SYSTEM PRIORS ON TOP OF IRIS

ESTIMATION, CALIBRATION, AND TESTING

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I. INTRODUCTION

In this document I provide a brief introduction to the files and exercies in the `sprior_tbx.zip` teaching mini toolbox.

To set up the environment, it is important to add IRIS Toolbox by Jaromir Benes to Matlab's path and startup IRIS. To use the spriors mini toolbox, it is also important to ad path to the `lib` folder, where most of the 'worker' files reside. Or, adjust the paths and run file `set_paths.m`.

There are three main driver files: `driver_spriors_a.m`, `driver_spriors_b.m`, and `driver_spriors_c.m`. The 'A' version illustrates the use of system priors inherent to IRIS toolbox. It is effecient, optimized, but not completely general. It also will not show you how to build user-defined estimation on top of IRIS for your models. The 'B' and 'C' version illustrate how to implement user-defined estimation and calibration on top of IRIS [or other modeling platform]. They are almost identicall and differ only in the exercise they illustrate.

The 'B' driver uses the small-open-economy gap model `model.model` and its basic calibration (model and calibration by Messrs Aleš Bulíř and Jaromír Hurník), to illustrate how a prior about the *sacrifice ratio* can be implemented. Sacrifice ratio is a cummulative loss of output after a 1 percentage point disinflation due to an announcement of the new inflation target.

The 'C' driver illustrates how the codes for system prior can be used without data for *calibration*. In the baseline calibration of the model the output gap increases for one period after a cost-push shock. The 'C' driver demonstrate how to update the calibration of the model with the sole information that the 'blip' in the first year should be eliminated.

II. KEY FILES AND STRUCTURE

[TBA]

The key files are `lib/estimate_pp.m` and `lib/lossfun.m`.

However, the user is solely responsible for coding the system priors and pass it as a handle function to `SPRIOR` structure in the main driver. The content can be anything but the signature of the function (its interface) must be identical or other estimation code needs to be changed as well. For the two examples, the files `spriors4teaching.m` and `spriors_c.m` are the user-defined functions that compute the features of interest and implied penalties.

III. EXAMPLES

A. Sacrifice ratio prior

Running the `driver_spriors_b.m` will 'estimate' the model with the prior about a new sacrifice ratio. In order to illustrate just the update of the marginal prior by the sacrifice ratio information, the data is not considered and thus the log-likelihood is not evaluated.

For simplicity, the marginal priors are use the Normal distribution centered around the mean calibration. The new loss of output implied by the prior is smaller than the baseline model calibration. The information updates the marginal priors in a non-trivial way – the posterior (or the composite prior) is a true joint distribution with parameters interacting.

Interpreting the movement of the individual coefficients, and their marginal distributions, is easy using the Figure 1. Since the output loss is supposed to be lower, the persietence of the output gap is lowered (`b1`), as well as the weight on the monetary condition index, (`b2`). Also, the persistence of the inflation-forecast-targeting central bank's policy rule, (`g1`), is lowered. It is common, that other parameters of the policy rule are not affected by the information on sacrifice ratio.

B. Tuning the Calibration

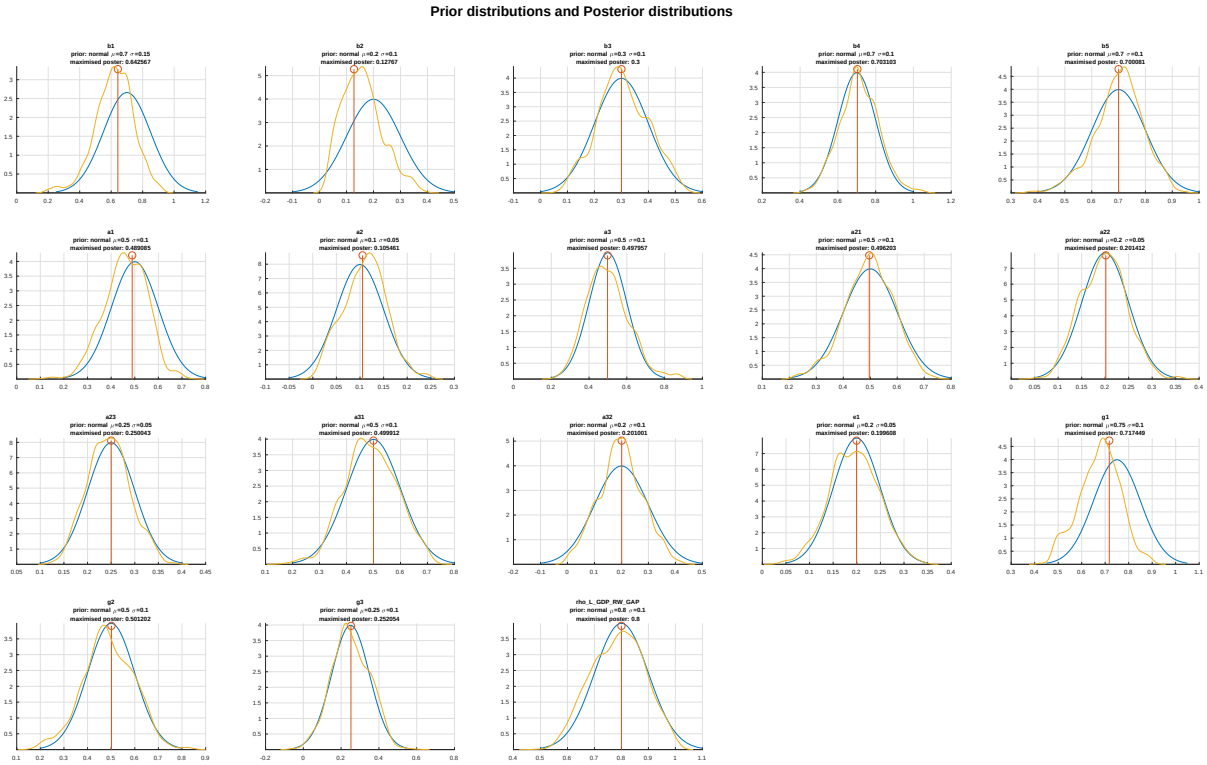
In the baseline calibration, the output gap increases and then declines for multiple quarters after an adverse cost push shock. Let's decide that it is desirable to eliminate the initial increase of output in response to the shock. What coefficients need to be changed and to what extent?

Of course, experienced model builders know. Sometimes the change in the calibration is easy to do, othertimes re-calibration can be really involved, be it for 'fixing' one property or having multiple goals.

Using the code in `sprior_tbx.zip` you can use the computer, with its vastly superior power to hold Hessians in its head, to help you. To fix the 'glitch,' I will use a simple code in `sprior_c.m` that simulates the shock and centers a relatively tight Normal prior around a small negative number of the output gap response. The reason for using Normal distribution is to simplify the optimization with standard and simple tools, especially starting from a calibration that implies a positive output on impact.

Is there any effect? Figure 2 demonstrates that the calibration has been 'fixed' in the direction desired. Now, what are the side effects of the change? If there are particularly negative side effects, coding in another prior to the 'wishlist' of the properties of the model.

Figure 1. Sacrifice Ratio Prior – Marginal and Composite Prior



How were the coefficients changed? Most of the dynamics coefficients chagne by a small amount. The largets relative change is in (b4), which is a weight on real interest rate in the monetary condition index. However, just using the value for b4 alone won't do the trick. Perhaps, doing more would do, and it is a clear indication of what one should do. After all, in this simple example the nature of the change is very intuitive. For more complex changes in calibration in large, multi-country models, the inutition often is not enough or is very time-consuming.

The side effects on other variable and for other shocks can be easily discerned from running additional experiments. Figures below illustrate the IRFs to a cost-push, demand, exchange rate, and interest rate shocks for the starting and new calibration.

IV. Conclusions

Thank you, hope it helps. Michal

Figure 2. Tuning the Calibration. . .

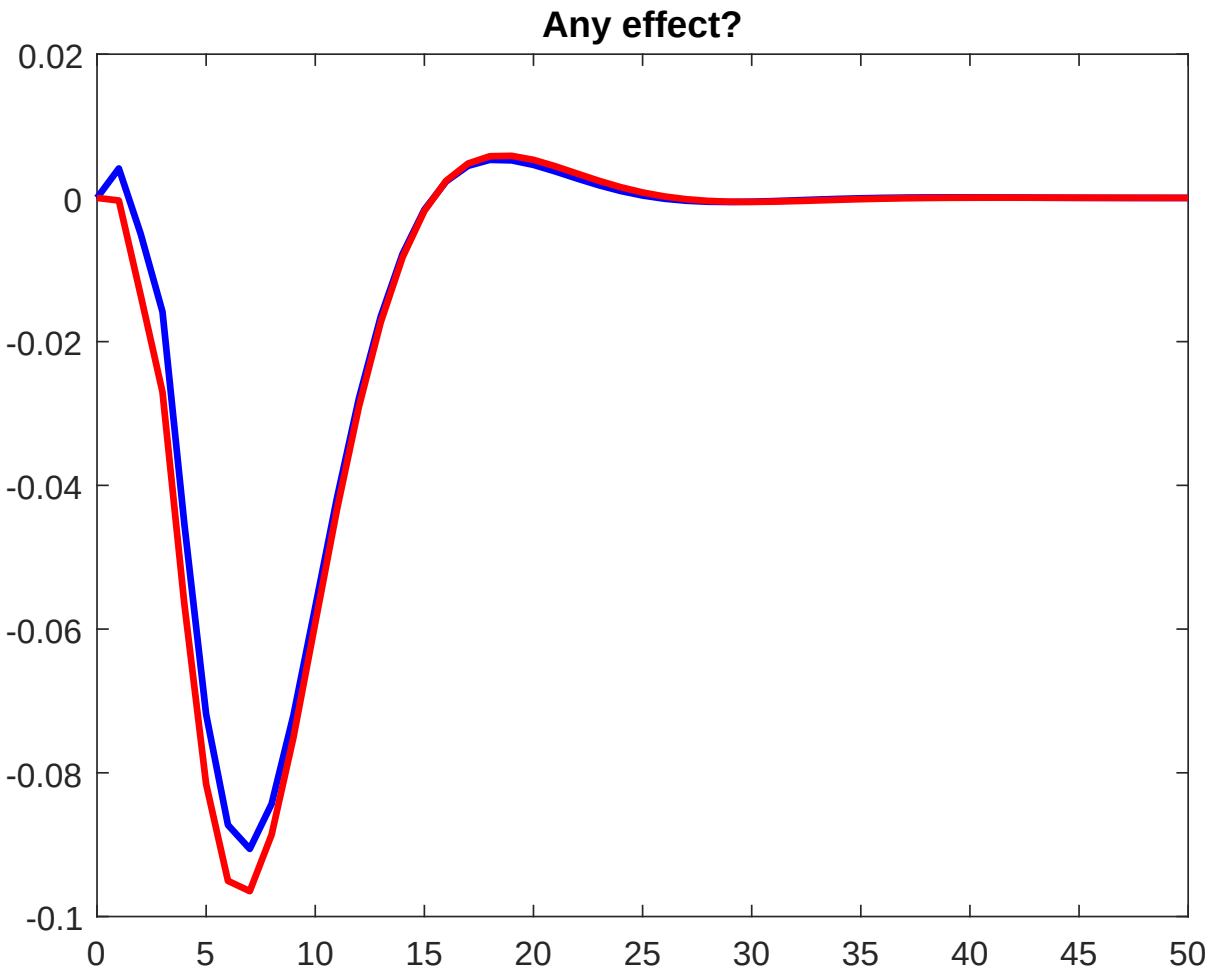


Figure 3. Cost-Push Shock

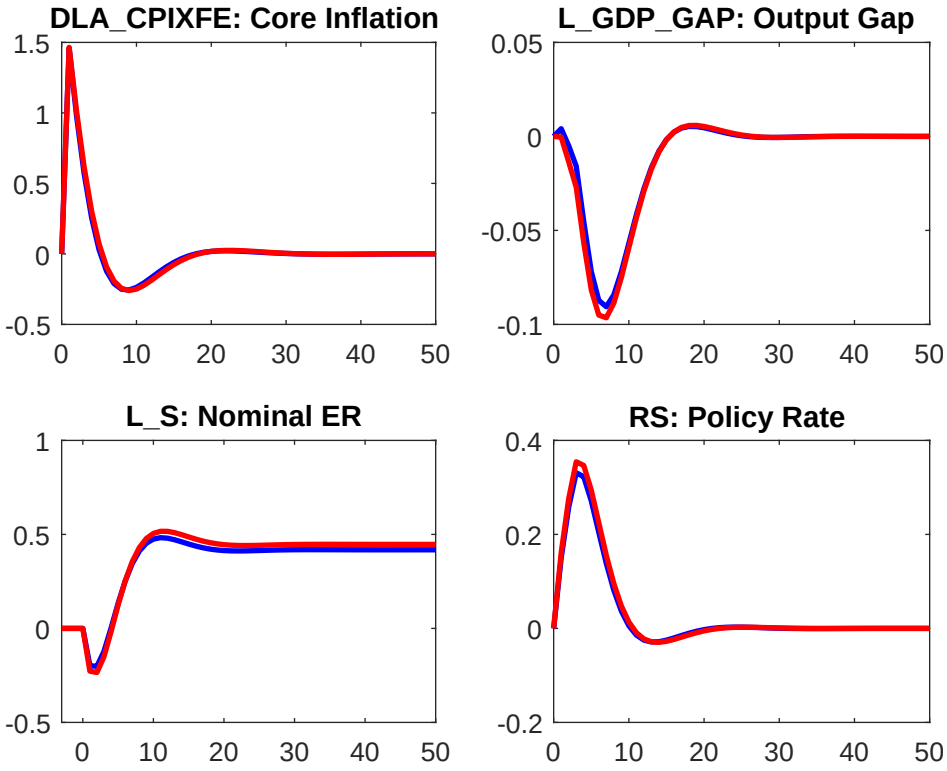


Figure 4. Demand Shock

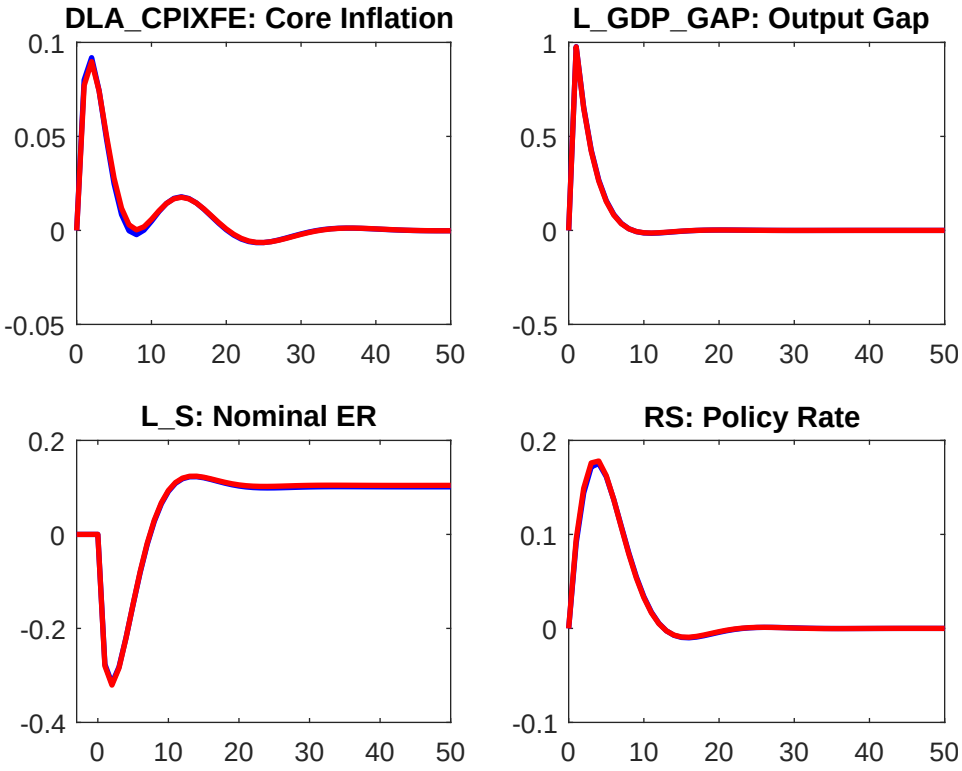
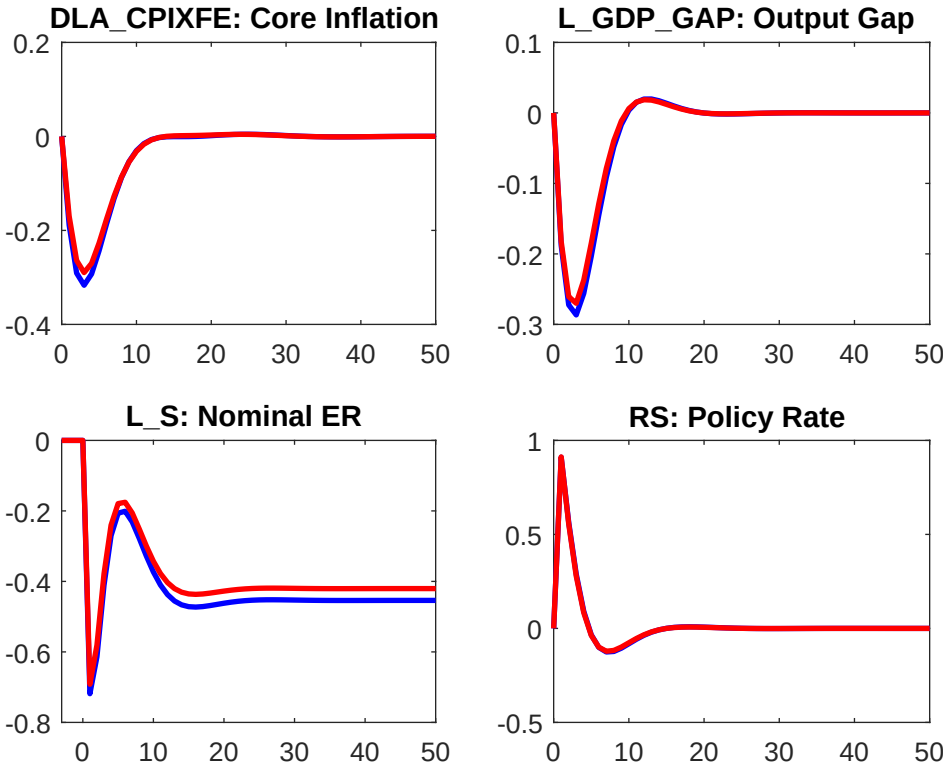



Figure 5. Policy Shock