Readme file for *Are the effects of financial crises big or small?*[*]

Regis Barnichon, Christian Matthes, Alex Ziegenbein

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Files

- *USdata.xls* contains the data for the United States used in the paper and the online appendix.
- *UKdata.xls* contains the data for the United Kingdom used in the paper and the online appendix.
- The folder *RomerRomerReplication* contains Stata code to replicate Romer and Romer (2017) as in Section 2 of the paper.
- The folder *GilchristZakrajsekReplication* contains Stata code to replicate Gilchrist and Zakrajsek (2012) as in Section 2 of the paper.
- *VAR-LP first pass* contains Stata code to replicate the results from the first pass approach in Section 3.
- *FAIR* contains the Matlab code to replicate the results from the FAIR approach in Section 5 and 6.

To facilitate replication of the FAIR-based results, we elaborate on the code and method below.

FAIR

The code allows for asymmetry in *one* shock of interest. Both for the US and the UK, we use two Gaussian basis function.

[*]For any question, please write to alexander.ziegenbein@univie.ac.at.

1 List of most important files and folders

1. Principal.m - the main file to estimate an asymmetric model.
2. setup_NL.m - initializes most of the setup structure that is used for estimation. The setup structure contains all the options used for the estimation except parameter restrictions and priors (which are both set in Principal.m).
3. results.m - plots the estimated Impulse Responses (IRs).
4. VAR_resp_match_lp.m - finds the initial guess for the maximization routine by calculating the FAIR model parameters that best fit the VAR-based IR functions. At the end, it plots the VAR-based IR along with the FAIR fitted values, so that the user can visually inspect whether the initial guess is reasonable. When changing the data source, it may be necessary to make minor adjustments in VAR_resp_match_NL.m in order to obtain a good initial guess, i.e. a good approximation of the VAR-based IR.
5. DGPRS4_BM.m - loads the data and initialises the VAR estimation.
6. /dataandlibrary - contains the data and additional functions used by Principal.m

In its current setup, the code estimates the FAIR using US data. One can use UK data instead by changing the data source in DGPRS4_BM adjusting lag-lengths in setup_NL (because we use quarterly data for the UK and monthly data for the US).

1.1 Other files that are important to modify the code

1. likelihood.m - computes the likelihood
2. params_mod.m - maps the parameter vector into the matrices used to compute the MA coefficients
3. unwrap_NL_lagged2.m - computes the MA coefficients
4. sampling_MH.m - main file that returns the draws from the MCMC algorithm. The corresponding file for the Monte Carlo example is sampling_MH_MC.m. The only difference with sampling_MH.m is that sampling_MH_MC.m takes into account that the intercepts and the above diagonal element in the matrix mapping from one-step forecast error to structural shocks are set to zero via a degenerate prior.

2 Priors and parameter restrictions

Priors are set in the Principal file. Timing restrictions are implemented by setting tight priors on some of the elements in the contemporaneous impact matrix.

Parameters are restricted in the Principal file - the MH acceptance probabilities are then adjusted to take into account that the proposal is now a random walk on a transformed parameter space.

In the setup file, the diagonal elements of Ψ_0 have to be restricted to be positive. These restrictions can be though of as further truncating the chosen prior distribution.

3 Order of Parameters in Parameter Vector

We now describe the ordering of the parameter vector. The parameters of the Gaussian basis functions a, b and c of each Gaussian basis function G correspond to

$$G = ae^{-\frac{(k-b)^2}{c}}$$

Note that c is not squared (unlike in the text of our FAIR papers), so that in order to interpret c as the width of the Gaussian (i.e., as the "bandwidth" of the basis function), one first need to take its square root.

1. intercepts
2. elements of Ψ_0^- (vectorized using the standard matlab vectorization operator :, as are the elements of all arrays below))
3. a^- (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)
4. b^- (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)
5. c^- (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)
6. free elements of Ψ_0^+ (i.e. the elements corresponding to the shock that is allowed to have an asymmetric response).
7. free elements of a^+ (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)
8. free elements of b^+ (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)

9. free elements of c^+ (if there are multiple Gaussian basis functions, all parameters associated with first basis function are order first and so on)

For instance, for a bi-variate FAIR with 1 Gaussian basis functions and asymmetry in response to the second shock, the parameter vector θ is ordered as follows

$$\theta = \left(\theta_\alpha,\ \theta_{\Psi_0^-},\ \theta_{a^-},\ \theta_{b^-},\ \theta_{c^-},\ \theta_{\Psi_0^+},\ \theta_{a^+},\ \theta_{b^+},\ \theta_{c^+}\right)' \tag{1}$$

with $\theta_\alpha = \begin{pmatrix} \alpha_1 \\ \alpha_2 \end{pmatrix}'$ the intercepts, $\theta_{\Psi_0^-} = \begin{pmatrix} \Psi_{0,11} \\ \Psi_{0,21} \\ \Psi_{0,12}^- \\ \Psi_{0,22}^- \end{pmatrix}'$, $\theta_{a^-} = \begin{pmatrix} a_{11} \\ a_{21} \\ a_{12}^- \\ a_{22}^- \end{pmatrix}'$ with a_{ij} the loading on the Gaussian basis function for the IR of variable i to shock j, $\theta_{b^-} = \begin{pmatrix} b_{11} \\ b_{21} \\ b_{12}^- \\ b_{22}^- \end{pmatrix}'$, $\theta_{c^-} = \begin{pmatrix} c_{11} \\ c_{21} \\ c_{12}^- \\ c_{22}^- \end{pmatrix}'$, $\theta_{\Psi_0^+} = \begin{pmatrix} \Psi_{0,12}^- \\ \Psi_{0,22}^- \end{pmatrix}'$, $\theta_{a^+} = \begin{pmatrix} a_{12}^+ \\ a_{22}^+ \end{pmatrix}'$, $\theta_{b^+} = \begin{pmatrix} b_{12}^+ \\ b_{22}^+ \end{pmatrix}'$, $\theta_{c^+} = \begin{pmatrix} c_{12}^+ \\ c_{22}^+ \end{pmatrix}'$.

With a FAIR(2) –two Gaussian basis functions (everything else the same)–, θ takes the same form as (1) but with $\theta_{a^-} = \left(a_{1,11},\ a_{1,21},\ a_{1,12}^-,\ a_{1,22}^-,\ a_{2,11},\ a_{2,21},\ a_{2,12}^-,\ a_{2,22}^-\right)'$ with $a_{1,ij}$ the loading on the first basis function and $a_{2,ij}$ the loading on the second basis function, and similarly for the other parameters of the FAIR θ_{b^-}, θ_{c^-}, etc..

References

[1] Gilchrist, Simon, and Egon Zakrajsek. 2012. Credit spreads and business cycle fluctuations. *American Economic Review*, 102(4): 1692-1720.

[2] Romer, Christina D., and David H. Romer. 2017. New Evidence on the Aftermath of Financial Crises in Advanced Countries. *American Economic Review*, 107(10): 3072-3118.

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