DSGE 2025 Exam for Kseniia and Jingle

This exam is based upon an SOE model developed at the Central Bank of Brazil and published in its Working Paper series in 2016. This model is in turn based upon work done at the Reserve Bank of New Zealand, and published in Kam, Lees and Liu (2009), "Uncovering the Hit List for Small Inflation Targeters: A Bayesian Structural Analysis", *Journal of Money, Credit and Banking*, 41(4). The model includes shocks to terms of trade (eq. 37), risk premium (eq. 38) and world interest rates, factors which are important in explaining the macroeconomic volatility of small open economies.

Q1 [25 points]. Open the ***attached*** zip file ***Exam.zip*** and extract the contents to a clean "***exam***" directory on your computer.

Based on the extract (included in this directory) taken from the Brazilian CB working paper, use equations 26 plus 35-40 and those (un-numbered) following equation 40 to construct a **Dynare** programme to simulate the SOE economy using the attached partial mod-file "***SOE4Exam_skeleton.mod***". The symbols, which are defined in the text, are self-explanatory and familiar, but carefully note differences regarding notation for exchange rates and TOT vs those used in the last lecture. Note also that you should ***NOT*** use equation 34; its replacement is indicated below.

To complete the model, you will need to fill in the missing equations. When complete, you will have a total of ***17 equations*** (13 for the endogenous variables (of which two are definitions) plus 4 for the AR(1) shock processes). [Note that as "*" means multiplication in **Dynare**, you should use the notation r_star, y_star and pi_star for the ROW variables r*, y* and π*. Additionally, to avoid confusion with the shock persistence parameters, I have used "psi_r" instead of "rho_r" as the interest rate smoothing parameter in the Taylor Rule (eq.26)].

As indicated above, equation 34 of the paper is not correctly specified for the data which you will be using. Instead, replace it with

$$c_t - h\,c_{t-1} = {y^*}_t - h\,{y^*}_{t-1} + \frac{1}{\sigma}\,(1-h)\,q_t$$

In addition, you will find it convenient to use ***composite parameters*** in your model, using the ***# prefix*** to define as composites:

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#lambda_h=((1-beta*theta_h)*(1-theta_h))/theta_h;
#lambda_f=((1-beta*theta_f)*(1-theta_f))/theta_f;
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Q2 [20 points]. Using the model constructed in Q1 above, and the parameter values set out in the partial mod-file "***SOE4Exam_skeleton.mod***", ***plus*** those you have inserted to complete the specification, simulate the SOE economy over 24 quarters and comment on your results, with special emphasis on the effects of the MonPol shock. In order to do so, you will have to introduce a shocks block; use "stderr 1" for each of the shocks you specify.

Q3 [10 points]. Open ***Matlab*** and point it to the exam directory you created in Q1 above. The data provided in the file "***Data4Exam.xls***" is a version of the Australian data used by Justiniano and Preston (2010) which you studied in PS6. The data map directly to the model variables, but you will have to construct appropriate measurement equations to use it in estimation. Adjust the ***prefilter*** option in your estimation command to get rid of any non-zero mean.

Q4 [25 points]. Name the model set up in Q2-Q3 as ***"Q4.mod"***. Now ***estimate*** (via ***RegMLE*** with mode_compute=4) the parameters of your model ***except for*** β. Thus, you will be estimating ***twenty*** structural parameters (α, η, θ_h, θ_f, φ, σ, h, δ_h, δ_f, ψ_r, ψ_π, ψ_y, $\psi_{\Delta e}$, ρ_a, ρ_s, ρ_q, ρ_r, a_1, b_1, c_1) plus ***seven*** standard errors (for e_r, e_q , e_a , e_s , e_{y^*} , e_{π^*} and e_{r^*}).

You may use the ***beta distribution*** with param1 = 0.5 and param2 = 0.2 for ***most*** parameter priors for your estimation. The Taylor Rule parameters will need ***special treatment*** given what you know about the Taylor Rule.

For the standard errors, use the standard ***inverse gamma*** distribution with param1 = 1 and param2 = inf.

Use the entire data period (***1982Q1 – 2007Q1)*** for your estimation. Use ***mode_compute=5*** for your estimations here and in Q5. Be sure also to use ***mh_replic=0*** to avoid a lengthy MH sequence.

There are eight possible observed variables to use for estimation purposes. Be careful of stochastic singularity and note that q and s interact strangely.

Comment on your results.

Q5 [20 points]. This question requires you to compare different versions of the model. Use the model ***"Q4.mod"*** as the baseline. Then re-estimate three new models defined separately by modifying ***Q4.mod*** with (one each of) the following settings:

> ***Q5a.mod***: no habit formation;
> ***Q5b.mod***: no indexation; and
> ***Q5c.mod***: no exchange rate in the Taylor Rule. [NB: use ***mode_compute=1*** (**not 5!**) for Q5c.mod]

Compare and contrast your results for these four different versions of the model. In so doing, you may use the Matlab file ***"SOE_comp.m"*** (also in the ***Exam.zip*** file). In your discussion, focus on the effects of the MonPol and the Foreign Output shocks.