tokyo overnight call rate - C158IM@IFS; Import prices - H158PFMI@G10; Import price for petroleum, coal and natural gas - H158PFMP@G10.

(3) Sheet "10yyieldsg7" contains the yields of ten year government treasury bonds for each of the G7 countries, which are used to generate Figure 1. The data are available through FRED (https://fred.stlouisfed.org/).

(4) Sheet "JPESRIDate" contains the recession dates of Japan according to its cabinet office. The data can be obtained through: http://www.esri.cao.go.jp/en/stat/di/150724rdates.html. The U.S. NBER recession dates, already included in the Matlab system, are accessible through http://www.nber.org/cycles.html.

(5) Sheet "LWestimate" contains the U.S. natural rate estimated by Laubach and Williams at the same observation vintage as ours in 2015Q2. The real-time estimates are accessible through John C. Williams' webpage (http://www.frbsf.org/economic-research/economists/john-williams/).

2 Code and Program

mainlwusbayes.m: set the starting value of the MCMC procedure by maximizing the posterior of the parameters;

mcmcparam.m: use the output of mainlwusbayes.m as the starting value and then implement the Metropolis Hasting MCMC procedure to draw parameters from the posterior;

mainbase.m: this is the main file for the baseline model which uses the posterior draws by mcmcparam.m to produce Table 1, Table 4 and Figures 2-7;

mainrobust.m: this is the main file for the baseline model which uses the posterior draws by mcmcparam.m to produce Table 3, Table 4 and Figures 8-13;

Table2.m: use the data to calculate the BICs shown in Table 2;

Fig1.m: output Figure 1 with the ten year treasury bond yields.

postestfxfunbig.m: subroutine used to evaluate the posterior likelihood of a draw;

priorprobex.m: subroutine called by posteextfxfunbig.m which evaluates the prior likelihood of a draw;

rst_data.m: subroutine to transform the U.S. data and generate the inflation expectations for U.S.;

dataJP.m: subroutine to transform Japan's data and generate the inflation expectations for

Japan;

setprior.m: subroutine to set the priors for the parameters;

setpriorh.m: subroutine called by setprior.m which set the priors for the home country parameters;

setpriorf.m: subroutine called by setprior.m which set the priors for the foreign country parameters;

plotpriorposterior.m: subroutine to plot the priors and posteriors of the draws and calculate the 90% interval of the priors and posteriors;

Cmat_s3.m: subroutine to specify the coefficient matrices and initial states used in the state space model;

KALFIL.m: subroutine to derive the estimation of the state variables by Kalman filter;

KALSMOO.m: subroutine to derive the estimation of the state variables by Kalman smoother;

abl.m: subroutine cited by Table2.m which calculates the AIC and BIC values;

jpesri.m: subroutine cited by mainbase.m to create Japan's recession dates in a way readable by Matlab.