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Advanced Macroeconomics 30/08/2013
Solutions to Problem Set 4

Exercise 1 - Dynare

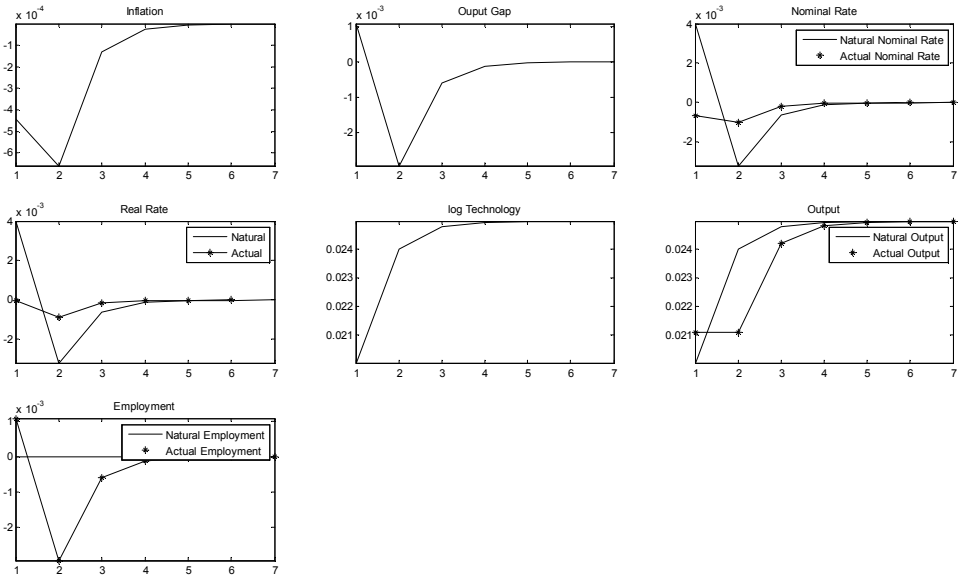
1)

Please see file `cgg_exam1.mod` for details.

As can be seen from the graphs below, the economy clearly overresponds to a technology shock (if the parameter ρ remains unchanged). In this scenario, unemployment is increased for several periods, whereas the beneficial effects of the technology shock on the long-term level of output can only be felt with a time lag.

The underperforming of the economy is likely caused by insufficient monetary policy measures, given the weak reaction of both nominal and real interest rates to the shock. This result is not too surprising, given that the policy rule for interest rate setting was optimized for a different set of assumptions. Given the modified model equation, a new parametrization of monetary policy is needed.

Impulse Responses of the Endogenous Variables to a Technology Shock



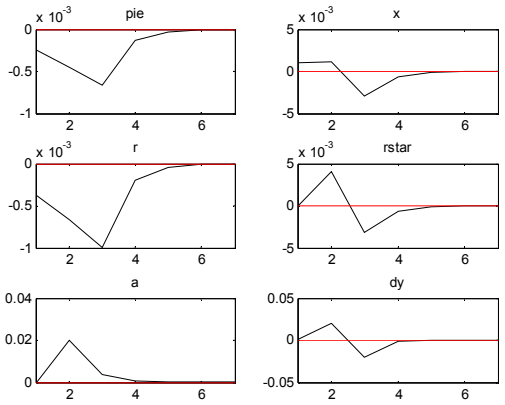
2)

Please see file `cgg_exam2.mod` for details.

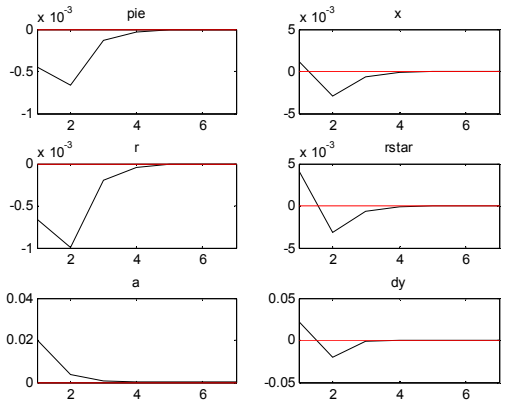
In the immediate aftermath of a news shock, there is a decrease in inflation and an increase in the output gap. This is indeed contradictory, since we would expect a higher output gap to be

accompanied by rising prices. However, as can be seen from the comparison below, the latter stage impulse responses to a news shock are virtually identical to the first period impulse response of a regular technology shock, indicating that the news shock will have the exact same consequences once the news become reality (there is no uncertainty about news in this model). Under this circumstances, the immediate reaction to the news shock can be understood as a preparation for things to come: Prices are already lowered by firms that are able to do so, whereas consumption – and thus output – is increased one more time before the shock hits. Such a scenario is unlikely to occur in reality, since perfect information is typically not available and shocks are typically not predictable.

Impulse Responses to a News Shock



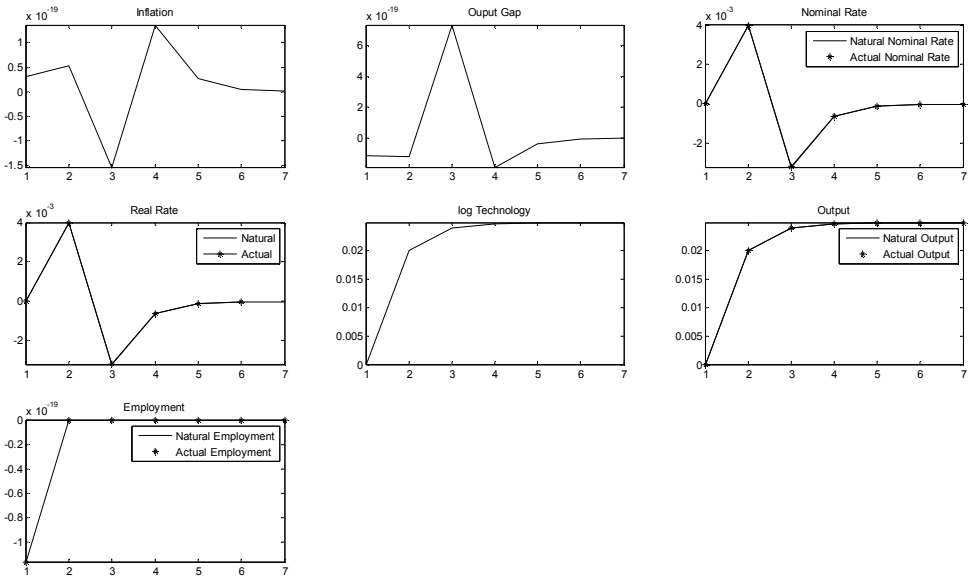
Impulse Responses to a Technology Shock



3)

Please see file `cgg_exam3.mod` for details.

Impulse Responses of the Endogenous Variables to a News Shock



In this scenario, there is no divergence between the natural and the actual reaction of the economy to a news shock. As already seen in the lecture, this specification of the Taylor rule uniquely supports the natural equilibrium as it guarantees that the interest rate will always return to its natural level.

Exercise 2 – Solution methods

1)

In this model,

- the state variable x_t is the dividend d_t
- the control variable y_t is the asset price p_t

2)

Not sure what to do…

3)

Not sure how to proceed…

Exercise 3 – Estimation methods

Please see file `cgg_exam2.mod` for details.

1)

Since there is only one specified shock in this model, it would not be possible to include more than one observable variable for the estimation. The number of observable variables must therefore be equal to one.

Given that the modification of the original model applies to the production structure of the economy, the output level might be the variable whose estimation suffers the most from the misspecification. I have therefore chosen to use consumption as the observable instead, given that the model's assumption on the behavior of this variable are closer to the true process.

As for the priors, I have chosen the following specification:

```
alpha, inv_gamma_pdf, .45, .05;
theta, beta_pdf, .35, .05;
tau, gamma_pdf, mode_and_variance_to_mean(2.0,.5^2,1,1),.5, 1;
```

Whereas the priors for θ and τ are the same as in the example file, I have chosen an inverse gamma distribution for α since the beta distribution yielded very unsatisfactory results.

2)

The posterior mode appears as follows:

```
RESULTS FROM POSTERIOR MAXIMIZATION
parameters
    prior mean     mode    s.d. t-stat prior pstdev

alpha    0.450   0.3544  0.0237 14.9416 invg  0.0500
theta    0.350   0.2456  0.0381  6.4386 beta  0.0500
tau      2.207   1.8625  0.2536  7.3439 gamm  0.5000
```

Although the deviations from the true mean of the parameters are non-neglegible, the results presented here were considerable closer to reality than many other prior specifications that I experimented with. Thus, I have chosen to use these results for further analysis, while being conscious of the fact that there might still be better ways to define the priors.

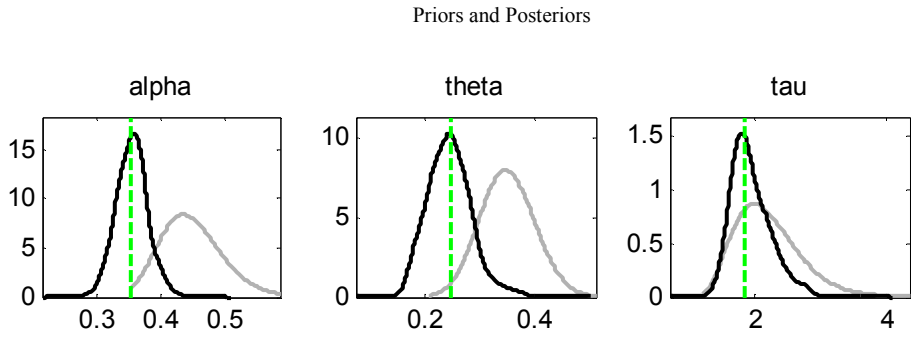
3)

The Metropolis-Hastings-Algorithm had an average acceptation rate of about 20%, as indicated below.

```
MH: Total number of generated files      : 3.
MH: Total number of iterations           : 5000.
MH: average acceptation rate per chain   :
    0.1988    0.2102    0.2046
```

This acceptance rate can – somehow artificially – be improved by changing the scale of the jumping distribution (`mh_jscale`). The results presented here were achieved with a scale of 1.7, which was also used in the lecture. By reducing it to a lower value, e.g. 0.5, acceptance rates of up to 80% are possible. However, this would probably restrict the prior far too strongly (given that, in reality, the true values of the parameters are unknown) and should not be considered a prudential practice.

By comparing the posterior distributions with the (true) prior distributions, it can be seen that, while deviating in the mean, the distributions are still somewhat overlapping. However, with the exception of τ, the estimations cannot be considered to be very precise.



4)

As indicated before, the estimation results are not wholly satisfactory. When compared to the parameter estimation based on the true model (the `rbcestim.mod` file), it becomes obvious that the true values are far more difficult to pin down when the underlying model is not exactly known. This problem is likely to persist independently of the chosen priors; however, a more comprehensive and systematical search for the best priors might help to improve upon the results presented here.

5)

The model comparison yields the following result:

```
Model Comparison

Model                          rbcestim          rbcexam
Priors                         0.500000          0.500000
Log Marginal Density           -342.768462       -33.077754
Bayes Ratio                    1.000000          314025799494299*10^140
Posterior Model Probability    0.000000          1.000000
```

The Bayes ratio for the misspecified model had to be manually adjusted in order to fit the layout of this document. Clearly, this ratio is extraordinarily high and thus somewhat suspicious.